Land Use Planning Guide for Hazardous Facilities

A resource for local authorities and hazardous facility operators

A report prepared by the Hazardous Facilities Screening Procedure Review Group in conjunction with the Ministry for the Environment

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This guide is designed to complement the *Assessment Guide for Hazardous Facilities* (MfE, 1999c).

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Quick Guide to Land Use Planning for Hazardous Facilities

1 Purpose

The *Quick Guide* summarises and highlights the key issues associated with land use planning for hazardous facilities in general, and the Hazardous Facility Screening Procedure in particular. A comprehensive description of the matters addressed here is provided in the main document, the *Land Use Planning Guide for Hazardous Facilities*. While the *Land Use Planning Guide* is intended for more detailed study, the *Quick Guide* is meant to serve as a frequently used rapid reference.

2 Relevant legislation

The management of hazardous substances is predominantly governed by the Hazardous Substances and New Organisms Act 1996 (HSNO) and the Resource Management Act 1991 (RMA) and their respective regulations. Other Acts, such as the Health and Safety in Employment Act 1992 (HSE), the Building Act 1991, the Agricultural Compounds and Veterinary Medicines Act 1997, the Transport Act 1962 and the Land Transport Act 1993 also play a role.

The HSNO Act establishes a comprehensive assessment and approval process for manufactured and imported hazardous substances (and new organisms), to ensure that any substances deemed to be hazardous (as defined by the HSNO Regulations) are subject to an integrated, consistent and performance based control system for all stages of their lifecycle. In practice, hazardous substances will be subject to minimum performance requirements (set by regulations) covering containment, packaging, identification/labelling, tracking, competency of handling, emergency preparedness and disposal once the HSNO Regulations come into force. These requirements apply regardless of circumstances such as activity, location and quantity.

The RMA addresses those aspects of hazardous substances management associated with a particular location or land use. Generally, this function is undertaken by territorial authorities (TAs) which make provisions for the control of hazardous facilities (i.e. sites where hazardous substances are used, stored, handled or disposed of) in their district plans. However, regional councils may choose to exercise this function (or part of it), but they need to state this intent in a regional policy statement.

The two Acts are designed to complement each other, with HSNO providing the overall framework for managing hazardous substances anywhere in New Zealand, and the RMA providing additional controls over and above those available through HSNO to ensure that site-specific circumstances can be taken into account.

3 Management controls for hazardous substances

The use, storage and handling of hazardous substances present potential sources of risk to humans, the environment and property. To manage such risks, facilities and/or sites involved in such activities have traditionally been subject to a variety of controls under different legislation, such as the Dangerous Goods Act 1974.

With the introduction of the HSNO Act, controls on hazardous substances and facilities have changed. Hazardous substances are now subject to minimum performance standards independent of their location. These performance standards address:

- packaging and containers
- identification
- tracking and competency
- emergency preparedness
- disposal.

However, HSNO does not allow for control mechanisms specific to a particular location, as Dangerous Goods Licenses used to do. Any site-specific controls can only be imposed under the RMA, through appropriate provisions in the district plan.

Typically, such provisions consist of two elements:

- a set of minimum performance requirements that apply to any facility using, storing or otherwise handling hazardous substances
- a mechanism for distinguishing between hazardous facilities deemed to be of low risk (i.e. permitted activities) and those of higher risk (i.e. those requiring a resource consent, enabling further controls to be imposed).

An overview of minimum performance requirements for hazardous facilities under the RMA is provided below. One possible mechanism for distinguishing between hazardous facilities of low and higher risk is the Hazardous Facility Screening Procedure or HFSP, which is explained in detail in the main document and presented in abbreviated form in this *Quick Guide*. Guidance with respect to assessing higher risk hazardous facilities requiring resource consents is provided in the companion document, *Assessment Guide to Hazardous Facilities* (MfE, 1999c).

4 Minimum performance requirements for hazardous facilities under the RMA

As noted above, site-specific controls for the use, storage and general handling of hazardous substances have to be provided under the RMA. These apply both to facilities presenting a relatively low risk (due to the type and quantity of substances on the site and the characteristics of the site itself), as well as to facilities requiring resource consents. A recommended set of minimum performance standards is outlined below.

A Site design

Any part of a hazardous facility which is involved in the manufacture, mixing, packaging, storage, loading, unloading, transfer, use or handling of hazardous substances must be designed, constructed and operated in a manner which prevents:

(i) the occurrence of any off-site adverse effects from the above listed activities on people, ecosystems, physical structures and/or other parts of the environment unless permitted by a resource consent

(ii) the contamination of air, land and/or water (including groundwater, potable water supplies and surface waters) in the event of a spill or other type of release of hazardous substances.

B Site layout

The hazardous facility must be designed in a manner to ensure that separation between on-site facilities and the property boundary is sufficient for the adequate protection of neighbouring facilities, land uses and sensitive environments.

C Storage of hazardous substances

The storage of any hazardous substances must be carried out in a manner that prevents:

(i) the unintentional release of the hazardous substance

(ii) the accumulation of any liquid or solid spills or fugitive vapours and gases in enclosed off-site areas, resulting in potentially adverse effects on people, ecosystems or built structures.

Specific performance requirements for the storage of hazardous substances are covered by HSNO regulations.

D Site drainage systems

Site drainage systems must be designed, constructed and operated in a manner that prevents the entry or discharge of hazardous substances into the stormwater and/or sewerage systems unless permitted by a network utility operator.

Suitable means of compliance include clearly identified stormwater grates and access holes, roofing, sloped pavements, interceptor drains, containment and diversion valves, oil-water separators, sumps and similar systems.

E Spill containment systems

Any parts of the hazardous facility site where a hazardous substances spill may occur must be serviced by suitable spill containment systems that are:

(i) constructed from impervious materials resistant to the hazardous substances used, stored, manufactured, mixed, packaged, loaded, unloaded or otherwise handled on the site; and for liquid hazardous substances:

- able to contain the maximum volume of the largest tank present plus an allowance for stormwater or fire water
- for drums or other smaller containers, able to contain 50 percent of the maximum volume of substances stored plus an allowance for stormwater or fire water

(ii) able to prevent the entry of any spill or other unintentional release of hazardous substances, or any contaminated stormwater and/or fire water into site drainage systems unless permitted by a network utility operator.

Suitable means of compliance include graded floors and surfaces, bunding, roofing, sumps, fire water catchments, overfill protection and alarms, and similar systems.

F Washdown areas

Any part of the hazardous facility site where vehicles, equipment or containers that are or may have become contaminated with hazardous substances are washed, must be designed, constructed and managed to prevent any contaminated wash water from:

(i) entry or discharge into the stormwater drainage or the sewerage systems unless permitted by a network utility operator

(ii) discharge into or onto land and/or water (including groundwater and potable water supplies) unless permitted by a resource consent.

Suitable means of compliance include roofing, sloped pavements, interceptor drains, containment and diversion valves, oil-water separators, sumps and similar systems.

G Underground storage tanks

Underground tanks for the storage of petroleum products must be designed, constructed and managed to prevent any leakage and spills and resulting adverse effects on people, ecosystems and property. Suitable means of compliance include:

- using materials that are resistant to the hazardous substances concerned
- using secondary containment facilities in areas of environmental sensitivity
- providing leak detection or monitoring system which capable of detecting a failure or breach in the structural integrity of the primary containment vessel
- adherence to the Code of Practice for “Design, Installation and Operation of Underground Petroleum Systems” (OSH, 1992).

H Signage

Any hazardous facility must be adequately signposted to indicate the nature of the substances stored, used or otherwise handled.

Suitable means of compliance include adherence to relevant Codes of Practice or the HAZCHEM signage system.

I Waste management

Any process waste or waste containing hazardous substances shall be managed to prevent:

(i) the waste entering or discharging into the stormwater drainage system

(ii) the waste entering or discharging into the sewerage system unless permitted by the sewerage utility operator

(iii) the waste discharging into or onto land and/or water (including groundwater and potable water supplies) unless permitted by a resource consent.

The storage and management of any process waste or waste containing hazardous substance on the site shall at all times comply with the performance standards specified for hazardous substances.

All waste containing hazardous substances shall be disposed of to facilities holding the necessary consents, or be serviced by a registered waste disposal contractor.

5 The Hazardous Facility Screening Procedure (HFSP)

The HFSP was first introduced in 1995 in the document entitled *Land Use Planning for Hazardous Facilities* (Hazardous Facility Screening Procedure Review Group, 1995). With the subsequent introduction of the HSNO Act and experience gained in implementing the HFSP, the method has now been revised to align it with HSNO requirements and make it more user-friendly.

The HFSP is a method that allows a council to distinguish between a low-risk hazardous facility and one presenting a higher risk, based on the type and quantity of the hazardous substances involved, and the characteristics of the site or facility in question (for example, the manner in which the substances are used or stored, or whether the facility is close to a sensitive environment). In the context of the HFSP, three types of effects are considered:

- Fire/Explosion Effect Type: addressing damage to the built environment and safety of people
- Human Health Effect Type: addressing adverse effects on the well-being, health and safety of people
- Environmental Effect Type: addressing adverse effects on ecosystems and natural resources.

The HFSP uses numerical values for this assessment, resulting in a number which can be compared with a value in the district plan. Essentially, if the number resulting from the HFSP calculation (Quantity Ratio) is below the value indicated in the district plan, the facility is a permitted activity, and if the number is higher, then a resource consent is required.

Detailed information on this process, and the development of appropriate district plan provisions, is provided in the main document.

An overview of the method and the steps involved to arrive at the Quantity Ratio is presented below.

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1 Describe the hazardous facility

Prior to using the HFSP, it is necessary to compile a full description of the hazardous facility in question. This includes the creation of an inventory of hazardous substances held on the site, including:

- names of hazardous substances
- quantities of hazardous substances
- the physical form of the substances at 20°C and 101.3 kPa
- the location of use or storage on the site, including separation distances from the site boundary and neighbouring hazardous facilities (on-site and off-site).

The description should also include site-specific details, including neighbouring land uses and the surrounding environment, with a focus on sensitive land uses and receptors (e.g. retirement accommodation, aquifers or wetlands).

</td><td>

Explanation:

The HFSP uses standard units of tonnes (for solids, liquids and liquefied gases) and m³ (for compressed gases). In some cases, it may therefore be necessary to convert substance quantities to these units. In the case of liquids, specific gravity (or density) must be taken into consideration when converting litres or m³ to tonnes.

Adjustments to quantities are also necessary where a substance is diluted with water or mixed with another substance. In this instance, only the percentage quantity of the hazardous substance or product in the dilution or mixture is assessed for the purposes of HFSP calculations (unless a mixture is more hazardous than its components, in which case data on the mixture needs to be used).

An exception to this are products or brands that already constitute dilutions or mixtures of hazardous substances and which have been classified in terms of their hazardous properties as the 'whole' dilution or mixture for life cycle management. Examples of this are corrosives, oxidising substances and pesticides, which are often sold commercially as standard solutions or strengths. In these cases, quantity adjustments are only applied when these commercially supplied concentrations are further diluted or mixed.

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2 Determine Hazard Rating

For the purposes of the HFSP, the effects of substances are categorised into three Effect Types*:*

- Fire/Explosion Effect Type: addressing damage to the built environment and safety of people
- Human Health Effect Type: addressing adverse effects on the well-being, health and safety of people
- Environmental Effect Type: addressing adverse effects on ecosystems and natural resources.

Each Effect Type is divided into three Hazard Rating Levels:

♦ High ♦ Medium ♦ Low

The rating levels are based predominantly on the HSNO classification system.

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Explanation:

The HFSP rates hazardous substances in terms of each of the three Effect Types as having a high, medium or low hazard. The Hazard Rating of a substance is derived as follows:

the list of HFSP-rated hazardous substances in Appendix B of the main document.

the HSNO classification (refer Appendix A in the main document). Once a substance has been classified under HSNO, Hazard Ratings can be assigned for each Effect Type as shown in Appendix A.

if a substance is not found in Appendix B and has not assigned a HSNO classification yet, default ratings should be used (Fire/Explosion Effect Type: Medium, Human Health Effect Type: Medium and Environment Effect Type: High). Alternatively, the user can follow the instructions in Appendix C to derive an appropriate Hazard Rating.

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3 Find Base Quantities (Table 1 in the Quick Guide) The Base Quantity (B) is pre-calibrated. It is the amount of a substance that has been assessed as generating no significant off-site effects in a heavy industrial area before site- and substance-specific considerations have been taken into account (refer Step 4 below). Base Quantities for different hazardous properties and hazard ratings in each Effect Type are listed in the next table. (Table 3 in the main document.)	***Explanation:*** For example, in the Fire/Explosion Effect Type [Sub-category Flammables], non-significant off-site effects in a heavy industrial area are represented by a Base Quantity of: • 100 tonnes of a HSNO Category D flammable liquid (3.1 D) which has a low hazard level for the Fire/Explosion Effect Type. • 30 tonnes of a HSNO Category C flammable liquid (3.1 C) which has a medium hazard level for the Fire/Explosion Effect Type.
4 Calculate Adjusted Quantity (A) (Table 2 in the *Quick Guide*) The pre-calibrated Adjustment Factors (FF, HF, EF) (refer Table 4 in the main document) are multiplied with the Base Quantities (B) to account for substance properties and site-specific environmental circumstances. This multiplication yields the Adjusted Quantity (A). Adjustment Factors differ for each of the Effect Types, and take into account the following considerations: • the physical state of the substance • the type of storage • the type of activity or use • separation distances to the site boundary • the environmental sensitivity of the site location.	***Explanation*:** Different Adjustment Factors are applied for each Effect Type. For example, for the Fire/Explosion Effect Type, the temperature is relevant, while for the Human Health Effect Type, proximity to a potable water resource is important. In some instances, more than one Adjustment Factor within each Effect Type must be applied, which then need to be multiplied with each other to yield the total Adjustment Factor for the Effect Type. When the Adjustment Factors for each Effect Type have been calculated, they in turn are multiplied with the Base Quantity to yield the Adjusted Quantity.
5 Calculate and add Quantity Ratios (FQ, HQ, EQ) This step requires the calculation of the Quantity Ratio for each hazardous substance in question. The Quantity Ratio is a dimensionless number. It is obtained by dividing the quantity of a substance that is proposed to be used or stored on a site, i.e. the Proposed Quantity (P) by the Adjusted Quantity (A). If several hazardous substances are used or stored on a site, the Quantity Ratios calculated for each of these substances are added up for each Effect Type. Note that $FQ/HQ/EQ_{Total}$ stands for the total sum of Quantity Ratio values from all assessed hazardous substances, within each Effect Type.	***Explanation*:** By using the dimensionless ratio of the Proposed Quantity of a hazardous substance over the Adjusted Quantity, it is possible to aggregate the effects presented by multiple substances held on the same site. Hence, it becomes possible to assess the cumulative potential effects which may be created by several substances present on the same site.
6 Assess resource consent status of hazardous facility When assessing the resource consent status of a particular hazardous facility, the added Quantity Ratios for each Effect Type are compared with relevant Consent Status Indices in the Resource Consent Matrix in the district plan. If they are exceeded, a resource consent is required.	***Explanation*:** When examining total Quantity Ratios against applicable Consent Status Indices, one or several substances may trigger a resource consent. This highlights the fact that when assessing hazardous facilities, it is often sufficient to assess just a few hazardous substances to start off with, mainly those that are either highly hazardous or are used/stored in high quantities.

The HFSP is only applied to new facilities, or those where a modification in operations causes a significant change in the character, nature and/or scale of actual or potential effects. However, if the HFSP is incorporated into a **regional** plan, the procedure may also be applied to existing facilities.

Certain situations or activities are not appropriate for being considered by the HFSP:

- trade waste sewers
- gas or oil pipelines
- storage and use of hazardous consumer products for private domestic purposes
- fuel in motor vehicles, boats and small engines
- retail outlets for the domestic scale use of hazardous substances (e.g. supermarkets, hardware stores, pharmacies)
- facilities presenting a dust explosion risk of non-hazardous substances
- hazardous activities that do not involve hazardous substances (e.g. high-voltage transmission lines, radio masts).

***Quick Guide* Table 1:** Base quantities (B) for all effect types and hazard ratings

HSNO category	UN class equivalent	Hazard level	Unit tonnes or cubic metres	Base quantity (B)		
				Fire/ explosion	Human health	Environment
Explosive substances						
1.1	1.1	High	tonnes	0.1	–	–
1.2	1.2	Medium	tonnes	1	–	–
1.3	1.3	Low	tonnes	3	–	–
1.5	1.5	Low	tonnes	3	–	–
Flammable gases						
2.1.1A	2.1	High	m^3 tonnes	10,000* 10	–	–
2.1.2A	2.1	High	m^3 tonnes	10,000* 10	–	–
	LPG	Medium	tonnes	30	–	–
Flammable liquids						
3.1 A	3PGI	High	tonnes	10	–	–
3.1 B	3PGII	High	tonnes	10	–	–
3.1 C	3PGIII	Medium	tonnes	30	–	–
3.1 D	Combustible liquids	Low	tonnes	100	–	–
Liquid desensitised explosives						
3.2 A 3.2 B 3.2 C	3 PGI 3 PGII 3 PGIII	High	tonnes	1		
Flammable solids						
4.1.1.A	4.1 (a) PGII	Medium	tonnes	10	–	–
4.1.1 B	4.1 (a) PGIII	Low	tonnes	30	–	–
4.1.2 A 4.1.2 B	4.1 (b) PGII	High	tonnes	1	–	–

HSNO category	UN class equivalent	Hazard level	Unit tonnes or cubic metres	Base quantity (B)		
				Fire/ explosion	Human health	Environment
4.1.2 C 4.1.2 D	4.1 (b) PGII	Medium	tonnes	10	–	–
4.1.2 E 4.1.2 F 4.1.2 G	4.1 (b) PGII	Low	tonnes	30	–	–
4.1.3 A	4.1 (c) PGI	High	tonnes	1	–	–
4.1.3 B	4.1 (c) PGII	High	tonnes	1	–	–
4.1.3 C	4.1 (c) PGIII	High	tonnes	1	–	–
4.2 A	4.2 PGI	High	tonnes	1	–	–
4.2 B	4.2 PGII	High	tonnes	1	–	–
4.2 C	4.2 PGIII	Medium	tonnes	10	–	–
4.3 A	4.3 PGI	High	tonnes	1	–	–
4.3 B	4.3 PGII	High	tonnes	1	–	–
4.3 C	4.3 PGIII	Medium	tonnes	10	–	–
Oxidising substances						
5.1.1 A	5.1 PGI	High	tonnes	1		
5.1.1 B	5.1 PGII	High	tonnes	1		
5.1.1 C	5.1 PGIII	Medium	tonnes	10		
5.1.2 A	2.2	High	m^3 tonnes	10,000 10		
5.2 A 5.2 B	5.2 Types A and B	High	tonnes	1		
5.2 C 5.2 D	5.2 Types C and D	Medium	tonnes	10		
5.2 E 5.2 F 5.2 G	5.2 Types E, F and G	Low	tonnes	30		
Toxic substances						
6.1 A	6.1 PGI 2.3	High	tonnes m^3	–	1 50	–
6.1 B	6.1 PGII 2.3	High	tonnes m^3	–	1 50	–
6.1 C	6.1 PGIII 2.3	Medium	tonnes m^3	–	10 150	–
6.1 D	Standard poison	Low	tonnes m^3	–	30 500	–
Corrosive substances						
8.2 A	8 PGI	High	tonnes	–	1	–
8.2 B	8 PGII	Medium	tonnes	–	10	–
8.2 C	8 PGIII	Low	tonnes	–	30	–
Ecotoxic substances						
9.1 A	GHS	High	tonnes	–	–	3
9.1 B	GHS	Medium	tonnes	–	–	30
9.1 C	GHS	Low	tonnes	–	–	100
9.1 D	GHS	Low	tonnes			100

***Quick Guide* Table 2:** Adjustment factors for all effect types

Fire/explosion	Human health	Environment
FF1: Substance form Solid = 1 Liquid, powder = 1 Gas (101.3 kPa, 20°C) = 0.1	***FH1: Substance form*** Solid = 3 Liquid, powder = 1 Gas (101.3 kPa and 20°C) = 0.1	***FE1: Substance form*** Solid = 3 Liquid, powder = 1 Gas (101.3 kPa and 20°C) = 0.1
FF2: Separation distance from site boundary (sub-facility) < 30 m = 1 > 30 m (>60 m)[1] = 3	***FH2: Separation distance from site boundary (sub-facility)*** *(gases only)* < 30 m = 1 > 30 m (>60 m)[2] = 3	***FE2: Environmental sensitivity*** Normal = 1 Adjacent to water resource[2] = 0.3
FF3: Type of activity Use = 0.3 Above ground storage = 1 Underground storage[3] = 10	***FH3: Type of activity*** Use = 0.3 Above ground storage = 1 Underground storage[6] = 10	***FE3: Type of activity*** Use = 0.3 Above ground storage = 1 Underground storage[6] = 3
Final fire/explosion adjustment factor **FF = FF1 x FF2 x FF3**	Final human health adjustment factor **FH = FH1 x FH2 x FH3**	Final environment adjustment factor **FE = FE1 x FE2 x FE3**

Other activities, although suitable for assessment by the HFSP, may be exempted should an individual council wish to do so. Such activities should be well regulated by other mechanisms such as Codes of Practice, for example those approved by ERMA NZ under the HSNO Act or Standards. They should also comply with the minimum performance standards specified in the district plan. Over time, it is expected that councils will exempt other activities where they are well regulated by other mechanisms, provided council is satisfied that the other regulations ensure all obligations under the RMA are complied with. Examples of activities suitable for exemption are:

- the retail sale of liquid fuel, up to a storage of 100,000 litres of petrol in underground storage tanks and up to 50,000 litres of diesel, provided that the *Code of Practice for the Design, Installation and Operation of Underground Petroleum Systems*, published by the Department of Labour – OSH, is adhered to
- retail LPG outlets, with storage of up to 6 tonnes (single vessel storage) of LPG, provided that the Australian/New Zealand *Standard AS 1596:1997 – Storage and Handling of LP Gas* is adhered to
- the use, storage and transport of hazardous substances by teaching and research laboratories, provided that the relevant Standards are adhered to.

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1 If the facility is assessed as a sub-facility, the distance to the neighbouring sub-facility must be more than 60 metres (i.e. 2 x 30 metres) to qualify for an Adjustment Factor of 3 (refer Section 5.5.4 of the main document).

2 Water resources include aquifers and water supplies, streams, springs, lakes, wetlands, estuaries and the sea, but do not include entry points to the stormwater drainage network. 'Adjacent' must be defined in respective district plans and will depend on the type of water resource potentially affected (adjacent is variably defined as between 30 and 100 metres).

3 Applicable to UN Class 3 substances (flammable liquids) only.

6 Using the HFSP in a district plan

A district plan chapter that incorporates the HFSP should be structured as follows:

- a general part outlining issues, objectives, policies and outcomes
- a section specifying the rules – this section must include a table showing consent status indices for the different activities (the so-called Consent Status Matrix)
- a section setting out minimum performance standards for all activities, whether permitted or in need of a consent (refer Section 4 of the *Quick Guide*)
- a section on monitoring and performance assessment
- an attachment providing information on the HFSP to enable potential applicants to understand and work with the procedure.

Detailed information on linking the HFSP with a district plan and a model district plan section can be found in Chapters 6 and 8 respectively of the main document.

7 Case study

This case study (also found in Appendix E of the main document) shows how the district plan provisions of an average provincial service town apply to a proposal to establish a panel-beating and spray painting workshop in its commercial area. The Consent Status Matrix below may be found in Section 6.4.1.1 of the main document.

Zone	Consent status indices for permitted activities	Consent status indices for discretionary activities
Industrial	≤1	>1
Light industrial	≤0.5	>0.5
Commercial	≤0.2	>0.2
Open space	≤0.1	>0.1
Residential	≤0.02	>0.02

This example uses a moderately sized panel-beating and spray-painting facility in a commercial area to demonstrate the HFSP. The storage of degreasers, thinners and paints is the major aspect of this operation. The facility is not near a water body.

Step 1: Describe the facility and hazardous substances

A major aspect of this operation is the storage of the 'tools of the trade', i.e. the paints and solvents necessary for undertaking the work and the tools used, some of which require gases such as acetylene and oxygen. The substances and the quantities in which they will be found on the site are listed in a table such as the one shown below. It is also important to note that the facility will be located less than 30 metres from its site boundary and that no water body of any kind is in the neighbourhood.

Name	Quantity (tonnes or cubic metres)	Form (liquid, powder, solid, gas)	Location
Degreaser (solvent)	0.015 t	Liquid	Inside, < 30 m from boundary
Thinner (xylene based)	0.1 t	Liquid	Inside, < 30 m from boundary
Waste thinner (xylene based)	0.05 t	Liquid	Inside, < 30 m from boundary
Lacquer paints	0.1 t	Liquid	Inside, < 30 m from boundary
Enamel paints	0.06 t	Liquid	Inside, < 30 m from boundary
Fibreglass resin (styrene)	0.01 t	Solid	Inside, < 30 m from boundary
Acetylene	8 m^3	Gas	Inside, < 30 m from boundary
Oxygen	8 m^3	Gas	Inside, < 30 m from boundary

For many of the substances, the proprietary name is not known. In addition, many different types and colours of paints are used, although all are solvent based. For this reason, the paints are conservatively assumed to be both flammable and corrosive, and summarised into the categories named above. As the specific gravity of the paints is not known, the conversion of proposed quantities is based on an estimated specific gravity of 1. The degreaser has been rated according to the general properties of solvents. As organic solvents generally have a specific gravity of less than 1, an averaged specific gravity value of 0.75 has been assigned for conversion purposes. The thinner, including the waste thinner, has been rated on the basis of its main component, xylene.

Step 2: Identify hazard ratings

As a first step, Appendix B of the main document is used to determine the hazard ratings for the listed substances. If the substance is not listed, Appendix A provides criteria for rating the substance provided that the HSNO classification is known. If these approaches do not yield a result, the default ratings of medium for the Fire/Explosion and Human Health effect types and high for the Environment Effect Type should be applied, unless the user is willing to undertake the steps required to rate the substance with the help of the Rating Guide in Appendix C of the main document. The ratings are recorded in a table as below.

As noted above, the paints have been summarised into two categories, and as for the degreaser, little substance-specific information is known. For this reason, default ratings have been used for all Effect Types, as indicated by italics.

Name	Hazard rating		
	Fire/explosion effect type	Human health effect type	Environment effect type
Degreaser (solvent)	*Medium*	*Medium*	*High*
Thinner (xylene based)	Medium	Low	–
Waste thinner	Medium	Low	–
Lacquer paints	*Medium*	*Medium*	*High*
Enamel paints	*Medium*	*Medium*	*High*
Fibreglass resin (styrene)	Medium	Low	Medium
Acetylene	High	–	–
Oxygen	Medium	–	–

Step 3: Find base quantities

Now that hazard ratings have been established for all substances that will be used or stored at the facility, Table 1 in this *Quick Guide* (Table 3 in the main document) can be consulted to find the Base Quantities (B) for each substance.

Name	**Base quantity (tonnes or m^3)**		
	Fire/explosion effect type	**Human health effect type**	**Environment effect type**
Degreaser (solvent)	30	10	3
Thinner (xylene based)	30	30	–
Waste thinner	30	30	–
Lacquer paints	30	10	3
Enamel paints	30	10	3
Fibreglass resin (styrene)	30	30	30
Acetylene	10,000	–	–
Oxygen	10,000	–	–

Step 4: Calculate adjusted quantity

Table 2 in the *Quick Guide* (Table 4 in the main document) lists the Adjustment Factors for the three Effect Types that must be used to calculate the Adjusted Quantity (A), i.e. the quantity that can be used at the facility without giving rise to adverse off-site effects.

In this case, no special circumstances apply. The facility is less than 30 metres from the site boundary, and information obtained from the council's district plan shows that the site is not located in the vicinity of a water body. Inquiries at the regional council have ascertained that the facility is not sited near a potable water resource.

Most of the substances used on the site are liquids, with the exception of acetylene and oxygen (gases) and fibreglass resin (solid). Although the substances are in use, the amount used represents only a part of the whole quantity. According to the guidance provided in the Step-by-Step Guide to the HFSP (refer main document), the substances held on the site are therefore regarded as being in storage.

Most Adjustment Factors, except for those relating to substance form in the case of fibreglass and the gases, are therefore set at 1. It should be noted that Adjustment Factor FH2 for the Human Health Effect Type does not apply at all in this case because all substances that have been assigned a hazard level for this Effect Type are either liquids or solids. The Adjusted Quantities are as follows:

Name	Adjusted quantity (tonnes or cubic metres)		
	Fire/explosion effect type	**Human health effect type**	**Environment effect type**
Degreaser (solvent)	30	10	3
Thinner (xylene based)	30	30	–
Waste thinner	30	30	–
Lacquer paints	30	10	3
Enamel paints	30	10	3
Fibreglass resin (styrene)	90	90	90
Acetylene	1000	–	–
Oxygen	1000	–	–

Step 5: Calculate quantity ratios

Now that all the necessary information has been collated, the Quantity Ratios (Q) for all three Effect Types can be calculated, by dividing the Proposed Quantity of a substance by the Adjusted Threshold for each Effect Type (P/A = Q). The values for each substance are then added together within the different Effect Types. Results are shown in the table below.

Name	Quantity ratio (Q)		
	Fire/explosion effect type	**Human health effect type**	**Environment effect type**
Degreaser (solvent)	0.0005	0.0015	0.0050
Thinner (xylene based)	0.0033	0.0033	–
Waste thinner	0.0017	0.0017	–
Lacquer paints	0.0033	0.0100	0.0333
Enamel paints	0.0020	0.0060	0.0200
Fibreglass resin (styrene)	0.0001	0.0001	0.0001
Acetylene	0.0027	–	–
Oxygen	0.0027	–	–
Total Q	**0.0163**	**0.0226**	**0.0584**

Step 6: Determine the proposal’s consent status

As indicated by the Consent Status Matrix used for this example, the Consent Status Index for a permitted activity in the commercial zone is 0.2. A proposed facility with a value higher than that in any of the three Effect Types would require a resource consent. In this case, no consent is required as even the highest Quantity Ratio (in the Environment Effect type) is still below 0.2.

The activity is permitted, but will need to comply with the minimum performance standards specified in the district plan. However, it is important to note that the facility may also have to comply with other provisions in the district plan (such as building specifications) or rules in a regional plan. For example, the spray-painting booth may require an air discharge consent, depending on regional rules.

8 What happens after a proposed hazardous facility has been screened using the HFSP?

Assessment of a hazardous facility proposal by the HFSP will result in one of the following outcomes:

- **The proposed facility is a permitted activity** and the minimum performance standards for hazardous facilities set out in the district plan need to be complied with, as well as any other relevant specifications. In cases of non-compliance with hazardous facility minimum performance standards, the facility should be regarded as being a discretionary activity.
- **The proposed facility requires a resource consent**. A consent application process must be initiated, including the preparation of an Assessment of Environmental Effects (AEE) and a risk assessment. Detailed information on this process is provided in the *Assessment Guide for Hazardous Facilities* (MfE, 1999c). Compliance with hazardous facility minimum performance standards is also required.

9 Further information

- Detailed information about the use of the HFSP and associated land use planning issues for hazardous facilities are contained in the main document, the *Land Use Planning Guide for Hazardous Facilities*.
- In-depth information about risk assessment and a suggested approach to dealing with facilities that require a resource consent may be found in the companion document, the *Assessment Guide for Hazardous Facilities* (MfE, 1999c).
- A simple approach to undertaking HFSP calculations and a list of common substances rated for the HFSP is provided in the HFSP Spreadsheet Package, a Microsoft Excel® Spreadsheet which may be downloaded from the MfE website: (http://www.mfe.govt.nz/about/laws/hsno/hazfacility.htm). It may also be requested on disk from the MfE.
- The MfE website presents all the resources named above for downloading, as well as providing relevant links, for example to the ERMA website.

The following aspects are essential in dealing effectively with proposed hazardous facilities:

- An understanding of the legislative requirements for hazardous substances and facilities
- District plan provisions that provide:
  - clear objectives, policies and methods
  - a method for assessing whether a proposed facility requires a consent or not, such as the HFSP
  - minimum performance standards for all hazardous facilities regardless of their consent status.

Chapter Overview

This document provides planning guidance for hazardous facilities under the Resource Management Act 1991 (RMA). It sets out methods for determining the resource consent status of hazardous facilities under the RMA and discusses one particular method, the Hazardous Facility Screening Procedure (HFSP), in greater detail as well as presenting information on using this method in district plans.

Section 1 provides background on the review of the 1995 document *Land Use Planning for Hazardous Facilities*, commonly known as the 'Red Book'. The 'Red Book' introduced guidelines for hazardous facilities and a new planning method, the Hazardous Facility Screening Procedure (HFSP). A definition of hazardous facilities is discussed and how the RMA deals with activities involving hazardous substances. Particular attention is given to the HFSP and how it can be made more accessible and user-friendly.

Section 2 introduces relevant statutes for hazardous substances management, including the RMA and the Hazardous Substances and New Organisms (HSNO) Act 1996. The RMA is the principal statute for land use controls for hazardous facilities, while the HSNO Act deals with life-cycle controls. Controls under both statutes are intended to be consistent and complimentary. Other relevant statutes for hazardous substance management include the Health and Safety in Employment Act 1992 (HSE), the Building Act 1991 and the Agricultural Compounds and Veterinary Medicines Act 1997.

Section 3 briefly outlines how the HSNO Act classifies hazardous substances establishing a series of hazard categories, with more stringent controls placed on substances with higher hazards. The system is broadly based on the United Nations (UN) system for the transport of dangerous goods, but includes additional categories for some highly hazardous substances, including toxic and ecotoxic substances.

Section 4 introduces land use planning methods for activities involving hazardous substances, including the HFSP and other methods. The advantages and disadvantages of the various methods are discussed. Irrespective of the adopted land use planning method, a series of controls need to be applied to all activities. These include minimum performance requirements under the RMA and the HSNO Act, and matters to be addressed in Assessments of Environmental Effects (AEEs) and assessment criteria for resource consent applications. Specific matters such as transboundary issues, transport and disposal of hazardous substances and relevant management systems are also addressed.

Section 5 provides background on the HFSP, including its development, use and application as well as an upgraded version of the procedure. The purpose of the HFSP is to establish whether a proposal for a hazardous facility requires a land use consent. The procedure helps to evaluate acceptable quantities of hazardous substances on a proposed site, based on a preliminary assessment of environmental effects. Explanations are given on how and when the HFSP is applied, where it should not be applied and which activities may be exempted.

Section 6	explains how the HFSP is linked with district plans through a Consent Status Matrix. This matrix contains a series of numerical values called Consent Status Indices that are assigned to each land use zone in the district. Numerical values (Quantity Ratios) calculated with the HFSP are compared against these indices to determine whether a proposed hazardous facility requires a resource consent. Guidance is provided on developing a Consent Status Matrix and on assigning and calibrating Consent Status Indices.
Section 7	discusses issues related to the implementation of the HFSP, such as the development of an implementation strategy to ensure the smooth introduction and long term administration of the procedure. This section discusses a range of concerns and solutions and the importance of monitoring the implementation of the HFSP.
Section 8	offers a model planning chapter on hazardous facilities to guide councils in the preparation of their district plans. It includes relevant definitions, a brief issue statement, objectives and policies, expected outcomes and a series of rules for hazardous facilities. The chapter is general in approach and will require translation into the context of particular districts.
List of abbreviations	provides a quick reference list for the abbreviations used in this document.
Glossary	contains a list of important terms and definitions.
References	gives a list of the documents used to prepare the Guide.
Bibliography	lists relevant Guidelines, Codes of Practice, Standards and other information sources (including electronic databases and websites) for the management of hazardous substances.
Appendix A	contains information on the rating of hazardous substances for the HFSP, based on the classification system adopted under HSNO.
Appendix B	lists commonly used hazardous substances for which the HFSP rating has already been completed.
Appendix C	is a guide enabling users to undertake their own research and subsequent rating of hazardous substances.
Appendix D	presents a spreadsheet for simplifying the HFSP calculations
Appendix E	details three case studies showing the application of the HFSP.
Appendix F	provides a model section 32 explanation that can serve as justification for the use of the HFSP under section 32 of the RMA.
Appendix G	contains a model schedule to accompany a district plan section on hazardous facilities.

1 Introduction

Key Points

- This Guide is the result of the review of the 1995 document *Land Use Planning for Hazardous Facilities,* commonly known as the 'Red Book'.
- The 'Red Book' introduced planning guidelines for hazardous facilities and a new planning method, the Hazardous Facility Screening Procedure (HFSP).
- A definition of hazardous facilities is provided, along with an overview of how the RMA deals with activities involving hazardous substances.
- This document gives particular attention to the HFSP to improve its accessibility and user-friendliness.

1.1 Purpose

This document is the result of the review of the 1995 document *Land Use Planning for Hazardous Facilities,* commonly known as the 'Red Book'. The 'Red Book' introduced planning guidelines for hazardous facilities and a new planning method, the Hazardous Facility Screening Procedure (HFSP). The HFSP was developed to help district councils decide whether a proposed hazardous facility is permitted, or whether it requires a land use consent and therefore an assessment of environmental effects and risks, as set out in the RMA.

The document is an updated version of the 'Red Book' containing a revised planning framework for hazardous facilities that is applicable to all districts, regardless of whether the HFSP has been adopted, as well as a revised version of the HFSP. The purpose of these amendments is:

- to provide an up-to-date statutory context including detail on new controls for hazardous substances under the HSNO Regulations
- to address issues associated with the use of the 'Red Book' and the HFSP in the last three years as raised by local authorities, industry and consultants
- to make the document and the HFSP more accessible and user-friendly.

This document should be read in conjunction with *Assessment Guide for Hazardous Facilities* (MfE, 1999c) which provides guidance on assessing hazardous facilities once it has been determined that a resource consent is required.

1.2 What are hazardous facilities?

The term 'hazardous facility' is not defined in New Zealand legislation. It is used to describe site-specific activities which involve the use and storage of hazardous substances. The term is relevant to land use planning under the RMA as opposed to the substance-specific controls under the HSNO Act.

For the purpose of this guide, hazardous facilities are defined as:

> *"Activities involving hazardous substances and sites, including vehicles for their transport, where hazardous substances are used, stored, handled and disposed of."*

These activities can include industrial operations such as chemical warehouses, manufacturing plants or bulk storage facilities, but also workshops, agricultural or horticultural activities or home occupations. The term may also apply to facilities involved in the storage, treatment and disposal of hazardous wastes.

Hazardous facilities do not include:

- the incidental use and storage of hazardous substances in minimal domestic scale quantities
- hazardous activities which do not involve hazardous substances but which may pose a risk to people or the natural environment due to a physical or biological hazard (e.g. earthworks, electromagnetic radiation, genetically modified organisms, flour dust)
- pipelines used for the transfer of hazardous substances such as gas, oil and sewage
- infectious substances (consistent with HSNO)
- sites or facilities subject to natural hazards (e.g. flooding, volcanic activity).

While some of the above hazards could be significant and may require controls under the RMA, they are beyond the scope of the planning method outlined in this document.

Hazardous facilities include sites which may be contaminated, or which discharge contaminants (including waste and sewage treatment, landfills, mineral extraction, etc.), only in so far as the use of the land involves the handling of hazardous substances (such as fuels, oils, pesticides and explosives). The term is not actually applied to the site contamination, to the discharge of contaminants into water or onto land, or to quarrying/blasting as part of mining activities.

1.3 Land use planning for hazardous facilities

The RMA provides for managing the effects of hazardous substances at a particular location, or, in other words, the site-specific use of land by hazardous facilities (sites or operations where hazardous substances are used or stored). The planning framework for the use of land by hazardous facilities under the RMA is complementary to the controls under the HSNO legislation and does not represent a competing control mechanism.

Most district councils have specific rules for the management of hazardous substances in their district plans. Approximately 30 district councils have adopted the HFSP to determine the consent status of a hazardous facility, while a number of generally small councils rely on activity or threshold lists.

This document supplies a general background on the regulatory context for hazardous substances and discusses regulatory requirements for hazardous facilities under the RMA in particular detail. Although it does not preclude the use of other suitable land use planning methods for hazardous facilities, specific focus is placed on the HFSP as a screening method for hazardous facilities.

1.4 Revisions

This Guide is not a statutory document, but provides means which should ensure the effective and sustainable management of hazardous substances. The performance of this guide will be assessed on a regular basis and in line with any new regimes for hazardous substance management under both the HSNO legislation and/or district plans. Possible amendments to the RMA may also need to be considered, along with developments in transport legislation or national hazardous waste standards. Revisions and updates of this Guide will be published as needed.

2 Regulatory Framework

Key Points

- The most relevant statutes for hazardous substance management are the Resource Management Act 1991 (RMA) and the Hazardous Substance and New Organisms Act 1996 (HSNO).
- The RMA is the principal statute for land use controls for hazardous facilities.
- Controls under both statutes are intended to be consistent and complementary.
- Other relevant statutes include the Health and Safety in Employment Act 1992 (HSE), the Building Act 1991and the Agricultural Compounds and Veterinary Medicines Act 1997.

2.1 Resource Management Act 1991 (RMA)

2.1.1 Functions of regional councils

The functions of regional councils with respect to hazardous substances management are defined by section 30 of the RMA:

> *"(1) Every regional council shall have the following functions for the purpose of giving effect to this Act in its region:*
>
> *[...]*
>
> *(c) The control of the use of land for the purpose of–*
>
> *[...]*
>
> *(v) The prevention or mitigation of any adverse effects of the storage, use, disposal, or transportation of hazardous substances; [...]*
>
> *(f) The control of discharges of contaminants into or onto land, air, or water and discharges of water into water."*

A further dimension is added to regional council responsibilities by the Second Schedule of the Act, which defines what matters may be provided for in regional policy statements and plans. These include discharges of contaminants into or onto land, air and water, the prevention or mitigation of any adverse effects of the storage, use, disposal, and transportation of hazardous substances (Clause 1), and any matters relating to the management of any actual or potential effects of any use, development or protection described in Clauses 1 or 2 on the creation, minimisation, recycling, treatment, disposal, and containment of all forms of contaminants (Clause 4).

In 1993, an amendment to section 62 of the Act provided for regional councils determining in the regional policy statement which local authority shall have responsibility for " [...] developing objectives, policies and rules relating to the control of the use of land for [...] the prevention or mitigation of any adverse effects of the storage, use, disposal or transportation of hazardous substances". Regional councils therefore have a role in controlling the use of land for the purpose of managing hazardous substances if they choose to exercise this function.

Changed again through the HSNO Act, however, the default responsibility now lies with territorial authorities (TAs) if not specified in the regional policy statement.

2.1.2 Functions of territorial authorities

Historically, TAs have had a land use planning and operational role with respect to hazardous substances management. Under the Dangerous Goods Act 1974, TAs have controlled the storage of dangerous goods by issuing dangerous goods licenses. Basic controls were also applied for land use under the old Town and Country Planning Act 1977.

Under section 31 of the Resource Management Act, TAs have been vested with the:

> *"... control of any actual or potential effects of the use, development or protection of land, including the implementation of rules for the avoidance or mitigation of natural hazards and the prevention and mitigation of any adverse effects of the storage, use, disposal or transportation of hazardous substances"*

a role which is similar to that of a regional council. A TA may carry out this function completely if so stated in the regional policy statement, or may share this responsibility with a regional council. In most regions of New Zealand, the majority of functions of controlling hazardous substance land use are carried out by TAs.

2.2 Hazardous Substances and New Organisms Act 1996 (HSNO)

The Hazardous Substances and New Organisms Act 1996 (HSNO) replaces the Explosives Act 1957, Dangerous Goods Act 1974, Toxic Substances Act 1979, a substantial part of the Pesticides Act 1979 and parts of other legislation. The Act covers all substances above defined minimum hazard threshold levels, excluding radioactivity.

The main purpose of the Act is the establishment of a comprehensive assessment and approval process for hazardous substances (and new organisms), and a consistent, performance based control framework. The Act also provides for the development of regulations specifying minimum requirements for hazardous substances, regardless of the activity, location, land use, quantity or the risk of cumulative effects of a number of substances.

A transitional period for existing hazardous substances is provided for in the Act, applying controls from the repealed legislation. It is currently intended that this period will expire in July 2004 unless extended further. During this time, substance in current use will gradually be transferred to the HSNO control scheme.

Under HSNO, the Environmental Risk Management Authority (ERMA) New Zealand is the central government agency responsible for establishing and administering core conditions for the management of all hazardous substances and new organisms. A number of other central and local government agencies have an enforcement role under the Act.

The HSNO legislation provides for various regulations which, among other things, specify a classification system and performance requirements for hazardous substances (MfE, 1994). The classification system is closely linked to international systems such as the United Nations Recommendations for the Transport of Dangerous Goods (UNRTDG, 1997, 11th edition), but contains some variations to include levels of hazard which are relevant at stages of a substance's life cycle other than transport. Other performance requirements cover matters such as the specific control of hazardous properties as well as the life cycle or systems controls (such as containment/packaging or identification/hazard communication).

Under the performance-based nature of the HSNO legislation, compliance with (ERMA New Zealand approved) Codes of Practices will become more important. Demonstrating legal compliance with such codes and possibly other relevant documentation will become an important legal defence mechanism both under the HSNO Act and other legislation.

2.2.1 The hazard classification system

The HSNO Hazard Classification System was established under section 74(a) of the Act for the following hazardous properties:

- explosiveness
- flammability
- oxidising capacity
- corrosiveness
- toxicity
- ecotoxicity
- substances which, upon contact with water or air, develop any of the above hazard properties.

The system provides minimum hazard threshold levels below which substances are not covered by the legislation. It also establishes between one and six or seven hazard categories for the various hazards allowing for more stringent controls to be placed on substances with higher hazards. These controls are termed hazard classification controls or property performance requirements. (See also Section 3 for links with the UN classification systems.)

2.2.2 Property performance and life cycle requirements

Property performance requirements are established under section 75 of the HSNO legislation. They are designed to reduce the likelihood of an unintended event caused by the hazardous properties of a substance and to control the adverse effects of the event.

The HSNO "pan-life cycle" (or systems) requirements cover the following areas:

- packaging and containers
- identification
- tracking and competency
- emergency preparedness
- disposal.

These requirements apply at all or some defined stages of the life cycle of a hazardous substance, regardless of location or land use.

2.3 Links between HSNO and planning controls under the RMA

As stated, HSNO requirements are minimum requirements which need to be met in all parts of New Zealand. Local planning documents cannot specify lesser requirements for hazardous substances covered by the HSNO legislation than those specified by HSNO. However, planning controls can be more stringent in some cases, for example to protect sensitive environments and locations, or in cases of risk of synergistic and/or cumulative effects of several hazardous substances, or to reflect particular concerns of local communities.

The scope of what is considered a hazardous substance from a RMA perspective may also be wider than for HSNO purposes. In practice, this means that substances with radioactive properties or potentially environmentally damaging substances, e.g. in terms of a high *biochemical* oxygen demand (BOD), can also be covered by planning controls. Hazard thresholds or cut-off levels may vary in some instances from those defined under HSNO, although this is not recommended.

It should be noted that, apart from HSNO property performance requirements and life cycle controls, other requirements may be relevant for hazardous substances planning purposes. In particular, national standards for hazardous waste management may need to be reflected in planning documents. Such standards are currently being considered by the Ministry for the Environment.

2.4 Other relevant legislation

Hazardous substances are also managed under a number of other Acts of Parliament and associated regulations, which are administered by various agencies. The most important of these Acts are listed below. However, particular aspects of hazardous substances management may also be affected by other statutes not listed, such as medicines, local government or civil defence legislation.

2.4.1 Building Act 1991

The Building Act covers issues associated with the construction, design and fire protection of buildings. It provides for the safe storage of hazardous substances to prevent their release into the environment in the case of fire (Section 6(2)(c)). The Act uses the general, qualitative definition of 'hazardous substance' of the Fire Service Act. The Building Code and 'approved documents' provide means of compliance with the requirements of the Act. Part F3 deals specifically with hazardous substances in buildings.

2.4.2 Fire Service Act 1975

The Fire Service Act deals with matters relating to the structure, function and funding of the New Zealand Fire Service. Under this Act, incidents involving hazardous substances are considered to be emergencies that are attended by the Fire Service. Of interest is section 17N, which stipulates that the National (Fire Service) Commander shall provide for co-operation with territorial local authorities and regional councils, with special reference to hazardous substances emergencies.

2.4.3 Health Act 1956

The Health Act provides for TAs to control nuisances, offensive trades, and the handling and storage of noxious substances, among other things. Although dated in some respects and long considered to require updating or replacing, this Act still provides considerable powers for managing hazardous substances.

2.4.4 Radiation Protection Act 1965

The Radiation Protection Act is administered by the Ministry of Health. It deals with the control of radioactive substances, including radiation emitting equipment such as x-ray machines, and the occupational safety and health of workers who use radioactive substances. The National Radiation Laboratory in Christchurch is the principal agency providing advice and guidance in these matters.

2.4.5 Health and Safety in Employment Act 1992

This Act is administered by the Department of Labour and provides comprehensive safety and health requirements for all places of work (covered by a very general and far-reaching definition). Particular emphasis is placed on hazard identification, analysis and management. Codes of Practice provide the means for meeting the requirements of the legislation.

2.4.6 Agricultural Compounds and Veterinary Medicines Act 1997

This Act is administered by the Ministry for Food and Fibre (previously Agriculture) and addresses, among other things, requirements for the registration and use of chemicals as agricultural compounds or veterinary medicines. The assessment and approval process for hazardous substances covered by this Act is designed to be closely linked to the process under the HSNO legislation. The Act comes into effect at the same time as the hazardous substance parts of the HSNO Act.

2.4.7 Transport Act 1962 and Land Transport Act 1993

These acts are especially relevant for the transport of hazardous substances on land. The Transport Act 1962 establishes classes of hazardous substances and places a duty on consignors and transporters of goods to package, label, segregate and provide documentation for hazardous substances, as well as requiring the training of drivers who transport hazardous substances. The Land Transport Act 1993 provides for the promulgation of Land Transport Rules, one of which, the *Land Transport Rule: Dangerous Goods 1999* (LTSA,1999) deals with the land transport of dangerous goods (used instead of the term 'hazardous substances'). The Dangerous Goods Rule and the associated *New Zealand Standard 5433:1999* will replace the provisions of the Transport Act 1962 and the old *New Zealand Standard 5433:1988*. The transport legislation is administered by the Land Transport Safety Authority.

3 Classification of Hazardous Substances

Key Points

- For the purpose of land use planning under the RMA, hazardous substances are classified in accordance with the HSNO legislation.
- The HSNO classification system establishes a series of hazard categories, with more stringent controls placed on substances with higher hazards.
- The HSNO classification system is generally based on the United Nations (UN) classification system for the transport of dangerous goods, but includes additional categories for some hazardous substances, including toxic and ecotoxic substances.
- The RMA definition of hazardous substances includes those substances classified under HSNO, but may also include radioactive and environmentally damaging substances.

3.1 Background

Hazardous substances are generally classified according to their hazardous properties and the degree of hazard. Substances of greater hazard are classified in higher hazard categories than substances of lower hazard. An example is flammable liquids which are, among other criteria, classified according to their flash point. Substances with a low flash point, i.e. those substances which can easily be ignited, are considered highly hazardous. Substances with a high flash point are less hazardous.

In New Zealand, HSNO provides for regulations which specify a classification system for hazardous substances. The principles of this system have not changed significantly since they were first published (MfE, 1994). The classification applies to all types of hazards generally controlled, apart from radioactivity and infectious substances (refer Section 3.2.2).

3.2 The HSNO hazard classification system

3.2.1 Purpose of classification

HSNO provides for hazardous substances to be classified so that appropriate controls may be allocated according to their hazard. Substances classified as highly hazardous are more tightly controlled through their entire life than less hazardous substances.

3.2.2 Hazardous substance categories and thresholds

The HSNO Hazard Classification System has been established under section 74(a) for the following hazardous properties:

- explosiveness
- flammability
- oxidising capacity
- corrosiveness
- toxicity

- ecotoxicity
- substances which, upon contact with water or air, develop any of the above hazard properties.

The system provides minimum hazard threshold levels below which substances are not covered by the legislation (HSNO section 74(b)). It also establishes between one and seven hazard categories for the various hazards (plus some sub-categories), allowing for more stringent controls to be placed on substances with higher hazards.

HSNO classification criteria are specified in regulations to provide transparency and to enable people to establish the likely classification of a substance themselves. For the precise definitions of the hazard categories and thresholds the relevant HSNO Regulations should be consulted.

3.2.3 Linkage with United Nations Recommendations for the Transport of Dangerous Goods

The HSNO classification system is closely linked to the United Nations Recommendations for the Transport of Dangerous Goods (UNRTDG, 1997; 11th edition). It also introduces criteria not part of the UNRTDG. These cover different aspects of toxicity (particularly chronic toxicity) and ecotoxicity. The criteria are based on work of the Organisation of Economic Co-operation and Development (OECD) and the United States Environmental Protection Agency (USEPA).

In terms of the labelling of packaging and containers imported into and/or transported in New Zealand, hazardous substances will be mostly identified in accordance with UNRTDG compatible classifications. However, it is important to note that UNRTDG labelling often only provides information on the identification of the primary hazard and sometimes the secondary hazard of a substance.

In contrast, HSNO requires a hazardous substance to be assessed and managed according to all the hazardous characteristics it identifies (refer Section 3.2.2). Therefore, a substance with multiple hazardous properties or with properties outside the UNRTDG criteria will need to comply with the controls placed on it under HSNO. This may include the identification (including labelling) of all the hazards of the substance within New Zealand.

Appendix A shows how some of the HSNO classification criteria relate to particular UN classes.

3.2.4 Linkage with the Resource Management Act 1991

The RMA defines hazardous substances as including, but not being limited to, the substances classified in accordance with the HSNO system. From a land use perspective, this is generally understood to include, in addition to the HSNO substances, radioactive materials and environmentally damaging substances.

Environmentally damaging substances include substances that can have adverse effects on ecosystems and wildlife but are not considered ecotoxic under HSNO as they are below the ecotoxicity threshold. Such properties include a high biochemical oxygen demand (BOD) leading to rapid depletion of oxygen if the substance (such as milk) is released into natural waters, or smothering effects (e.g. by some oils).

The RMA also defines the term 'contaminant' which is likely to include most hazardous substances for the purpose of controlling discharges to the environment. This is a function of regional councils and is therefore not specifically addressed in this document.

4 Land Use Planning for Hazardous Substances under the RMA

Key Points

- Land use planning methods for hazardous facilities under the RMA include the Hazardous Facilities Screening Procedure (HFSP) and a series of other methods.
- Irrespective of the adopted land use planning method, specific minimum controls need to be applied to all activities involving hazardous substances. These include minimum performance requirements under the RMA and HSNO, matters to be addressed in AEEs and assessment criteria for resource consent applications.
- Specific matters such as transboundary issues, transport and disposal of hazardous substances, and relevant management systems are also addressed.

4.1 Risks presented by hazardous substances

Hazardous substances and their use, storage and handling present potential sources of risk. Under normal operating conditions and environmental circumstances, hazardous substances may be perfectly safe.

However, accidents such as structural failures of containment or process facilities, operational malfunction or human error can cause the release, or loss of control, of hazardous substances and consequent events such as:

- fire resulting in heat exposure
- explosion resulting in overpressure and/or missile projection
- hazardous substance release resulting in acute toxic/ecotoxic exposure
- corrosive spill resulting in irritative exposure.

It should be noted that a risk assessment of a hazardous facility for land use safety planning purposes generally focuses on accidental events involving hazardous substances (MfE, 1999c). Such an assessment does not normally address any long-term effects or risks caused by routine and long-term discharges of environmental contaminants as authorised under the RMA through discharge consents.

4.2 Objectives of land use planning methods and the HFSP

The primary objective of land use planning controls for hazardous substances is to assist with managing the risks of hazardous substance and to avoid, remedy or mitigate adverse environmental effects by:

- identifying any new or modified activities involving the use, storage, transport and disposal of hazardous substances with the potential to exert significant environmental effects or risks
- determining whether the adverse effects and risks presented by these activities are significant and therefore require a resource consent and a more detailed assessment, or whether they may proceed as permitted activities

- applying minimum performance standards to all activities involving hazardous substances irrespective of their resource consent status
- where required, imposing appropriate resource consent conditions to ensure that any adverse environmental effects and risks of activities involving hazardous substances are adequately managed
- providing for the long-term monitoring of activities involving hazardous substances.

4.3 Planning methods

4.3.1 The HFSP

The purpose of the Hazardous Facility Screening Procedure (HFSP) is to determine whether a proposed activity involving the use, handling and/or storage of hazardous substances requires a land use consent under the RMA or not. It is also used to determine the specific consent status of such an activity (for example, whether it is a permitted, controlled or a discretionary activity). However, it cannot be used to determine the outcome of a resource consent application without a more detailed assessment of environmental effects and risks.

The HFSP is a preliminary screening method. It is used to determine whether the potential cumulative environmental effects presented by hazardous substances on a proposed site are significant. It does so by taking into account substance properties and quantities, the type and nature of the proposed storage facilities and the location of the proposed site in relation to sensitive environments.

The HFSP evaluates hazardous substances generically in terms of three different kinds of Effect Types:

- Fire/Explosion
- Human Health
- Environment.

Acceptable quantity limits for permitted activities involving hazardous substances are specified in the district plan. If the cumulative effects of hazardous substances exceed these limits for any of the three Effect Types, a resource consent is required.

As a tool, the HFSP can also assist with locating hazardous facilities in areas with compatible land uses. For example, large facilities are best placed in areas designated for industrial use and with the necessary infrastructure in place to address such effects. It must be noted, however, that the HFSP itself does not specify any controls or performance standards. This must be done through rules in a district (or regional) plan.

The procedure is explained in detail in Section 5.

4.3.2 Other methods

There are a few other methods for determining the consent status of hazardous facilities in district plans. They include the following:

- hazardous substance threshold lists
- hazardous activities lists specifying the consent status of selected activities
- the Dow/Mond Index.

Hazardous substance threshold lists show either individual substances or classes/categories of substances, together with maximum permissible quantities. Often, two thresholds are provided for controlled and discretionary activities involving these substances. The thresholds vary, depending on the zoning.

Hazardous activities lists generally include specific industries or commercial activities, sometimes in combination with maximum quantities of hazardous substances. Some activities are specified as requiring a particular type of land use consent in all zones of a district, while other activities have a tiered consent status depending on scale of operation and/or location.

The Dow Index involves the calculation of a possible maximum product loss. While the index can theoretically be used for establishing levels of risk to the environment in general, it has been initially designed for the evaluation of fire, explosion and reactivity potential of industrial process equipment and its content. Only one territorial authority currently uses the index, for part of the district (the HFSP is used for the remainder of the district).

All these methods have been used previously in district schemes. However, substance threshold and activity lists are generally not considered to be effects-based and therefore not consistent with the principles of the RMA. Also, being lists, they are by nature limited to the types of substances and activities listed and fall short for those substance/activities that are not listed. Further, lists can not account for cumulative effects, as each substance/activity is assessed on an individual basis.

The Dow Index is used for historical reasons in an area with specific types of industries. It has limitations for smaller scale activities, toxic or ecotoxic substances and the consideration of off-site effects. The site-specific application of this method means it can not be translated easily to other districts.

If other methods than the HFSP are being used for the establishment of the consent status of a hazardous facility under the RMA, the following matters need to be addressed:

- The method should provide for the technically defensible assessment of an activity and the actual and potential environmental effects resulting from the use, storage and/or handling of hazardous substances.
- Hazardous substances tend to be used throughout a district. Therefore, any method must be able to cover all conceivable activities/facilities and land use zones. For example, activity lists are generally limited to industrial and commercial land use zones, but should also include activities in other land use zones (such as farming and horticultural enterprises, home enterprises or suburban dry cleaners).
- Most currently existing lists tend to be incomplete as only a certain number of substances or activities can be practically included. However, in excess of 100,000 hazardous substances are used commercially worldwide. Toxic and ecotoxic substances need to be specifically included.

- If generic hazardous substance categories are used (e.g. ‘flammable substances’ or ‘chemical manufacturing’), they need to be well defined and consistent with HSNO legislation.
- Activities (e.g. use, handling, storage, transport, retail, disposal etc.) need to be clearly defined.
- Consistency is required in defining the consent status of an activity involving hazardous substances. For example, if a consent is required for the storage of a specific quantity of a given hazardous substance it must also be required when the same quantity of the substance is used in a manufacturing or other process.

4.4 Minimum performance requirements for hazardous substances

4.4.1 Minimum performance requirements under the RMA

Under the land use provisions of respective district plans in New Zealand, hazardous facilities are normally required to comply with a series of minimum performance requirements. These apply irrespective of the method used or the consent status of the hazardous facility, that is, they apply also to permitted activities.

Minimum performance requirements for hazardous facilities may address general, zone-related and hazardous facilities specific requirements. General and zone-specific requirements vary from district to district. In contrast, minimum performance requirements for hazardous facilities tend to be more consistent and to apply in areas where minimum requirements stipulated by other legislation (in particular life cycle controls under HSNO) are not deemed sufficient to address site-specific issues or community concerns.

4.4.2 Minimum performance requirements under HSNO

Property performance requirements under HSNO apply to all substances under the hazard classification system, that is, all substances with one or more of the hazardous properties above defined minimum hazard threshold levels.

Property performance requirements specify, as the name indicates, a required performance, not prescriptive controls. They are designed to reduce the likelihood of an unintended event caused by the hazardous properties of a substance and to control any adverse effects of the event. While HSNO specifies a required performance, it does not prescribe the means by which performance can be achieved. It therefore leaves considerable flexibility in terms of how people go about meeting performance.

HSNO specifically aims to control for the following events and effects:

- **Explosiveness** (capability of sudden expansion due to a release of internal energy):

limiting the chance of an accidental explosion

limiting the effects of an unintended explosion (or of an intended explosion outside a defined impact area)

managing areas where substances with explosive properties are manufactured, loaded/unloaded, stored or used.

- **Flammability** (capability to be ignited in the presence of oxygen and to sustain combustion):

limiting the chance of accidental ignition of substances with flammable properties

limiting the effects of unintended ignition and of intended combustion outside defined area

managing areas where substances with flammable properties are manufactured, loaded/unloaded, stored or used.

- **Oxidising capacity** (capability to contribute to fire or explosion due to release of oxygen):

limiting the chance of unintended combustion or explosion by either accidental contact with incompatible materials or occurring as a result of exposure to energy sources (including by desensitisation or temperature control)

limiting the effects of unintended combustion, explosion or spills

managing areas where substances with oxidising capacity are stored or used.

- **Corrosiveness** (capability to chemically break down metals or human tissue on contact):

avoiding adverse effects on human tissue, by implementing measures such as protective clothing/equipment or purpose-specific equipment

limiting exposure of people by setting Tolerable Exposure Limits (for the purpose of property performance, corrosiveness controls are considered to be a sub-set of the toxicity requirements).

- **Toxicity** (capability for adverse health effect, short or long term, following exposure):

limiting access to highly toxic substances; implementing measures to avoid adverse health effects such as protective clothing/equipment or purpose-specific equipment

limiting exposure of people by setting of so-called ‘Acceptable Daily Intakes’ and ‘Tolerable Exposure Limits’.

- **Ecotoxicity** (capability for adverse toxic effects on non-human organisms or ecosystems):

limiting access to highly ecotoxic substances

avoiding adverse effects on organisms and ecosystems by implementing measures such as purpose-specific equipment

limiting exposure by setting ‘Maximum Application Rates’ for target areas and ‘Environmental Exposure Limits’ for non-target areas

keeping ‘Records of Use’ of ecotoxic substances as a biocide.

HSNO “pan-life cycle” (or systems) performance requirements are applicable in the following areas:

- **packaging and containers** (including strength, durability and containment requirements of anything from small retail packages to tank-wagons or explosive magazines)
- **identification** (or ‘hazard communication’ requirements, covering labels, signs and workplace material safety data documentation)
- **tracking and competency** (for highly hazardous substances and defined persons dealing with certain hazardous substances, including test certifiers)
- **emergency preparedness** (covering minimum emergency response information as well as more specific information for locations with substances above specified quantities; specifying the type of information necessary and the performance of systems and equipment for a hazardous substance emergency response)

- **disposal** (requiring the reduction of all defined hazardous properties of waste substances to defined levels beyond the point of disposal).

These system requirements apply at all or some defined stages of the life cycle of a hazardous substance, regardless of location or land use (with the exception, to some degree, of the disposal requirements).

The HSNO Regulations should be consulted for specific details on HSNO performance requirements.

4.4.3 Minimum performance requirements under other Acts

Both the Building Act 1991 and the Health and Safety in Employment Act 1992 contain some basic performance based controls for hazardous substance management. The Building Act provides for Clause F3 of the New Zealand Building Code as a means of compliance with the requirements of the Act for buildings containing hazardous substances. This will be reviewed once HSNO is fully in force, as it currently only applies to some classes of hazardous substances.

The HSE Act requires a hazard identification process for workplaces as well as incident notification procedures that are relevant to the performance of workplaces that are also hazardous facilities.

4.5 Management systems

4.5.1 Site management systems

Increasingly stringent requirements for hazardous substances under the RMA and other legislation result in growing legal liabilities for operators of hazardous facilities. As a result, companies need to deal with these liabilities in a systematic and well-organised fashion. Management systems are key tools to demonstrate legal compliance and underpin a company's ability to demonstrate due diligence and mount a defence in a legal court.

For some facilities, site management systems may be required under the conditions attached to a resource consent. However, in many cases management system are a voluntary measure companies implement for worker health and safety, internal quality assurance and due diligence purposes.

Site management systems can take many shapes and forms, although there are some that are particularly suitable for incorporating hazardous substances-related provisions:

- **ISO 14001 –** this international standard sets the blue print for Environmental Management Systems (EMS). It was finalised in 1996 and superseded an earlier British Standard. While ISO 14001 covers the fundamentals of an EMS, a series of other related standards are in preparation that relate to environmental management and environmental performance. Under ISO 14001, organisations commit themselves to identify and manage significant environmental issues related to their activities and to comply with the law and other requirements.

- **ISO 9000 –** this international standard focuses on ensuring product and/or service quality according to specified customer requirements. Even though not primarily targeting environmental quality, many aspects of an ISO 9000 quality management system have beneficial effects on environmental performance and can be directly linked with an ISO 14001 EMS.
- **Responsible Care –** this management system was introduced in 1984 by the Canadian Chemical Producers' Association and is administered by the New Zealand Chemical Industry Council in New Zealand (NZCIC). The programme is designed to help industry manage health, safety and environmental protection issues through improvement in performance.
- **Fire Service Approved Evacuation Schemes –** pursuant to the Fire Safety and Evacuation of Buildings Regulations 1992. Such schemes relate to the site management of hazardous substances, as control measures for storage and use must be specified and integrated into the overall scheme.

4.5.2 Risk management systems

Risk management is an integral part of good site management practice. Standards Australia and New Zealand have recently developed a risk management standard (AS/NZS 4360:1995). This standard addresses risk management in a systems context and ties in with the general approach taken under ISO 14001.

4.6 Preparation and assessment of resource consent applications for hazardous facilities under the RMA

4.6.1 Preparation of an Assessment of Environmental Effects (AEE)

Once it has been determined that a hazardous facility requires a resource consent, an Assessment of Environmental Effects (AEE) pursuant to Section 88(4)(b), (5) and (6) and the Fourth Schedule of the RMA has to be undertaken. A companion guide to this document, the *Assessment Guide for Hazardous Facilities* (MfE, 1999c) provides detailed information on the preparation and assessment of resource consent applications for hazardous facilities. Also, the MfE has published good practice guides on how to prepare and audit AEEs (MfE, 1999a, b).

An AEE should include the following:

1 A full description of the nature and scale of the proposed facility and associated operations, and a preliminary outline of the scope of the AEE to be undertaken.

2 Documentation of alternatives (sites/locations, substances, quantities, processes/equipment, site management etc.).

3 Description of the environment potentially affected by the proposal, including pathways and receptors).

4 Preliminary hazard and risk analysis (a screening process such as the HFSP could be used).

5 Detailed hazard and risk analysis of installations, operations and processes involving the use, handling, storage, transport and disposal of hazardous substances which is appropriate to the type and scale of the proposed facility. A qualitative or, in some cases,

a quantitative risk assessment may be required, depending on the scale or potential effects of the proposed development. This assessment should place emphasis on the following issues:

- a hazardous substance inventory and description of proposed/existing installations, operations and processes on the site
- the biophysical characteristics of the site and surrounding area and relevant infrastructure on and off-site (e.g. drainage, roads)
- the location of the facility in relation to people-oriented activities (e.g. child care facilities, schools, rest homes, hospitals), sensitive environments (e.g. natural waters, ecosystems) and infrastructures (neighbouring roads, buildings etc.)
- identification of potential hazards, failure modes and exposure pathways
- assessment of the probability and potential consequences of an accident leading to a release of a hazardous substance or loss of control, including, as applicable, cumulative and/or synergistic effects
- acceptability of the assessed risks, including cumulative risks
- proposed risk control and environmental mitigation measures, with emphasis on sensitive activities and environments, including, as applicable, fire safety and site management systems, engineered safety measures such as containment devices, spill contingency and emergency plans, monitoring and maintenance schedules as well as training programmes.

6 Management of wastes containing hazardous substances.

7 The transport of hazardous substances, where this forms a significant part of the operations. Hazardous substances transport poses risks that are similar to those of use and storage in terms of uncontrolled releases, but may require different methods of control. For an assessment of the transport of hazardous substances, it should be demonstrated that the proposal will generate no significant adverse effects on the safety of the operation of the adjoining road network and that vehicles transporting hazardous substances will utilise appropriate roads as a regular means of transport.

8 Outline of proposed site management systems and plans, as necessary.

9 An emergency management plan detailing emergency preparation and response measures.

10 Development of a consultation strategy to facilitate communication with the regulatory authority and stakeholders/affected parties.

11 Final review of the AEE to ensure that it is in accordance with the Fourth Schedule of the RMA.

The detail of any hazard identification and risk assessment of a hazardous facility for a land use consent application must reflect the nature and scale of the proposal. This includes relevant aspects of installations and operations utilising hazardous substances, as well as the hazard levels of the substances and their quantities. The scope of an AEE to support the application can therefore vary significantly. For a home occupation or small commercial operation, 5–10 pages of information on the hazardous substance aspects of the proposal may be sufficient. For large-scale industrial facilities, hundreds of pages may be necessary.

4.6.2 Criteria for the evaluation of resource consent applications

Regulatory authorities generally assess a consent application and the accompanying AEE with regard to the following matters:

1. Consistency with the objectives, policies and rules outlined in the district plan, or any regional policy statements or plans, as applicable, for the relevant location.
2. Justification for the proposed site, including consideration of alternatives where off-site effects are considered to be significant.
3. The appropriateness of the assessment of environmental effects and risks carried out for the proposed facility, and the accuracy and completeness of the presented information.
4. The scale and significance of environmental effects and risks associated with the hazardous substances proposed to be used, stored, transported or disposed of by the proposed facility, including the potential for cumulative risks.
5. The appropriateness of the proposed risk control and mitigation measures.
6. Adequacy and comprehensiveness of the employed consultation process, the nature of submissions received and/or written confirmations by relevant stakeholders.
7. The adequacy of proposed site management systems and plans, particularly in relation to hazardous substances.
8. Proposed measures for the management and disposal of hazardous wastes.
9. Scale and significance of off-site transport of hazardous substances, and proposed measures for control.
10. The scope and suitability of the emergency management proposals.

4.6.3 Recommended resource consent conditions

Resource consent conditions for hazardous facilities can be as varied as the facilities themselves. The following recommendations for conditions cover various, but not necessarily all, aspects for which conditions may need to be specified. Some minimum conditions are likely to be specified in district plans as minimum performance standards for permitted hazardous facilities. These generally apply regardless of the conditions stated in resource consents.

4.6.3.1 Site design, construction and management

Site design conditions should ensure that hazardous facilities are designed, constructed and managed in a manner that avoids or minimises the risk of adverse effects on the environment from the activities carried out on the site. This should include provisions for the intentional use of hazardous substances and for the unintentional reaction or release of hazardous substances. Adverse effects on the environment include adverse health effects or injury to people, damage to other living organisms and ecosystems, and damage to off-site property.

Resource consent conditions on site design, construction and management may cover:

- appropriate spill containment systems for liquid hazardous substances
- separation requirements between facilities and the property boundary
- the identification of the storm water drainage system
- emergency response installations and equipment.

Conditions may also require compliance with development plans submitted by the developer, or specify additional design requirements.

4.6.3.2 Hazard communication

Hazard communication conditions should be used to ensure that hazardous facilities are adequately sign-posted to indicate the nature of the substances stored, used or otherwise handled. Generally, compliance with the HSNO identification and hazard communication performance requirements can be expected to be sufficient, although substances not covered by the HSNO legislation may need to be considered.

It is unlikely that additional requirements for resource management purposes are necessary in regard to labels and information on packaging and containers, or documentation such as Material Safety Data Sheets.

4.6.3.3 Hazardous substances management plan

A hazardous substances management plan may be required through a consent condition if appropriate to the scale of the operation and its hazards. Such a plan should include:

- inventories of hazardous substances, facilities and locations
- emergency response procedures specific to particular hazardous events identified in the risk assessment process
- notification procedures and details (internally and externally), including for incident and accident reporting
- site and process plans
- monitoring and maintenance schedules
- training and review procedures.

The hazardous substances management plan could be part of a wider site management plan, health and safety plan or an environmental management system.

4.6.3.4 Management of hazardous waste

Waste management conditions should ensure that process waste or waste containing hazardous substances are stored, managed and disposed of in a manner that minimises the risk of adverse effects on the environment. Conditions may require the selection of waste management contractors who must have the appropriate facilities and processes to manage the wastes in compliance with all relevant statutes. If hazardous wastes are a significant part of the operation, a hazardous waste management plan may also be required.

4.6.3.5 Transport

Conditions may be required to ensure that on-site transport of hazardous substances is carried out in a manner that minimises the risk of adverse effects on the environment. Matters specified may include specific areas for manoeuvring and loading/unloading of hazardous substance transports or restrictions of other vehicle movements in parts of a site where hazardous substances are handled or stored.

Off-site transport is generally difficult to control as part of a land use consent for a hazardous facility. In individual cases, dedicated transport routes or times could be specified, although they are difficult to monitor. Where a council identifies specific transport routes, it needs to ensure that these are compatible with district/regional plans of other affected authorities.

4.6.3.6 Emergency preparation and management

During an emergency, it is unlikely that there will be enough time to decide who is in charge, identify sources of help, train people to respond adequately and decide on a plan of action to follow. For this reason, it is important that an emergency plan, tailored to the specific requirements of the facility, is prepared and adhered to.

4.6.3.7 Monitoring

Hazardous facilities require monitoring, which ranges from assessing general environmental performance indicators to compliance with district plan rules and resource consent conditions. Monitoring may be carried out by regulatory authorities or by the hazardous facilities operator (self-monitoring), with appropriate reporting procedures to the regulatory authority (refer Section 4.6.3.9).

Self-monitoring by the consent holder may cover specific matters or be part of a wider management system, and needs to include reporting to the regulatory authority on a regular basis. Issues covered by self-monitoring regimes can include inspection and site/equipment maintenance, incident/accident reporting, training and any changes in the management of hazardous substances on the site during the consent period.

A monitoring strategy for a hazardous facility can include the following matters:

- hazardous substance inventories
- inspection schedules for site, storage areas and equipment (daily, weekly, monthly, events based)
- testing of performance of equipment (e.g. examination of tanks/pipelines/ valves, stormwater retention/treatment devices)
- testing of procedures (e.g. evacuation or spill response)
- training programmes for new staff, updates for existing staff
- audits of sites and site management systems.

4.6.3.8 Codes of Practice

Codes of Practice may be used as means to achieve compliance with specific resource consent conditions. Examples of relevant codes include the *Code of Practice for Design, Installation and Operation of Underground Petroleum Systems* (Department of Labour – OSH) or the *Code of Practice for Warning Signs for Premises Storing Hazardous Substances* of the NZCIC. It is expected that new Codes of Practice will be developed and existing Codes updated under the HSNO Act. A bibliography of useful guides, Codes of Practice and Standards is contained in Section 10 of this document.

4.6.3.9 Reporting

Reporting requirements placed on the consent holder will primarily focus on supplying data to the regulatory agency at specified intervals to demonstrate compliance with the RMA and relevant rules, as well as resource consent conditions. Reporting requirements may cover hazardous substance inventories, relevant inspection/monitoring data, records on incidents/accidents, testing of equipment and staff training, as well as results of site or systems audits.

4.6.4 Involvement of technical specialists

In some instances, hazardous substance/hazardous facilities experts may need to be involved in the preparation and/or assessment of hazardous facilities consent applications. This may be the case where specialist expertise by either the consenting authority or the applicant (or both) is not available, or where reasonably complex risk assessment and/or management procedures may need to be developed and utilised.

Examples of where specialist involvement may be necessary are the application of the HFSP and the establishment of the consent status of the proposal, or the development of measures to limit or mitigate risks. In some instances, this process may be managed entirely by the specialist. Technical specialists may also assist either the applicant or the consenting authority with particular aspects of the proposal and application.

4.6.5 Consultation

Good consultation between the applicant and the relevant regulatory authority or authorities is very important. Depending on the scale of a proposed hazardous facility, this may need to start well before any applications are lodged. Obtaining and issuing consents for hazardous facilities are seldom routine procedures due to the varying nature of such facilities, the sometimes highly technical nature of the information and the reasonably small number of applications in comparison with other consent applications.

For non-routine and/or large-scale proposals, in-depth discussions about the proposal may be necessary, and it is important that the lines of communication between the applicant and council representatives are kept open and maintained during the entire process. In many instances, technical advisors and hazardous substance specialists may be engaged by one or both parties. A clear understanding of the respective roles and responsibilities of everyone involved in the process will assist in constructive discussions and the smooth processing of an application.

4.6.6 Monitoring and enforcement by regulatory authorities

At present, monitoring and enforcement of district plan and other applicable rules for hazardous facilities/substances and hazardous facilities resource consent conditions by regulatory authorities are highly variable. Few nominated enforcement persons have been assigned to carry out hazardous facilities monitoring and enforcement activities. In many instances, dangerous goods inspectors have until now carried out some functions under the RMA, without always having the necessary authority.

Monitoring and enforcement of hazardous facilities controls under the RMA may in future be linked to the enforcement regime under HSNO. Dedicated HSNO enforcement officers will carry out this function. Appropriate authority needs to be given to these officers under the RMA, if they are to carry out the monitoring and enforcement of resource management specific matters. Training in the resource management area may need to be provided to such staff. This could, however, also apply to other persons carrying out monitoring functions under the RMA in respect to hazardous substance management. It is noted that the extent to which individual TAs provide enforcement under HSNO is still being developed. However, it is important that TAs develop a strategy for monitoring and enforcing hazardous substance controls that addresses the necessary links between the various functions.

5 The Hazardous Facility Screening Procedure (HFSP)

Key Points

- The Hazardous Facility Screening Procedure (HFSP) was developed to assist district councils with managing activities involving hazardous substances under the RMA.
- This section includes background information on the HFSP as well as instructions on its use and application.
- The purpose of the HFSP is to establish whether a proposal for a hazardous facility requires a land use consent. The procedure is based on evaluating quantities of hazardous substances on a proposed site, based on a preliminary assessment of environmental effects.
- The section revises the HFSP originally introduced in the 1995 publication *Land Use Planning for Hazardous Facilities* with the aim of simplifying the method and making it more user-friendly.
- Explanations are given on how and when the HFSP is to be applied, where it should not be applied and which activities may be exempted.

5.1 Background

5.1.1 Development

When work began on new district plans in 1991, the requirements of the RMA led to the consideration and adoption of a new approach to the assessment and management of hazardous substances and facilities that use or store these substances. In 1993, the Auckland City Council adopted a new method for the screening of hazardous facilities in their Proposed Isthmus District Plan. This approach focused on assessing off-site environmental effects of hazardous facilities to determine whether a land use consent was required. However, some limitations and shortcomings of this method were identified and the need for an independent review became evident.

As part of the review process, an evaluation of the 'traditional' New Zealand list approach and overseas screening methods for hazardous substances was undertaken to assess their applicability to the New Zealand regulatory environment. None of these methods were thought to be suitable to provide an adequate focus on the environment and to satisfy the effects-based approach required by the RMA.

One of the findings of the review referred to the purpose of the procedure, which is the screening of proposed developments involving hazardous substances to determine whether a consent is required or not, rather than an actual risk assessment of the proposed facility. To better reflect this purpose, the procedure was renamed the Hazardous Facility Screening Procedure, or HFSP.

Throughout the initial review process and subsequent revision of the original method, advice was sought from a number of interested parties, including the New Zealand Fire Service and various industry representatives. As a result, the review process was lengthy, but incorporated a wide range of input from those involved in hazardous substances management.

The review resulted in the promulgation of a guide on land use planning for hazardous facilities, the so-called 'Red Book', in 1995 (Hazardous Facility Screening Procedure Review Group, 1995). Since that time, some 30 councils have adopted the HFSP as a land use planning method. The intention was to carry out a further review of the HFSP after it had been in use for some two to three years and update the procedure accordingly, which is the purpose of this document.

The current review was initiated with a survey of HFSP users to determine necessary and desirable improvements. Three major requirements were identified:

- simplification of the procedure
- enhanced user-friendliness
- reclassification of hazardous substances to comply with the new HSNO Act.

The peer review of the revised Procedure was carried out by industry and local and central government representatives.

5.1.2 Purpose

The purpose of the HFSP is to determine whether a particular proposal for the use, handling and/or storage of hazardous substances requires a land use consent under the RMA. While it is used to determine the resource consent status of a proposed hazardous facility, it is not suitable to determine the outcome of a resource consent application. This decision can only be made once additional information presented in AEE has been evaluated.

Nor is the HFSP suitable for assessing activities such as the transport or disposal of hazardous substances (although these activities will need to be addressed in resource consent applications if they form a significant part of the proposed activity). Individual councils may also wish to exempt particular activities from the scope of the HFSP, if the effects are well known and are comprehensively controlled by other mechanisms such as accepted industrial Codes of Practice or appropriate national/international standards.

Councils may also wish to deal with certain nominated extremely hazardous industries by way of non-complying or prohibited status, which would also mean that the HFSP does not apply. In such cases, the council needs to specify in its plan the conditions under which a proposed facility or activity would be exempted from the HFSP (refer Section 5.6).

5.1.3 Terminology

The terminology used for the revised HFSP is largely consistent with the 1995 'Red Book'. However, some terms (listed in Table 1) have been amended to better reflect their intention, as well as making them somewhat easier to remember.

Table 1: Overview of changed HFSP terminology

Old Term	New Term	Explanation
Base threshold	Base quantity	The pre-calibrated quantity of a hazardous substance that is deemed to be acceptable on a heavy industrial site without causing any significant off-site effects.
Adjusted threshold	Adjusted quantity	Equivalent to the Base Quantity that has been adjusted using Adjustment Factors.
Effect group	Effect type	Three Effect Types are used by the HFSP: • Fire/explosion • Effects on human health • Effects on the environment
Effects ratio	Quantity ratio	The ratio of the proposed quantity of a substance over the applicable Base Quantity.
Effects ratio trigger level	Consent status index	Numerical values in the district plan that are used to determine the consent status of a facility.
	Hazard rating	The level of hazard (high, medium or low) applied to a hazardous substance for the purpose of an HFSP calculation, based on its HSNO classification.

Other terms such as Proposed Quantity or Adjustment Factor remain the same:

Proposed quantity	The quantity of a hazardous substance proposed to be used or stored on a site.
Adjustment factor	Pre-calibrated factors that take into account substance, storage and site-specific circumstances.

5.2 Overview

The HFSP is designed to assess, on a preliminary basis, the environmental effects of hazardous substances proposed to be stored or used on a site by taking into account their quantities, characteristics, location, type of activity and local environmental conditions. This assessment is carried out for three defined Effect Types:

- Fire/Explosion
- Human Health
- Environment.

Basically, the HFSP provides for a comparison of proposed quantities of hazardous substances with maximum allowable quantities (Adjusted Quantities). The latter depend on the type of substances, how they are used and stored, and the location of the facility. A Quantity Ratio is calculated by dividing the proposed quantity of each hazardous substance by the Adjusted Quantity. The Quantity Ratios of individual substances are added up for each Effect Type. The cumulative Quantity Ratios are then compared with defined limits called Consent Status

Indices. These are listed in a Consent Status Matrix in the district plan and vary for different land use zones.

If the cumulative Quantity Ratios are below the applicable Consent Status Index for any of the three Effect Types, a land use consent is not required for the hazardous facility. If they are above, a consent is necessary.

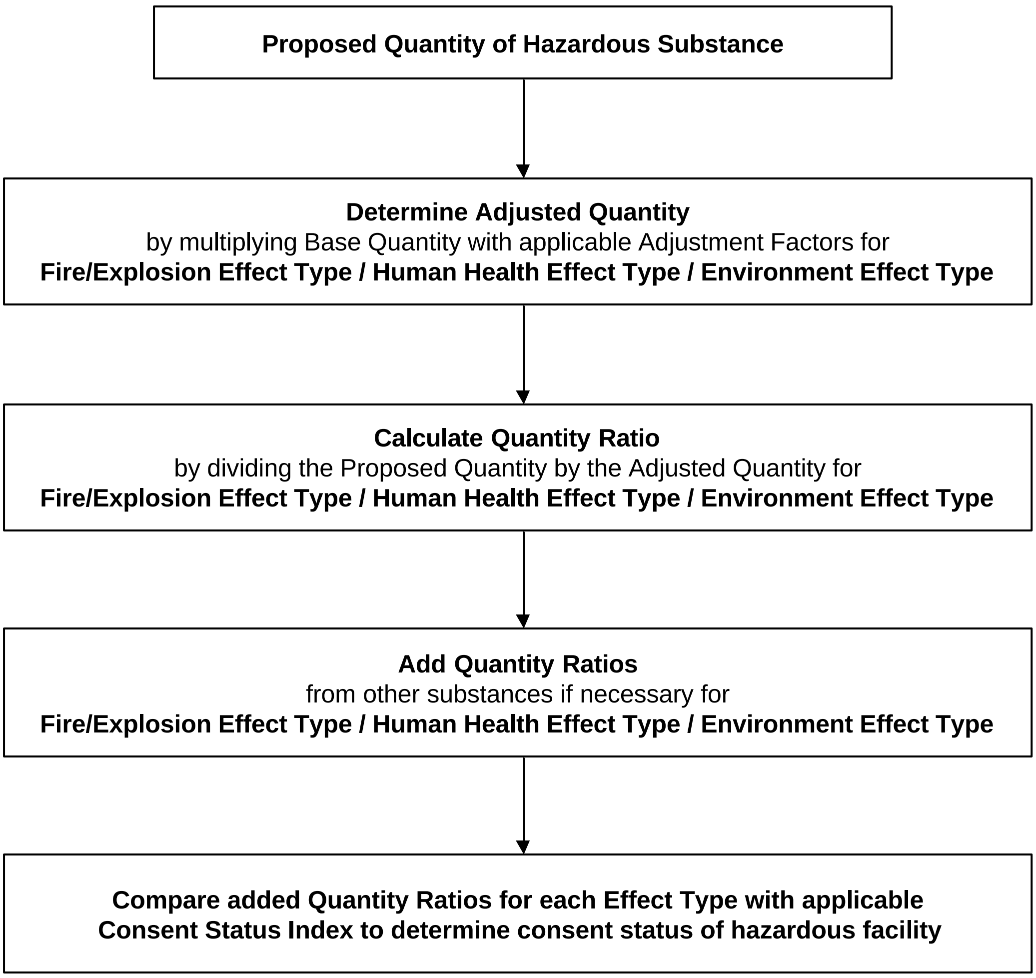
Some information needs to be assembled at the outset about the hazards of the substances concerned. This includes site *layout* and location, types of activities as well as the sensitivity of the surrounding environment.

In most cases, only a limited number of substances need to be assessed to determine the resource consent status of an activity. This particularly applies if one, two or three substances are either very hazardous or stored/used in large quantities.

However, if a land use consent is required, a full set of information on the types and quantities of hazardous substances proposed to be used and stored will be required to be able to fully assess the effects and risks of a proposed facility by way of an AEE (refer Section 4.6.1).

An overview of the HFSP is presented in Figure 1. Further detail about the individual steps of the HFSP is presented in Section 5.4.

Figure 1: Overview of the HFSP process for a single substance



5.3 Rating of hazardous substances for the HFSP

5.3.1 Purpose

To be able to assess hazardous substances under the HFSP, they must be rated first. The rating criteria, which are broadly based on the HSNO classification criteria, are specified in Appendix A.

It is important to note that these rating criteria are different from those presented in the original 'Red Book', when HSNO Regulations were still in their early development.

Rating criteria for the HFSP simplify the HSNO classification in some areas. This is because land use controls for hazardous substances under the HFSP differ somewhat from the substance-specific life-cycle requirements under HSNO. As a result, some HSNO categories have been combined to reflect the minimal differences in possible adverse effects from a land use perspective. Further, for some hazardous properties, the lowest hazard categories have no HFSP rating, as additional controls to the HSNO requirements are considered unnecessary for land use planning purposes.

5.3.2 Rating of hazardous substances

For the purposes of the HFSP, each substance receives a hazard rating based on three Effect Types:

- Fire/Explosion Effects: concerned with damage to property, the built environment and safety of people;
- Human Health Effects: concerned with the well-being, health and safety of people;
- Environmental Effects: concerned with damage to ecosystems and natural resources.

Each Effect Type is divided into three hazard levels:

♦ high ♦ medium ♦ low.

The rating of a hazardous substance for the HFSP requires each substance to be assessed in terms of each of the hazard categories listed in Appendix A (e.g. explosiveness, flammability of gases, liquids and solids etc.). However, this is often a very involved exercise and requires extensive research of Material Safety Data Sheets (MSDSs) and specialist hazardous substances databases.

This is clearly not very practical for a preliminary screening tool such as the HFSP, as the rating of hazardous substances can take a substantial amount of time. To reduce the need to establish the rating of hazardous substances, the following strategy has been developed:

1. More than 300 commonly used hazardous substances in New Zealand have already been assessed and rated for the HFSP. These are listed in Appendix B. The list is further enhanced by a synonym list (also in Appendix B), which makes provision for more than 1000 substance names. This database is available on the MfE website (http://www.mfe.govt.nz/about/laws/hsno/hazfacility.htm).
2. As part of the transitional provisions of HSNO, all substances previously controlled by repealed legislation such as the Dangerous Goods and Toxic Substances Acts will be classified according to the HSNO classification scheme. Further, all new substances approved in New Zealand will also be classified. This work will be carried out by ERMA

New Zealand, and a database of these substances is currently being developed and will be accessible through the ERMA web site (refer Section 7.2.4) in the future. Once the HSNO classification is known, rating of a hazardous substance for the HFSP can be easily carried out using the criteria in Appendix A

3 Where information for the rating of a hazardous substance for the HFSP is not or only partially available from Appendix B or the MfE/ERMA websites, a precautionary default rating of 'Medium' for the Fire/Explosion and Human Health Effect Types and 'High' for the Environmental Effect Type should be applied.

4 Where no HFSP rating is available through Options 1 or 2 above and the default ratings given in Option 3 are not considered suitable, Appendix C may be used to research and assign HFSP ratings to hazardous substances.

5.4 The step-by-step guide to the HFSP

This section presents a step-by-step guide on how to use the HFSP. An overview is shown in Figure 2, and details are provided in Table 2. **This information must be included into the relevant parts of the district plan if the HFSP has been adopted**

Figure 2: Overview of the step-by-step guide to the HFSP

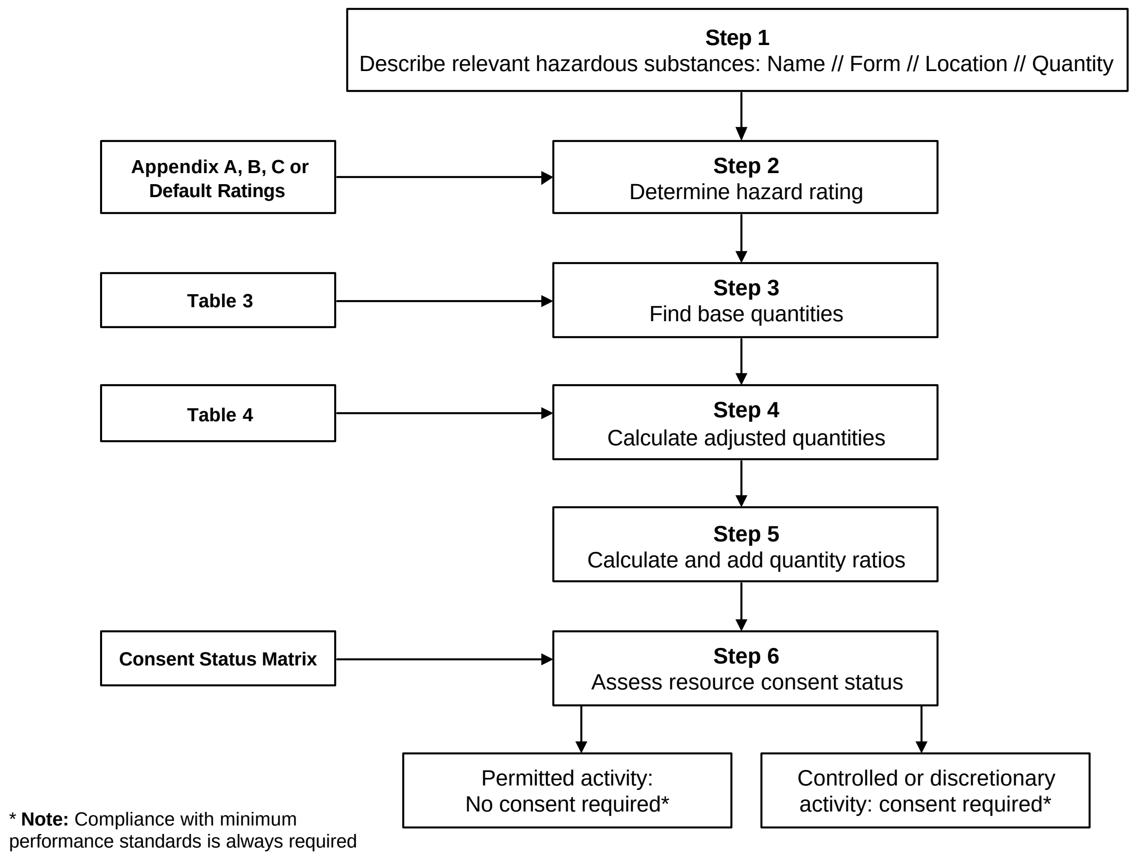


Table 2: The HFSP step-by-step guide

Steps	HFSP calculations				Explanation
1 Describe the hazardous facility Prior to using the HFSP, it is necessary to compile a full description of the hazardous facility in question. This includes the creation of an inventory of hazardous substances held on the site, including: • names of the hazardous substances • quantities of the hazardous substances • the physical form of the substances at 20°C and 101.3 kPa • the location of use or storage on the site, including separation distances from the site boundary and neighbouring hazardous facilities (on-site and off-site). The description should also include site-specific details, including neighbouring land uses and the surrounding environment, with a focus on sensitive land uses and receptors (e.g. retirement accommodation, aquifers or wetlands).	**Substance name** Substance 1 Substance 2 … Substance 10	**Substance form** (liquid, solid, gas)	**Location of substances on site**	**Proposed quantity (P)** (tonnes or m^3)	The HFSP uses standard units of tonnes (t) (for solids, liquids and liquefied gases) and cubic metres (m^3) (for compressed gases). In some cases, it may therefore be necessary to convert substance quantities to these units. In the case of liquids, specific gravity (or density) must be taken into consideration when converting litres or m^3 to tonnes (i.e. $\frac{\text{volume of liquid (litres) x specific gravity}}{1000}$ = tonnes). Adjustments to quantities are also necessary where a substance is diluted with water or mixed with another substance. In this instance, only the percentage quantity of the hazardous substance or product in the dilution or mixture is assessed for the purposes of HFSP calculations (unless a mixture is more hazardous than its components, in which case data on the mixture need to be used). An exception to this are products or brands that already constitute dilutions or mixtures of hazardous substances and which have been classified in terms of their hazardous properties as the 'whole' dilution or mixture for life cycle management purposes. Examples of this are corrosives, oxidising substances and pesticides, which are often sold commercially as standard solutions or strengths. In these cases, quantity adjustments are only applied when these commercially supplied concentrations are further diluted or mixed.
	Example				
	Petrol	**Liquid**	**< 30 metres**	**50 +**	
2 Determine hazard rating For the purposes of the HFSP, the effects of substances are categorised into three Effect Types: • Fire/Explosion Effect Type: addressing damage to the built environment and safety of people • Human Health Effect Type: addressing adverse effects on the well-being, health and safety of people • Environmental Effect Type: addressing adverse effects on ecosystems and natural resources. Each Effect Type is divided into three Hazard Rating Levels: ♦ High ♦ Medium ♦ Low The rating levels are based predominantly on the HSNO classification system.	**Substance name** **Substance 1** **Substance 2** **…** **Substance 10**	**Hazard rating** Fire/ Explosion High (H) or Medium (M) or Low (L)	Human Health High (H) or Medium (M) or Low (L)	Environ-ment High (H) or Medium (M) or Low (L)	The HFSP rates hazardous substances in terms of each of the three Effect Types as having a high, medium or low hazard. The Hazard Rating of a substance is derived from: 1 The list of HFSP-rated hazardous substances in Appendix B. 2 The HSNO classification (refer Appendix A). Once a substance has been classified under HSNO, Hazard Ratings can be assigned for each Effect Type as shown in Appendix A. 3 Where a substance is neither found in Appendix B nor the HSNO database on the ERMA website, the following default ratings should be used: • Fire/Explosion Effect Type: Medium • Human Health Effect Type: Medium • Environment Effect Type: High 4 The substance may be rated using Appendix C as a guide.
	Example				
	Petrol	High	Low	Medium	

Steps	HFSP calculations				Explanation
	Substance name				
3 Find base quantities The Base Quantity (B) is pre-calibrated. It is the amount of a substance that has been assessed as generating no significant off-site effects in a heavy industrial area before site- and substance-specific considerations have been taken into account (refer Step 4). Base Quantities for different hazardous properties and hazard ratings in each Effect Type are listed in Table 3.	**Substance name** **Substance 1** **Substance 2** **…** **Substance 10** **Example** Petrol	**Base quantities (B)** Fire/ Explosion B_1 B_2 … B_{10} 10 t	 Human Health B_1 B_2 … B_{10} 30 t	 Environ-ment B_1 B_2 … B_{10} 30 t	For example, in the Fire/Explosion Effect Type (Sub-category Flammables), non-significant off-site effects in a heavy industrial area are represented by a Base Quantity of: • 100 tonnes of a HSNO Category D flammable liquid which has a low hazard level for the Fire/Explosion Effect Type. • 30 tonnes of a HSNO Category C flammable liquid which has a medium hazard level for the Fire/Explosion Effect Type.
4 Calculate Adjusted Quantity (A) The precalibrated Adjustment Factors (FF, HF, EF) are multiplied with the Base Quantities (B) to account for substance properties and site-specific environmental circumstances. This multiplication yields the Adjusted Quantity (A). Adjustment Factors differ for each of the Effect Types, and take into account the following considerations: • the physical state of the substance • the type of storage • the type of activity or use • separation distances to the site boundary • the environmental sensitivity of the site location. The Adjustment Factors are listed in Table 4.	**Substance name** **Substance 1** **Substance 2** **…** **Substance 10** **Example** Petrol	**Adjusted quantities (A)** Fire/ Explosion A_1 A_2 … A_{10} 100 t (10 tonnes x 10)	 Human Health A_1 A_2 … A_{10} 300 t (30 tonnes x 30)	 Environ-ment A_1 A_2 … A_{10} 90 t (30 tonnes x 3)	Different Adjustment Factors are applied for each Effect Type. For example, for the Fire/Explosion Effect Type, the temperature is relevant, while for the Human Health Effect Type, proximity to a potable water resource is important. In some instances, more than one Adjustment Factor within each Effect Type must be applied, which then need to be multiplied with each other to yield the total Adjustment Factor for the Effect Type. When the Adjustment Factors for each Effect Type have been calculated, they in turn are multiplied with the Base Quantity to yield the Adjusted Quantity). In the example given, the following parameters have been assumed: • <30m to site boundary • not adjacent to water body • underground storage.
5 Calculate and add Quantity Ratios (FQ, HQ, EQ) This step requires the calculation of the Quantity Ratio for each hazardous substance in question. The Quantity Ratio is a dimensionless number. It is obtained by dividing the quantity of a substance that is proposed to be used or stored on a site, i.e. the Proposed Quantity (P) by the Adjusted Quantity (A). If several hazardous substances are used or stored on a site, the Quantity Ratios calculated for each of these substances are added up for each Effect Type. Note that $FQ/HQ/EQ_{Total}$ stands for the total sum of Quantity Ratio values from all assessed hazardous substances, within each Effect Type.	**Substance name** **Substance 1** **Substance 2** **…** **Substance 10** **Example** Petrol	**Quantity ratios (FQ, HQ, EQ)** Fire/ Explosion FQ_1 FQ_2 … FQ_{10} $\mathbf{FQ_{Total}}$ 0.50 **(50 tonnes / 100 tonnes)**	 Human Health FQ_1 FQ_2 … FQ_{10} $\mathbf{HQ_{Total}}$ 0.1667 **(50 tonnes / 300 tonnes)**	 Environ-ment FQ_1 FQ_2 … FQ_{10} $\mathbf{EQ_{Tpta;}}$ 0.5556 **(50 tonnes / 90 tonnes)**	By using the dimensionless ratio of the Proposed Quantity of a hazardous substance over the Adjusted Quantity, it is possible to aggregate the effects presented by multiple substances held on the same site. Hence, it becomes possible to assess the cumulative potential effects which may be created by several substances present on the same site.
6 Assess resource consent status of hazardous facility When assessing the resource consent status of a particular hazardous facility, the added Quantity Ratios for each Effect Type are compared with relevant Consent Status Indices in the Resource Consent Matrix in the district plan. If they are exceeded, a resource consent is required.	**Substance name** **Substance 1** **Substance 2** **…** **Substance 10** **Example** In a typical industrial zone: Petrol	**Does quantity ratio exceed consent status index?** Fire/ Explosion **Yes / No** No	 Human Health **Yes / No** No	 Environ-ment **Yes / No** No	When examining total Quantity Ratios against applicable Consent Status Indices, one or several substances may trigger a resource consent. This highlights the fact that when assessing hazardous facilities, it is often sufficient to assess just a few hazardous substances to start off with, mainly those that are either highly hazardous or are used/stored in high quantities.

Table 3: Base quantities (B) for all effect types and hazard ratings

HSNO category	UN class equivalent	Hazard level	Unit tonnes or cubic metres	Base quantity (B)		
				Fire/ explosion	Human health	Environment
Explosive substances						
1.1	1.1	High	tonnes	0.1	–	–
1.2	1.2	Medium	tonnes	1	–	–
1.3	1.3	Low	tonnes	3	–	–
1.5	1.5	Low	tonnes	3	–	–
Flammable gases						
2.1.1A	2.1	High	m^3 tonnes	10,000* 10	–	–
2.1.2A	2.1	High	m^3 tonnes	10,000* 10	–	–
	LPG	Medium	tonnes	30	–	–
Flammable liquids						
3.1 A	3PGI	High	tonnes	10	–	–
3.1 B	3PGII	High	tonnes	10	–	–
3.1 C	3PGIII	Medium	tonnes	30	–	–
3.1 D	Combustible liquids	Low	tonnes	100	–	–
Liquid desensitised explosives						
3.2 A 3.2 B 3.2 C	3 PGI 3 PGII 3 PGIII	High	tonnes	1		
Flammable solids						
4.1.1.A	4.1 (a) PGII	Medium	tonnes	10	–	–
4.1.1 B	4.1 (a) PGIII	Low	tonnes	30	–	–
4.1.2 A 4.1.2 B	4.1 (b) PGII	High	tonnes	1	–	–
4.1.2 C 4.1.2 D	4.1 (b) PGII	Medium	tonnes	10	–	–
4.1.2 E 4.1.2 F 4.1.2 G	4.1 (b) PGII	Low	tonnes	30	–	–
4.1.3 A	4.1 (c) PGI	High	tonnes	1	–	–
4.1.3 B	4.1 (c) PGII	High	tonnes	1	–	–
4.1.3 C	4.1 (c) PGIII	High	tonnes	1	–	–
4.2 A	4.2 PGI	High	tonnes	1	–	–
4.2 B	4.2 PGII	High	tonnes	1	–	–
4.2 C	4.2 PGIII	Medium	tonnes	10	–	–
4.3 A	4.3 PGI	High	tonnes	1	–	–
4.3 B	4.3 PGII	High	tonnes	1	–	–
4.3 C	4.3 PGIII	Medium	tonnes	10	–	–
Oxidising substances						
5.1.1 A	5.1 PGI	High	tonnes	1		
5.1.1 B	5.1 PGII	High	tonnes	1		
5.1.1 C	5.1 PGIII	Medium	tonnes	10		

HSNO category	UN class equivalent	Hazard level	Unit tonnes or cubic metres	Base quantity (B)		
				Fire/ explosion	Human health	Environment
5.1.2 A	2.2	High	m^3 tonnes	10,000 10		
5.2 A 5.2 B	5.2 Types A and B	High	tonnes	1		
5.2 C 5.2 D	5.2 Types C and D	Medium	tonnes	10		
5.2 E 5.2 F 5.2 G	5.2 Types E, F and G	Low	tonnes	30		
Toxic substances						
6.1 A	6.1 PGI 2.3	High	tonnes m^3	–	1 50	–
6.1 B	6.1 PGII 2.3	High	tonnes m^3	–	1 50	–
6.1 C	6.1 PGIII 2.3	Medium	tonnes m^3	–	10 150	–
6.1 D	Standard poison	Low	tonnes m^3	–	30 500	–
Corrosive substances						
8.2 A	8 PGI	High	tonnes	–	1	–
8.2 B	8 PGII	Medium	tonnes	–	10	–
8.2 C	8 PGIII	Low	tonnes	–	30	–
Ecotoxic substances						
9.1 A	GHS	High	tonnes	–	–	3
9.1 B	GHS	Medium	tonnes	–	–	30
9.1 C	GHS	Low	tonnes	–	–	100
9.1 D	GHS	Low	tonnes			100

* Base threshold in m^3 at 101.3 kPA and 20°C for permanent or compressed gases.

Table 4: Adjustment factors for all effect types

Fire/explosion	Human health	Environment
FF1: Substance form	**FH1: Substance form**	**FE1: Substance form**
Solid = 1 Liquid, powder = 1 Gas (101.3 kPA and 20°C) = 0.1	Solid = 3 Liquid, powder = 1 Gas (101.3 kPA and 20°C) = 0.1	Solid = 3 Liquid, powder = 1 Gas (101.3 kPA and 20°C) = 0.1
FF2: Separation distance from site boundary (sub-facility)	**FH2: Separation distance from site boundary (sub-facility)** (gases only)	**FE2: Environmental sensitivity**
< 30 m = 1 > 30 m (>60 m)[4] = 3	< 30 m = 1 > 30 m (>60 m)[2] = 3	Normal = 1 Adjacent to water resource[5] = 0.3
FF3: Type of activity	**FH3: Type of activity**	**FE3: Type of activity**
Use = 0.3 Above-ground storage = 1 Underground storage[6] = 10	Use = 0.3 Above-ground storage = 1 Underground storage[6] = 10	Use = 0.3 Above-ground storage = 1 Underground storage[6] = 3
Final fire/explosion adjustment factor **FF = FF1 x FF2 x FF3**	Final human health adjustment factor **FH = FH1 x FH2 x FH3**	Final environment adjustment factor **FE = FE1 x FE2 x FE3**

5.5 Application of the HFSP

5.5.1 Carrying out HFSP calculations

Based on the Step-by-Step Guide outlined in Table 2, HFSP calculations can be carried out manually or using software based tools. Quick manual calculations are appropriate, especially for experienced practitioners and in situations where one or only few substances will exceed the Consent Status Indices. A sample calculation sheet (derived from the HFSP Calculation Spreadsheet Package) to assist with a manual calculation is included in Appendix D.

Alternatively, the HFSP Calculation Spreadsheet Package, based on Microsoft Excel® and downloadable from the MfE website (http://www.mfe.govt.nz/ about/laws/hsno/hazfacility.htm), may be used. Further information on electronic support is provided in Section 7.2.4.

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4 If the facility is assessed as a sub-facility, the distance to the neighbouring sub-facility must be more than 60 metres (i.e. 2 x 30 metres) to qualify for an Adjustment Factor of 3 (refer Section 5.5.4).

5 Water resources include aquifers and water supplies, streams, springs, lakes, wetlands, estuaries and the sea, but do not include entry points to the stormwater drainage network. 'Adjacent' must be defined in respective district plans and will depend on the type of water resource potentially affected (adjacent is variably defined as between 30 and 100 metres).

6 Applicable to UN Class 3 substances (flammable liquids) only.

5.5.2 Where is the HFSP applied?

Historically, land use controls for hazardous substances have generally been restricted to industrial zones. However, hazardous substances tend to be used in almost all land use zones or environments, including rural and residential areas. Any hazardous substance-related controls should therefore apply across a district, regardless of whether the district is of largely urban, industrial or rural nature. Based on this assumption, the HFSP is applied to hazardous facilities in all land use zones as an 'overlay' control on top of other zone-specific land use controls. A proposed hazardous facility therefore needs to comply with the rules for individual land use zones as well as with those for hazardous facilities.

For example, a home enterprise using hazardous substances needs to comply with the rules applicable to both the residential land use zone and hazardous facilities. It is therefore possible that a proposed home enterprise is a permitted residential activity, but requires a resource consent for the use or storage of hazardous substances – or vice versa.

5.5.3 New and existing hazardous facilities

The HFSP is generally not applied to existing facilities as these are normally subject to existing use rights under the RMA. There are, however, two exceptions:

- Where an existing facility changes its operations to such an extent as to cause a change in the character, nature and/or scale of actual or potential effects, as defined in Sections 10, 10A and, as applicable, section 20 of the RMA. The district plan must define the extent and nature of the change that will trigger this provision.
- Where the HFSP is adopted as part of a regional plan. These plans are able to override existing use provisions.

The HFSP is applied to all new hazardous facilities, irrelevant of their type and size. Where the HFSP indicates that a hazardous facility is a permitted activity in a given land use zone, the facility does not require a resource consent although it must comply with any minimum performance standards specified in a district plan (refer Sections 4.4.1 and 8.3).

5.5.4 Facilities and sub-facilities

The HFSP is used to screen hazardous facilities and their sites. Where two separate hazardous facilities are located on the same site, the HFSP treats them as a single facility. However, there are some situations where this concept presents problems, particularly where large sites or sites with multiple ownership or occupancy are concerned.

The Palmerston North City Council (1996) addresses such sites by introducing the concept of a 'sub-facility'. The definition for sub-facility[7] is based on the assumption that if multiple hazardous facilities on the same site are separated by more than 30 metres from each other, they may be dealt with as sub-facilities and thus be assessed separately. If any of these sub-facilities exceeds the consent status index for the respective land use zone, potential risks to other sub-facilities or any other hazardous facilities located off-site need to be considered.

[7] A sub-facility is any hazardous facility that is separated by more than 30 metres from any other hazardous facility on the same site.

If the concept of sub-facilities is adopted in a district plan, appropriate changes need to be made to the Adjustment Factors shown in Table 4. Adjustment Factors FE2 for the Fire/Explosion and FH2 for the Human Health Effect Types need to be adjusted to 60 metres for sub-facilities (refer Table 4).

5.6 Exceptions and exemptions from the HFSP

5.6.1 Exceptions: Where the HFSP should not be applied

The HFSP was developed to deal with most activities involving hazardous substances. However, there are situations where it is not suitable or appropriate, as described in Table 5.

Table 5: Exceptions to the HFSP

Exceptions	Explanation
Trade waste sewers	Difficult to cover as trade waste sewers transect land use zones. Also, trade waste sewers normally form part of larger developments requiring resource consents and are therefore already captured under the RMA.
Storage and use of hazardous consumer products for private domestic purposes	This is deemed to be an insignificant activity.
Retail outlets for the domestic-scale usage of hazardous substances such as supermarkets, hardware shops and pharmacies. This does not include wholesale outlets or outlets for the supply of trade.	The scale of these activities is deemed to be insignificant. However, activities which serve both the retail and wholesale trade are not excepted.
Developments that are or may be hazardous but do not involve hazardous substances (e.g. high voltage transmission lines, radio masts, natural hazard areas)	These activities do not involve hazardous substances and need to be covered by other land use planning provisions.
Facilities presenting a dust explosion risk of non-hazardous substances	This risk arises from the presence of finely powdered organic material such as milk powder or coal dust present in a building due to inadequate housekeeping practices. Such dust does not represent a contained storage of hazardous substances.
Gas or oil pipelines	Refer to trade waste sewers.
Fuel in motor vehicles, boats and small engines.	This is deemed to be an insignificant activity.

5.6.2 Exemptions: Where the HFSP may be waived

A council may wish to specifically exempt some activities involving hazardous substances from the HFSP on the basis that these activities are already well regulated by other controls, or because well established industry Codes of Practices or suitable regulations exist. This approach is also intended to serve as an incentive for industry to develop standards or Codes of Practice for self-regulation purposes. A similar approach has been adopted by HSNO, where ERMA may issue and/or approve Codes of Practice.

Exemptions merely apply to the application of the HFSP itself, but not to any other rules relating to hazardous substances or facilities contained in a district plan. The proponent of an exempt hazardous facility will therefore still need to carefully check any other controls which may apply, including minimum performance standards (refer Sections 4.4.1 and 8.3).

Although it was previously considered appropriate that exempt activities could become permitted activities, this has been revised since the implementation of the HFSP. The main reason is that Codes of Practice or standards are usually not legally binding, but are used on a voluntary basis, even if assurances are given through industry-wide agreements concerning such controls.

Therefore, district councils have taken the stance that exempt activities should be given a controlled resource consent status. This enables councils to implement rules to check that voluntary control measures have been implemented correctly and within the stated intent. It also enables councils to impose resource consent conditions to ensure that control measures are implemented and maintained in the long term.

The use of references to Codes of Practice or standards within district plan rules is legally questionable, due to the changing nature and editions of such documents. As a result, the practice is to include rules that state the intent of the standards or Codes of Practice. Reference can then be made in the explanation to the rule that adherence to a suitable standard or Code of Practice will be deemed to be a suitable means of compliance.

Examples of hazardous facilities that can be exempted from the HFSP, under the above stated assumptions, include:

- The retail sale of liquid fuel, up to a storage of 100,000 litres of petrol in underground storage tanks and up to 50,000 litres of diesel, provided that the *Code of Practice for the Design, Installation and Operation of Underground Petroleum Systems* (Department of Labour OSH, 1992) is adhered to.
- Retail LPG outlets, with storage of up to 6 tonnes (single vessel storage) of LPG, provided that the Australian/New Zealand *Standard AS 1596:1997 – Storage and Handling of LP Gas* is adhered to.
- The use, storage and transport of hazardous substances by teaching and research laboratories, provided that the following Standards are adhered to:

AS 2982.1:1997 (or more recent amendments/editions) – Laboratory Design and Construction

AS 2243.1:1997 (or more recent amendments/editions) – Safety in Laboratories – General

AS 2243.2:1997 (or more amendments/recent editions) – Safety in Laboratories – Chemical Aspects

AS 2243.3:1995 (or more recent amendments/editions) – Safety in Laboratories – Microbiology

AS 2243.5:1993 (or more recent amendments/editions) – Safety in Laboratories – Non-ionising Radiation

AS 2243.6:1990 (or more recent amendments/editions) – Safety in Laboratories – Mechanical Aspects

AS 2243.8:2001 (or more recent amendments/editions) – Safety in Laboratories – Fume Cupboards

AS 2243.9:1991 (or more recent amendments/editions) – Safety in Laboratories – Recirculating Fume Cabinets

AS 224310:1993 (or more recent amendments/editions) – Safety in Laboratories – Storage of Chemicals.

As ERMA will progressively introduce Codes of Practice to assist with HSNO compliance, district councils may consider that the HSNO Codes of Practices provide an appropriate basis for exempting a hazardous facility if the above conditions are complied with.

The Palmerston North City Council (1996) has also introduced an exemption for temporary military training activities. Similar to other exempt activities, temporary military training activities are controlled activities subject to specified hazardous substance quantities. Matters of control include compliance with minimum performance standards.

Section 8 provides a translation of the above exemptions into district plan rules.

6 Linking the HFSP with the District Plan

Key Points

- The Consent Status Matrix is the main link between a district plan and the Hazardous Facilities Screening Procedure (HFSP). It contains a series of numerical values called Consent Status Indices that are assigned to each land use zone in the Consent Status Matrix.
- Quantity Ratios calculated by the HFSP are compared against these indices to determine whether a proposed hazardous facility is a permitted activity or whether it requires a resource consent.
- This section provides guidance on how to develop a Consent Status Matrix and the approach taken in assigning and calibrating Consent Status Indices.
- Interfaces between incompatible land uses are addressed, together with available measures to manage these.

6.1 The Consent Status Matrix

The Consent Status Matrix is the main link between a district plan and the HFSP. It contains a series of Consent Status Indices for each land use zone of the district. These are both district and zone-specific and reflect the level of risk which is considered appropriate and acceptable for different land use zones. The Consent Status Matrix enables the consent authority to determine the appropriate level of scrutiny for each land use consent application in its respective location.

The main purpose of the Consent Status Matrix is to screen out those activities which require further assessment to separate them from those which can proceed as permitted activities. It is not used to determine the outcome of a resource consent application for a proposed facility. This will be decided only after an additional assessment and a review of environmental effects and risks have been undertaken.

6.2 Consent Status Indices

Consent Status Indices are the numerical values assigned to each land use zone in the Consent Status Matrix. They are the values against which the Quantity Ratios (Q) calculated with the HFSP are compared to determine whether a proposed hazardous facility is permitted or whether it requires a resource consent. Effectively, where the Quantity Ratio exceeds a Consent Status Index for a particular land use zone, a resource consent is required.

The HFSP has been calibrated for assessing potential off-site effects in a heavy industrial zone. Therefore, the Consent Status Index for this zone acts as a benchmark and has been set at a numerical value of 1. All Consent Status Indices for other land use zones are set in relative terms to the established benchmark of a heavy industrial zone.

Thus, for an application for a hazardous facility in a heavy industrial zone:

- if the calculated Quantity Ratios of the facility are less than 1 in each Effect Type, the activity is permitted because the potential off-site effects are deemed to be acceptable, provided the operator complies with the minimum performance standards specified in the district plan

- if the calculated Quantity Ratios of the facility exceed 1 in any one of the Effect Types, the application requires a consent to determine the significance of potential off-site effects.

For more sensitive land use zones such as residential areas, the Consent Status Index is set proportionately lower, so that a resource consent will be required at a lower level of potential off-site effects. Table 6 gives an example of a Consent Status Matrix showing hypothetical Consent Status Indices for industrial, business and residential zones.

Table 6: Example of a consent status matrix

Zone	Consent status indices for permitted activities	Consent status indices for activities requiring a consent
Industrial	≤1	>1
Business	≤0.2	>0.2
Residential	≤0.02	>0.02

Where Consent Status Indices indicate that a proposed hazardous facility requires a consent, it may be possible to review the proposed development to reduce cumulative potential effects to within permitted levels. This may be achieved by:

- reducing the number and quantity of substances used/stored
- replacing highly hazardous substances with less hazardous alternatives
- relocating the proposed facility to a more suitable land use zone
- carrying out the HFSP for individual sub-facilities on the site, subject to sub-facilities being separated more than 30 metres from each other.

6.3 How to develop a Consent Status Matrix

Each TA needs to develop its own Consent Status Matrix. This process takes into account the quality and sensitivity of the existing environment, land use zones and typical activities in the district to ensure that the levels of risk presented by hazardous substances are appropriate to the characteristics of the district. The factors considered in this process are further discussed below.

6.3.1 Land use strategy

When developing a Consent Status Matrix, district councils need to consider a range of factors as they relate to the council's planning and land use strategy and the characteristics of the district. The Consent Status Matrix must provide for each of the land use or zoning types that a council intends to use within its district plan. Consent Status Indices should be calibrated on the basis of the anticipated effects of activities and the particular environmental sensitivity of each area. If a typical heavy industrial zone has a Consent Status Index of 1, increasingly sensitive areas must have proportionally lower indices.

6.3.2 Interface issues

Occasionally, historical land use zoning practices result in industrial or business zones being inadequately separated from adjoining sensitive land uses such as residential areas. Further, modern land use planning practices increasingly allow mixed activities to take place within the same land use zone to maximise the effectiveness of the use of land. In some instances, additional controls may need to be applied to protect more sensitive adjoining land uses. Options for dealing with interface issues are further discussed in Section 6.5.

6.3.3 Natural hazards

Some districts and regions are particularly prone to natural hazards. While the HFSP itself cannot account for such additional risks, this may be reflected by lower Consent Status Indices in land use zones prone to natural hazards or by developing appropriate minimum performance standards.

6.3.4 Transport of hazardous substances

There is a range of laws and regulations that deal with the transport of hazardous substances (refer Sections 2.4.7 and 3.2.3). The HFSP itself is not suitable to address the transport of hazardous substances, as hazardous substances in transit are a 'shifting target' and move between land use zones. No account can therefore be taken of hazardous substances transport in a Consent Status Matrix.

However, stationary vehicles loaded with hazardous substances that are parked on a site for more than one hour are generally considered to constitute a fixed hazard and have to comply with relevant Consent Status Indices for the particular land use zone the activity is located in.

6.3.5 Community aspirations

Different communities may be willing to accept different levels of risk – either higher or lower – depending on the perceived benefits associated with the proposed activity. This can be reflected in the magnitude of Consent Status Indices. However, in setting higher acceptable levels, a TA must consider its ability to effectively enforce its district plan provisions and other statutes relevant for the management of hazardous substances effectively.

6.3.6 Number of potential applications

Where a TA expects applications for a large number of small to medium scale proposed hazardous facilities, it may consider the inclusion of an intermediary consent status category in the Consent Status Matrix (for example, controlled or restricted discretionary).

An intermediary resource consent status category is applied to proposed hazardous facilities where these are small to medium-scale and only just exceed Consent Status Indices for permitted activities. This would reduce the level of scrutiny for small to medium-scale facilities as well as the expense for an applicant to obtain a consent. It would still assist a TA in monitoring and the keeping of records of the locations of these facilities.

A controlled activity status indicates that approval for the activity shall be given, provided that relevant matters of control, as well as the standards and terms specified in the plan can be met. This gives applicants more certainty about the likely outcome of a resource consent application.

A restricted discretionary activity status indicates that approval may be given, provided that matters identified in a plan over which a TA has exercised its discretion are being appropriately addressed.

Where one of these options is taken, TAs will need to give careful consideration to the matters it wishes to control or exert discretion over, and how these matters will be reflected in resource consent conditions. Although this approach gives no or only limited opportunity to decline an application for a hazardous facility, it assists TAs in retaining limited control and carrying out their monitoring function by providing information about the nature and location of the facility or activity.

6.4 How to calibrate a Consent Status Matrix

Usually, a Consent Status Matrix is calibrated using the benchmark approach outlined in Section 6.2. However, in some cases, Consent Status Indices may need to be calibrated on a case-by-case basis. This is done to ensure that they meet the objectives of a particular land use zone and that small to medium-scale activities will in fact be permitted activities in appropriate land use zones.

In such circumstances, it is appropriate to carry out a range of surveys of hazardous facilities that fall into the predominant activity class of the land use zone in question. Hazardous substance data for similar hazardous facilities are then averaged and submitted to the HFSP. The calculated Quantity Ratios are then used to derive appropriate Consent Status Indices.

6.4.1 Examples of different Consent Status Matrix tables

To assist councils in developing a Consent Status Matrix that suits the special needs of their community and the characteristics of the local environments, the following general examples are provided:

- provincial service town – example of basic Consent Status Matrix
- small service town surrounded by mixed rural land uses – example of calibrating the Consent Status Index for rural land use zones
- metropolitan centre – example of using an intermediary consent status category.

6.4.2 A provincial service town

This Consent Status Matrix applies to an average provincial service town of approximately 20,000–40,000 people, with limited rural land and typical residential and commercial zoning. The industrial zoning is categorised into a Light Industrial and an Industrial Zone.

The latter zone is designed to accommodate sites with large processing facilities, including a large dairy factory and timber processing plant. The former zone generally surrounds the small urban centres and residential areas in the district. It therefore enables the development of small to medium-scale industries servicing the large industries, the business sector and limited rural activities in the district.

The council does not expect or want to plan for any further significant industrial development. For this reason, the Consent Status Indices are set to permit most small to medium-size facilities in the Light Industrial Zone.

Table 7: Example of a consent status matrix for a provincial service town

Zone	Consent status indices for permitted activities	Consent status indices for discretionary activities
Industrial	≤1	>1
Light industrial	≤0.5	>0.5
Commercial	≤0.2	>0.2
Open space	≤0.1	>0.1
Residential	≤0.02	>0.02

6.4.3 A small service town surrounded by mixed rural land uses

Land uses in this town are categorised into five zones:

- Residential
- Commercial
- Industrial
- Rural 1
- Rural 2.

There is very little industrial development in the district at present. The council wishes to discourage any industry using or storing large amounts of hazardous substances from locating in the town in the future, reflecting community concerns. For this reason, the Consent Status Index for discretionary activities in the Industrial Zone is set at >0.5, indicating that most medium-size and large facilities would have to apply for a consent.

The council also wishes to restrict the use and storage of hazardous substances in the business centre of the town and has set the trigger level for the Commercial Zone at 0.1. This level will permit businesses with an incidental use of hazardous substances, but would require businesses that use hazardous substances as part of their day-to-day operation to apply for a consent.

Of the two rural zones, Rural 1 covers the greatest part of the district. Traditionally, this zone comprises large cattle and dairy farms which have a range of requirements for hazardous substances, such as animal remedies, sanitisers and disinfectants, fertilisers, pesticides, etc. A hazardous substances survey of the Rural 1 zone has indicated that to sustain normal farming activities as permitted activities in this zone, a Consent Status Index of approximately 0.75 is required.

The Rural 2 zone comprises mainly market gardening and horticultural activities on lifestyle blocks in the vicinity of town. The Council expects significant storage of agricultural sprays in this zone. A hazardous substance survey of the activities indicates that to enable most market gardening and horticultural activities to proceed as permitted activities, a Consent Status Index of 0.5 is required.

Based on the hazardous substance surveys of the two rural zones, the council now understands that farming and related activities are major users of hazardous substances, which will be accommodated by Quantity Ratios of between 0.5 and 0.75, thus enabling average farming activities to proceed as permitted activities. However, the council also wants to embark on a long term education and monitoring strategy to help farmers develop better knowledge about the management of hazardous substances, with a view to lowering these Quantity Ratios in the long term.

Table 8: Example of a consent status matrix for a small town

Zone	Consent status indices for permitted activities	Consent status indices for discretionary activities
Industrial	≤0.5	>0.5
Commercial	≤0.1	>0.1
Residential	≤0.02	>0.02
Rural 1	≤0.75	>0.75
Rural 2	≤0.5	>0.5

6.4.4 A metropolitan centre

This is a metropolitan area with a population of more than 150,000 people. In this city, very large industries are anticipated, for example plastics manufacture, oil refineries etc. They have been provided for with a Heavy Industrial Zone which in turn is buffered by a surrounding Industrial Zone. A third category of industrial zoning, the Light Industrial Zone, includes a variety of commercial and small industrial facilities.

A Special Purpose Zone is used to provide for activities ranging from hospitals to schools (which store and use hazardous substances), while the Business Zone represents the commercial centres of the city. Open Space zoning is used for parks, playing fields and other recreational facilities.

As the city expects a large number of applications for hazardous facilities each year, a 'controlled activities' category has been introduced into the Consent Status Matrix. This enables the council to impose certain conditions on the facilities falling into this category as well as making provisions for monitoring, while the consent process is less rigorous than for a discretionary activity.

Table 9: Example of a consent status matrix for a metropolitan area with heavy industrial activity

Zone	Consent status indices for permitted activities	Consent status indices for controlled activities	Consent status indices for discretionary activities
Heavy industrial	<1	1–2	>2
Industrial	<0.75	0.75–1.5	>1.5
Light industrial	<0.5	0.5–1	>1
Special purpose	<0.3	0.3–0.6	>0.6
Business	<0.2	0.2–0.4	>0.4
Residential	≤0.02	–	>0.02
Open space	≤0.1	–	>0.1

6.5 Interfaces between incompatible land uses

Interface issues arise where incompatible activities are located next or close to each other. While district plans endeavour to address major interfaces through the zoning strategy, residual interface issues in terms of hazardous substances still need to be dealt with locally. The HFSP addresses interface issues in terms of the use and storage of hazardous substances in different ways, as outlined below.

6.5.1 Interfaces within the same land use zone

Interface issues may arise within a zone where mixed or multiple activities take place, and where facilities presenting differing levels of hazard propose to locate next to each other. The HFSP addresses these issues through the resource consent status of individual facilities. In other words, the applicant for a consent to operate a proposed hazardous facility needs to assess any significant effects of the proposed facility and risks on neighbouring facilities and demonstrate that these are appropriately mitigated. Where neighbouring facilities are permitted activities, the interface is considered to be insignificant as long as minimum performance standards are complied with.

6.5.2 Interfaces between hazardous facilities and sensitive environmental resources

The HFSP applies an Adjustment Factor of 0.3 to hazardous substance Base Quantities if a hazardous facility is located close to sensitive water resources, effectively reducing acceptable quantities by 70%. This Adjustment Factor is applied in the case of a specified distance from the facility to the water resource, as specified by the TA in the district plan (generally assigned between 30–100 metres). The nature and capacity of the stormwater system in the area may need to be taken into account in specifying an appropriate distance.

6.5.3 Interfaces between incompatible land use zones

In some districts, industrial or business zones may be located close to more sensitive land use zones, for example residential land use zones. In the application of the HFSP, buffer zones can be created between incompatible land use zones. The buffer zone is then placed along the inside boundary of the more hazardous land use zone. Within this buffer zone, a more conservative Consent Status Index is applied to hazardous facilities to ensure the adequate protection of the adjoining, more sensitive land use zone.

The location and extent of buffer zones need to be considered very carefully. Overall, the objective of the buffer zone is to provide protection for sensitive land uses if adjacent to more hazardous land use zones, while not unduly compromising activities in the more hazardous land use zones.

6.5.4 Interfaces between neighbouring districts

The HFSP is not able to deal with interface issues between district council boundaries. These issues can only be resolved through effective communication with other councils and a good understanding of the respective district plan controls for hazardous substances.

7 Implementing and Administering the HFSP

Key Points

- The Hazardous Facilities Screening Procedure (HFSP) is sometimes perceived as complex, particularly by smaller TAs and TAs with limited industrial activity. It is therefore necessary to facilitate implementation of the HFSP with appropriate tools.
- Hazardous substances are used in a wide range of activities outside of industrial zones (e.g. the storage of pesticides in rural zones or the use of hazardous substances by home enterprises). The HFSP is therefore useful to rural TAs as well, and may be applied to all land use zones in a district.
- For those TAs that plan to adopt the HFSP, it is important to develop an implementation strategy to ensure the smooth introduction and long-term administration of the procedure.
- This section discusses a range of concerns and possible solutions, and the importance of monitoring the implementation of the HFSP.

7.1 Issues

The HFSP is sometimes perceived as complex, particularly by small TAs and those with limited industrial activity in their district. However, it is the subject of hazardous substance management which is technical and complex rather than the Screening Procedure. The HFSP is a practical and effective tool to assist in the management process, especially once the HSNO Regulations are fully in force and other control mechanisms such as Dangerous Goods Licences are no longer in use. Overall, there is widespread recognition that hazardous substances and wastes present significant environmental risks that need to be managed throughout New Zealand better than in the past to protect human health, the natural environment and infrastructures.

The need for increased controls for hazardous substances has been reflected in key pieces of legislation such as the HSE Act and the HSNO Act (refer Section 2). The HFSP complements, but does not duplicate, these controls and ensures that appropriate site-specific controls are put into place for hazardous facilities.

Overall, increasingly stringent legislation requires practitioners in industry and councils to improve their technical knowledge and understanding of hazardous substances. For councils, technical know-how of hazardous substances and wastes is not limited to the urban districts, as rural land uses often involve significant quantities of very hazardous materials, such as pesticides.

7.2 Implementation and administration strategy

For those TAs that plan to adopt the HFSP, it is important to develop a strategy that goes beyond the incorporation of the HFSP into the district plan. Potential concerns and problem areas must be identified at an early stage to enable the development of proactive solutions and processes. This will ensure smooth implementation and long term administration of the HFSP.

Issues that need to be addressed include:

- TA staff structure and consent application process
- training requirements
- public information requirements
- electronic support
- external support and networking.

7.2.1 Council staff structure and consent application process

Different council staff will, to varying degrees, be involved in the implementation and administration of the HFSP. This includes counter staff, regulatory planners and also dangerous goods/hazardous substance officers.

It is of benefit to allocate responsibilities for the HFSP at an early stage, preferably with the help of a flow chart outlining the consent application process for hazardous facilities from receipt of inquiry, to deciding on the resource consent status of the proposal and beyond.

TAs which implement the HFSP usually involve two or three key staff members in the day-to-day administration of the HFSP, including dangerous goods/hazardous substance officers. These keep in ongoing contact with counter staff to make sure that applications which involve hazardous substances are picked up at the point of inquiry.

Normally, they also carry out quick HFSP calculations to determine whether a proposed hazardous facility requires a consent and pass relevant information on to regulatory planners. This applies in particular to small and medium-scale facilities. They usually remain involved in the ongoing processing of any resource consent applications, review of any information and development of consent conditions.

An HFSP implementation strategy which is solely based on in-house support may not be appropriate for some councils. This applies especially to small councils or those councils with no or limited technical expertise on staff.

In these instances, it may be worthwhile exploring outsourcing opportunities, where external contractors or consultants enter into an agreement with a TA to provide assistance with an implementation strategy for the HFSP training, screening resource consent applications for hazardous facilities and processing resource consent applications.

7.2.2 Training requirements

The nature and extent of the HFSP training programme depends on the structure and size of a council and how tasks such as consent application processing are allocated. The programme may need to be targeted at counter staff, technical staff and regulatory planners as well as managers – and on occasions, councillors. As a result, training needs can vary significantly from one council to the next and may range from a two-hour introductory session to a full day involving practical case studies.

7.2.3 Public information requirements

Once council staff are fully aware of and trained in the use of the HFSP, it is necessary to give out information to the public. Such information can be in the form of a tri-fold or an A4 sheet explaining, in simple terms, the controls for hazardous substances, how the council deals with applications for hazardous facilities and what the information requirements are.

Industry planning guides are a very useful way of helping the public with resource applications, particularly small to medium-scale hazardous facilities that are common in the district. They are based on hazardous substances surveys of small industries typically present in a district, for example panel beaters or dry cleaners. Survey data for each industry are averaged and submitted to the HFSP. This information is used to calculate acceptable quantities of hazardous substances that each industry may store in the different land use zones of the district to remain a permitted activity (refer Section 6.4).

Industry planning guides, usually in the form of leaflets, therefore explain what quantities of hazardous substances are allowed to be stored by a proposed new facility without triggering the need for a land use consent application.

7.2.4 Electronic support

The Step-by-Step Guide in Section 5.4 outlines the manual calculations that are required for the HFSP. It is of benefit to work through these calculations several times using the case studies outlined in Appendix E to become familiar with the concept of the HFSP. Once this concept and the available shortcuts are understood, HFSP calculations can be carried out very quickly, even on a manual basis.

The first edition of *Land Use Planning for Hazardous Facilities* (the 'Red Book') was accompanied by software specifically designed for the HFSP. However, this software became quickly obsolete due to the introduction of new upgrades of Microsoft software. Although it was originally planned to upgrade the HFSP software in conjunction with revising the HFSP itself, this did not to proceed for the following reasons:

- There was a need to continuously upgrade the software, and thus a risk of potential flaws.
- Software creates the impression that the HFSP is a highly complex method that cannot be used without computer support, which is clearly not the case as manual calculations can be carried out very quickly. Off-the-shelf software such as the spreadsheet package Microsoft Excel® can be used to aid with HFSP calculations without the need for designer software.
- Probably the most time-consuming aspect of the HFSP is collating information about hazardous substances and rating them for HFSP calculations. To help this process, a number of widely used hazardous substances have been rated for HFSP calculations (Appendix B) and included in the HFSP Calculation Spreadsheet available for downloading from the MfE website. Further information will be published on this website from time to time. This task would be much more difficult with specifically designed software.

Given the above considerations, an alternative concept for electronic support, focused on the MfE website, was developed which will offer the following information (Figure 3):

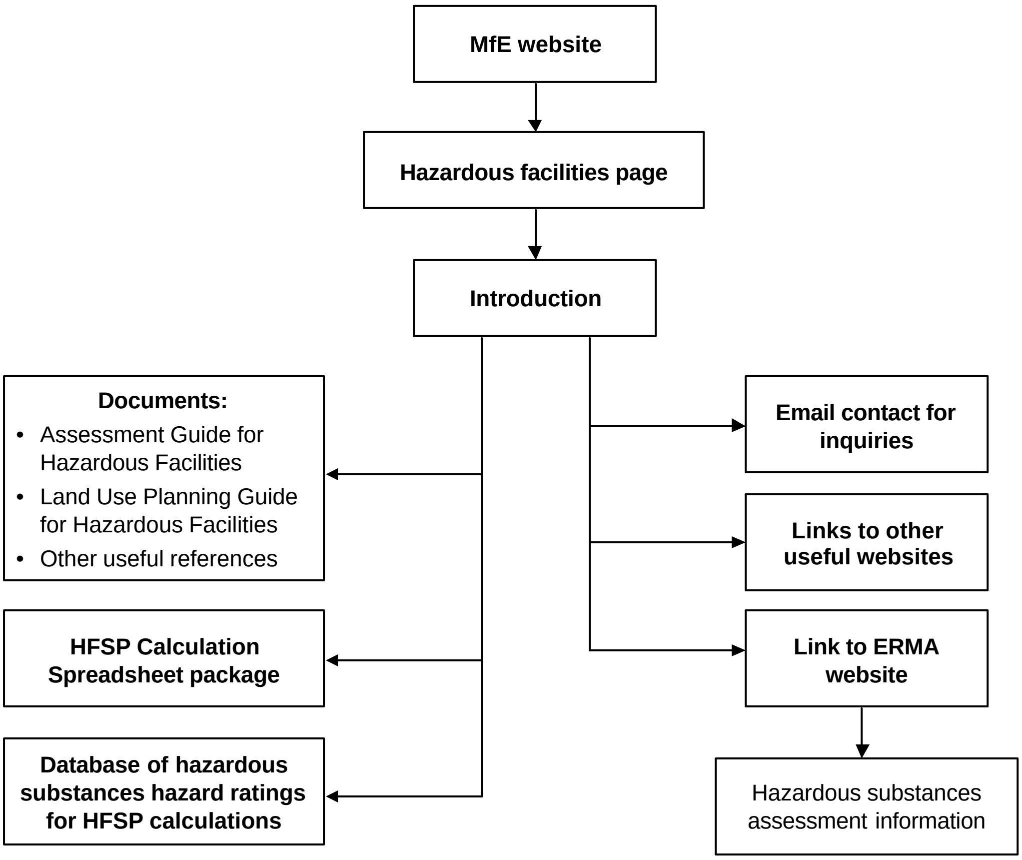
- downloadable copies of relevant technical documents
- the HFSP Calculation Spreadsheet Package to assist with HFSP calculations
- hazardous substances ratings for common hazardous substances to facilitate HFSP calculations (Appendix B)
- a link to the ERMA website providing additional information on the classification of existing and new hazardous substances
- links to other national and international websites containing relevant information on hazardous substances.

7.2.5 External support

Historically, the Auckland Regional Council has played a vital role in providing free and independent support and advice to users of the HFSP. This role has now been taken over by the MfE. Information and support is available to district councils and other government agencies, prospective applicants and consultants in the form of:

- newsletters
- updating and maintenance of the hazardous facility information on the website
- notification of training opportunities and seminars.

Figure 3: Structure of the MfE hazardous facilities website



7.3 Monitoring the implementation process

To enable the successful implementation of the HFSP in a region or district, it is important to monitor this process. This includes aspects such as staff training records, numbers of inquiries related to hazardous facilities, numbers of resource consent applications processed and consents granted. Such monitoring takes place in addition to regulatory monitoring of resource consent conditions (see Section 4.6.6).

It is important to note that once the traditional licensing requirements under the repealed Dangerous Goods legislation have ceased, monitoring of hazardous facilities under the RMA will gain increasing importance. It will be one of the few mechanisms available to district councils to obtain data on hazardous facilities.

It is also important to build monitoring into the implementation strategy for the HFSP and to maintain this process in the long term.

8 Model District Plan Section on the HFSP

Key Points

- Under the RMA, controls on hazardous facilities and activities are primarily exercised through district plans.
- This section presents a model planning chapter on hazardous substances to guide councils in the preparation of their district plans. It includes relevant definitions, an issue statement, objectives and policies, expected outcomes and a series of rules for hazardous facilities and activities.
- The design of the model planning chapter is general and requires translation into the context of particular districts. District councils may adopt all or part of it.
- If the HFSP is adopted, the setting of Consent Status Indices for the Consent Status Matrix in particular needs to be carried out by each council, taking into account its own land use planning strategy.

8.1 Background

Under the RMA, controls for hazardous facilities and activities are primarily exercised through district plans. However, an overriding management framework may be set out in Regional Policy Statements, if regional councils choose to exercise this function.

To provide a context for the HFSP and assist councils with developing suitable planning and management controls, this section offers a model chapter on hazardous substances and facilities management which councils may wish to consider for inclusion in their plans.

The suggested model planning and management controls for district plans focus on addressing the effects of the use, storage, transportation and disposal of hazardous substances. It should be noted that transportation and disposal of hazardous substances may also be controlled by other measures. The model includes:

- relevant definitions
- introduction
- a brief issue statement
- objectives and policies
- explanation and reasons
- anticipated environmental results
- a detailed management strategy outlining:

minimum performance standards for hazardous facilities
assessment criteria for consent applications
the Hazardous Facility Screening Procedure
the Consent Status Matrix.

The design of this chapter is general and will require translation into the context of particular regions and districts. Similarly, if the HFSP is adopted, the setting of Consent Status Indices for the Consent Status Matrix needs to be carried out by each TA for its own requirements. However, because the HFSP has been assessed, peer-reviewed and endorsed in this form by technical and scientific experts, it is strongly recommended that the procedure itself is adopted without modification.

In adopting the model planning provisions and methods for hazardous facilities (such as the HFSP) outlined in this chapter, each TA will need to give careful thought to the costs and benefits of doing so, as outlined in Section 32 of the RMA. Appendix F provides a suitable explanation to justify the scope and use of the HFSP in a district plan. Further explanation may need to be provided by individual TAs in terms of the broader issues, objectives and policies of the district plan in relation to hazardous facilities.

Also addressed in this section are other aspects of hazardous facility management planning that should be provided for in a district plan, examples of facilities and activities that should be excepted from the HFSP and possible exemptions.

8.2 Definitions

It is recommended that the following definitions are inserted into the district plan:

Hazardous substance

For the purposes of this district plan, hazardous substances are defined as:

a) substances with one or more of the following intrinsic properties
   - an explosive nature
   - an oxidising nature
   - a corrosive nature
   - flammability
   - acute and chronic toxicity
   - ecotoxicity with or without bioaccumulation.

b) substances which in contact with air or water (other than air and water where the temperature or pressure has been artificially increased or decreased) generates a substance with any or more of the properties specified in paragraph a) of this definition

c) substances that, when discharged to surface or ground waters, have the potential to deplete oxygen as a result of the microbial decomposition of organic materials (for example, milk or other foodstuffs)

d) radioactive substances except smoke detectors.

Hazardous facility

A hazardous facility means any activity involving hazardous substances and their sites where hazardous substances are used, stored, handled or disposed of, and any installations or vehicles parked on site that contain hazardous substances. Hazardous facility does not include:

- the incidental use and storage of hazardous substances in domestic quantities
- fuel in motor vehicles, boats and small engines
- retail outlets for the domestic usage of hazardous substances (i.e. supermarkets, hardware shops, pharmacies, home garden centres)
- gas and oil pipelines
- trade waste sewers.

Hazardous sub-facility	A sub-facility is any hazardous facility that operates separately, being more than 30 metres from any other hazardous facility on the same site; for example, a university or research centre.

8.3 Other aspects of hazardous facilities management

There are other matters that need to be considered in preparing the District Plan which may not be part of the Hazardous Substances Chapter, such as cross boundary matters and monitoring. Each territorial authority will have a different approach to these matters, as they relate to wider issues than simply hazardous substances. For this reason, these matters are not included in the Model District Plan Section – Hazardous Substances, and are instead, described below:

8.3.1 Cross-boundary effects

The Hazardous Facility Screening Procedure and the management strategy of which it is a part, focus on the potential off-site effects a hazardous facility may have on the environment, people and property, including surrounding land uses.

Liaison between neighbouring district/regional councils to ensure that zoning or land use strategies are compatible is therefore essential. This is of particular importance where a hazardous facility is located at district/regional boundaries and has the potential to affect the neighbouring district/region.

Cross-boundary liaison is also important with respect to the transport of hazardous substances. Where a council identifies specific transport routes it needs to ensure that this is compatible with district/regional plans of other affected authorities.

Each council is to decide how to address cross boundary issues in their District Plan, for example by way of a separate section on cross boundary issues for hazardous substances, or with a comprehensive chapter on all cross boundary issues.

8.3.2 Monitoring

Monitoring by the consent authority is an integral component of any management strategy, to establish the effectiveness or otherwise of the adopted system. With respect to land use planning for hazardous facilities, the following matters should be considered for inclusion in monitoring programmes:

- information on the location and layout of the facility
- the quality and availability of plant documentation, including operating procedures
- information about the nature and quantity of the hazardous substances used, stored and transported
- process description and design
- emergency planning for the facility
- transport movements and routes
- information on waste management
- a review of the hazards and safeguards in place.

Where deemed appropriate, council may require the consent holder to undertake self-monitoring.

Each council is to decide how to address monitoring in their District Plan, for example by way of a separate section on monitoring for hazardous substances, or with a comprehensive chapter on all monitoring issues.

Model HSFP for your District Plan

Section X – Hazardous Substances

Introduction

The use, storage, transportation and disposal of potentially hazardous substances are an integral part of the normal activities of a community. These substances whether singularly or in combination have the potential to adversely affect the health and safety of the community, and the wellbeing and sustainability of the local natural and physical environment.

Territorial Authorities have responsibility under Section 31 of the RMA to control any actual or potential effects of the use, development or protection of land including the prevention or mitigation of any adverse effects of the storage, use, disposal or transportation of hazardous substances in the context of the environment in which they occur. Under Section 30 of the RMA, Regional Councils are to control the use of land for the purpose of prevention or mitigation of any adverse effects of the storage, use, disposal and transportation of hazardous substances.

> There are other legislative requirements for hazardous substances, such as the Hazardous Substances and New Organisms Act 1996 (HSNO). The focus of the HSNO legislation and regulations is on the characteristics of the substance itself regardless of the location. This includes containment, packaging, identification, tracking, competency handling, emergency preparedness and disposal. The HSNO Act provides the means to set conditions on the management of hazardous substances which apply irrespective of location. The control of potential adverse environmental effects at a particular site will be set under the RMA.

There are three main types of potential adverse effects from hazardous substances that need to be controlled:

- effects on the physical and natural resources caused by fire and explosion
- effects on the receiving environment caused by pollution, contamination and poisoning
- effects on human health, including risk to people and communities.

The controls need to be implemented at the site where the activities and facilities involved with hazardous substances are to be located.

X.1 Issue statement

The use, storage, transportation and disposal of hazardous substances are associated with primary production, manufacturing and processing activities, as well as retail, business and domestic activities. There are risks associated with hazardous substances that could adversely affect the environment and human health. The risks are the likelihood of occurrence of an adverse effect from a hazard and the resulting consequences adversely affecting people and the environment. These hazards include explosiveness, flammability, corrosiveness, toxicity and ecotoxicity.

Hazardous substances should be managed in a safe manner to avoid, remedy or mitigate any adverse effects on human health and the environment caused by an accidental or deliberate release of hazardous substances. Measures should also be taken to reduce the risk to the local community and environment from the location of hazardous facilities.

X.2 Objectives and policies

X.2.1 Objective

X.2.1.1 To avoid, remedy, or mitigate adverse effects on the environment, including risk, associated with the use, storage, transportation and disposal of hazardous substances.

X.2.2 Policies

X.2.2 (i) Hazardous facilities are to be located, designed, constructed and managed to avoid, remedy or mitigate adverse effects and unacceptable risks to the environment.

X.2.2 (ii) Appropriate facilities and systems are to be provided to avoid the pollution of soil, groundwater, watercourses and air in the event of accidents (such as spills, gas escapes, etc) involving hazardous substances.

X.2.2 (iii) Transportation of hazardous substances, including wastes, should be undertaken in a safe manner, by modes and transport routes which prevent or minimise the risk of adverse effects on residents, on the natural and physical environment, and on other transport users.

X.2.2 (iv) Disposal of hazardous wastes is to be undertaken in an environmentally safe manner at authorised facilities to avoid the risk of hazardous substances escaping into the environment thereby creating adverse environmental effects.

Explanation and principal reasons for this approach

Hazardous substances could be toxic, flammable, highly reactive, corrosive, and ecotoxic. Therefore all activities involving the manufacture, storage, use, transportation and disposal of hazardous substances have the potential to create adverse environmental effects if the substances escape into the environment as a result of inadequate management or an accidental spillage. To avoid, remedy, or mitigate these effects, hazardous facilities and activities need to be managed correctly and located appropriately.

The nature and scale of environmental effects resulting from a discharge of hazardous substances is influenced by the location of the hazardous facility or activity. For example, near sensitive ecological areas, a discharge of hazardous substances may have far reaching adverse effects. The location of hazardous facilities must be addressed carefully in relation to the surrounding community and environment.

Reverse sensitivity, that is the effects of neighbouring activities on the ability of a hazardous facility in question to carry out its operations effectively, may also need to be taken into account for existing areas of particularly large hazardous facilities where residual risks cannot be completely eliminated.

Specific controls relating to the use and storage of hazardous substances, in particular site design, layout and operational management procedures should prevent/mitigate the risk of hazardous substances escaping into the environment thereby creating adverse environmental effects. This involves the on-site storage requirements and also the statutory requirements of the HSNO Act provisions. There are also New Zealand standards, Codes of Practice and Regulations for the storage of hazardous substances.

An aggregation of such hazardous facilities may generate adverse effects if operational procedures do not conform to defined minimum conditions or malfunctions occur in the process/facility. The location, site design and operation of each hazardous facility are to be managed wisely to avoid or mitigate off-site effects. Where there are a number of separate hazardous operations within one site, each operation is to be managed in a safe manner to avoid adverse effects on each other and off-site. Such operations are known as hazardous sub-facilities. A typical example would be a University Campus or Research Centre.

The transport of hazardous substances poses risks that are similar to those posed by use and storage, in terms of uncontrolled releases, but require substantially different methods of control. Other legislation, regulations and codes of practice address the transportation of hazardous substances. For example, the Transport Act establishes classes of substances and places a duty on transporters of goods to label and provide documentation for hazardous substances, as well as requiring the training of drivers who transport hazardous substances. Other provisions include the Land Transport Rule and the New Zealand Standard 5433:1999. The land transport legislation is administered by the Land Transport Safety Authority.

The disposal of hazardous wastes involve risks to the health of the transporter, landfill operators, and the community; as well as risk for the receiving environment. The disposal of hazardous wastes to authorised facilities or those serviced by an approved waste contractor should avoid the risk of hazardous substances escaping into the environment thereby creating adverse environmental effects. Authorised facilities and operators will need to comply with other legislative provisions, regional council requirements and codes of practice for hazardous waste management.

X.2.3 Methods

The objective and policies will be implemented through the following methods:

District Plan

- Appropriate zoning.
- Hazardous Facilities Screening Procedure (HFSP) and Rules – which ensure that the level of control of hazardous substances and facilities using them is commensurate with the scale of the likely environmental effects. Each facility using or storing hazardous substances will be screened using the HFSP and the consent status determined, i.e. permitted or require a resource consent. Minimum performance standards will apply to all such activities. See Appendix A for details on the HFSP Strategy.
- Use of Consent Status Matrix to identify the appropriate level of scrutiny to process an application for a proposed hazardous facility.
- Use of buffer area provisions to address interface situations, particularly to deal with incompatible land use activities.
- Application of appropriate resource consent conditions.
- Monitoring of compliance with rules and resource consent conditions.
- Monitoring of compliance with codes of practice, New Zealand Standards, Guidelines and Regulations for hazardous substances.

Other methods

- **Hazardous Substances and New Organisms Act** – sets out technical standards for the use, storage, inspection, identification and regulation of hazardous substances.
- **Legislation, regulations and codes of practice addressing the transportation of hazardous substances** – imposes relevant controls on the transportation of hazardous substances. See Appendix E.
- **Education** – will be used to promote public awareness about the costs and benefits of hazardous substances and facilities, to encourage resource users to take responsibility for their own health and safety, and for management of the effects of their activities on the public and the environment.

- **Industry Codes of Practice, New Zealand Standards and Guidelines** – will be used to avoid, remedy or mitigate environmental effects and in managing risks associated with hazardous facilities. Industry Codes will be utilised in some circumstances to provide the basis for controls on the use of hazardous substances.
- **Develop specific guidelines** to assist operators of hazardous facilities in achieving compliance with relevant management requirements.
- **Prepare and operate site management systems and emergency plans** to avoid or mitigate the risk of hazardous substances escaping into the environment.
- **Promotion of "Cleaner Production" and recycling principles**.
- **Waste Disposal Guidelines** will be used for the disposal of hazardous waste to Local Authority approved facilities to protect human health and the receiving environment from potential adverse effects. Advice may be given on pre-treatment requirements or alternative methods of disposal for non- acceptable wastes.
- **Liaison with parties involved with hazardous substance use** – such as the regional council and adjoining territorial authorities, Ministry of Health, Ministry for the Environment, the Environmental Risk Management Authority (ERMA), the New Zealand Police and owner/operators who use hazardous substances, will allow more effective risk management co-ordination.

X.2.4 Anticipated Environmental Results

a) Protection of the life supporting capacity of air, water, soil and ecosystems from adverse environmental effects and an unacceptable level of risk from the location and operation (use, storage, transportation and disposal of hazardous substances) of hazardous facilities and activities.

b) Protection of the natural and physical resources from adverse environmental effects and an unacceptable level of risk from the location and operation (use, storage, transportation and disposal of hazardous substances) of hazardous facilities and activities.

c) Protection of human health from potential adverse effects associated with the use, storage, transportation and disposal of hazardous substances and hazardous wastes.

d) Reduction in the number of accidents, incidents and extent of adverse environmental effects related to hazardous facilities and hazardous substances.

e) Reduction in risk associated with hazardous substances due to:

   - increased industry and community awareness of risks posed by activities using, storing, transporting and disposing of hazardous substances
   - better operational practices and improved design and management of hazardous facilities in the district.

X.3 Hazardous facilities rules

Rule statement

Rules for hazardous facilities are based on controlling the location, design, construction, operation and management of hazardous facilities in a manner that avoids, remedies or mitigates risks and adverse effects to human health, property and sensitive environments. This will be achieved through the use of the Hazardous Facility Screening Procedure (HFSP), which determines the necessary level of scrutiny based on the risk and potential environmental effects presented by hazardous facilities, and through rules based on a series of Minimum Performance Standards. For the avoidance of doubt, all rules pertaining to hazardous facilities apply to hazardous sub-facilities, unless otherwise stated.

Means of compliance

The following rules shall be read in conjunction with the standards and performance assessments in the relevant zone, and all other rules within *(your Council's Plan)*.

The activity status of a Permitted or Controlled Activity will be altered from the activity list below where the activity cannot meet one or more of the standards in the rule and a resource consent will be required.

X.3.1 Hazardous facilities – Consents Status Matrix

X.3.1 (i) The activity status of any hazardous facility is determined by the effects ratio as indicated in the Consents Status Matrix below.

Insert your Councils Consent Status Matrix here.

Table I: Consent Status Matrix – Consent Status Index

Zone	Effects Ratio Trigger Level for Permitted Activities	Effects Ratio Trigger Level for Controlled Activities	Effects Ratio Trigger Level for Restricted Discretionary Activities	Effects Ratio Trigger Level for Discretionary Activities

See example provided below.

Table X: Consent Status Matrix (example only)

Zone	Consent status index for permitted activities	Consent status index for controlled activities	Consent status index for discretionary activities
Heavy industrial	<1	1–2	>2
Industrial	<0.75 <0.1 (if within 30 m of a residential zone)	0.75–1.5 0.1–0.2 (if within 30 m of a residential zone)	>1.5 >0.2 (if within 30 m of a residential zone)
Light industrial	<0.5 <0.1 (if within 30 m of a residential zone)	0.5–1 0.1–0.2 (if within 30 m of a residential zone)	>1 >0.2 (if within 30 m of a residential zone)
Special purpose	<0.3	0.3–0.6	>0.6
Business	<0.2	0.2–0.4	>0.4
Residential	≤0.02	–	>0.02
Open space	≤0.1	–	>0.1

X.3.1 (ii) Exemptions from the Hazardous Facility Screening Procedure (HFSP): The following activities shall be exempted from compliance with the HFSP and do not require an effects ratio trigger level calculation. They are not exempt from other requirements relating to hazardous substances, including compliance with Permitted Activity Standards:

a) The retail sale of fuel, up to a storage of 100,000 litres of petrol and up to 50,000 litres of diesel in underground storage tanks, provided it can be demonstrated that the *"Codes of Practice for the Design, Installation and Operation of Underground Petroleum Systems"* published by the Department of Labour (Occupational Safety and Health) 1995 is adhered to.

b) The retail sale of LPG, with a storage of up to six tonnes (single vessel storage) of LPG, provided it can be demonstrated that the most recent edition of the *"Australian Standard (AS 1596–1997) for LP Gas Storage and Handling – Siting of LP Gas Automotive Retail Outlets"* is adhered to.

c) Existing facilities will not be subject to the HFSP unless they significantly expand or alter their operations. A significant alteration occurs when the effects of the use are not the same or similar in character, intensity or scale as previously, as defined in Sections 10, 10A and 20 of the Resource Management Act 1991.

d) Teaching and research laboratories excluding any activities that are undertaken by such laboratories outside of the laboratory (including bulk hazardous substances storage facilities, field tests, etc).

e) Radioactive substances.

f) Milk or any organic liquid substances with the potential to deplete oxygen in receiving waters.

X.3.1 (iii) Exceptions from the Hazardous Facility Screening Procedure (HFSP): The following activities do not require an effects ratio trigger level calculation and do not have to comply with the Permitted Activity Standards:

a) Trade waste sewers, or waste treatment and disposal facilities (this exception does not apply to the storage of hazardous substances or waste associated with these facilities).

b) Domestic storage and use of hazardous consumer products for domestic purposes.

c) Retail outlets for the sale of hazardous substances for the domestic use (e.g. supermarkets, hardware shops, pharmacies).

d) Facilities using genetically modified organisms.

e) Dust explosion.

f) Gas or oil pipelines.

g) Fuel in motor vehicles, boats and small engines.

h) Developments that are or may be hazardous but do not involve hazardous substances (e.g. radio masts, electrical substations).

i) The occasional loading and unloading of hazardous substances on a site where this forms only a minor part of site operations.

X.3.2 Permitted activities

The following activities are permitted activities provided they comply with the standards in Rule X.3.3:

(i) Any hazardous facility which has been assessed as having an Effects Ratio (Quantity Ratio) which is below the Effects Ratio (Consent Status Index) for Permitted Activities in the Consent Status Matrix in Table I.

(ii) Any storage of milk or other organic liquids in quantities below 10,000 litres.

(iii) Any use or storage of radioactive materials with an activity below that specified as an exempt activity in the Radiation Protection Regulations 1982.

X.3.3 Permitted activity standards (minimum performance standards)

The following minimum performance standards apply to all hazardous facilities and activities.

a) Hazardous facilities site design

Any part of a hazardous facility which is involved in the manufacture, mixing, packaging, storage, loading, transfer, usage or handling of hazardous substances shall be designed, constructed and operated in a manner that prevents:

i) the occurrence of any off-site adverse effects from the above listed activities on people, ecosystems, physical structures and/or other parts of the environment unless permitted by a resource consent

ii) the contamination of air, land and/or water (including groundwater and potable water supplies and surface waters) in the event of a spill or other type of release of hazardous substances.

Details for site design, construction and operation (including emergency spill procedures) are to be certified by a suitably qualified engineer, to achieve the above.

b) Hazardous facilities site layout

The hazardous facility must be designed in a manner to ensure that separation between on-site facilities and the property boundary is sufficient for the adequate protection of neighbouring facilities, land uses and sensitive environments.

Details for site design, type and volume of hazardous substances, nature of operation and safe separation distances are to be certified by a suitably qualified engineer, to achieve the above.

c) Storage of hazardous substances

The storage of any hazardous substances must be carried out in a manner that prevents:

(i) the unintentional release of the hazardous substance

(ii) the accumulation of any liquid or solid spills or fugitive vapours and gases in enclosed off-site areas, resulting in potentially adverse effects on people, ecosystems or built structures.

Compliance with specific performance requirements for the storage of hazardous substances covered by HSNO Regulations, will assist in achieving the above.

d) Site drainage systems

Site drainage systems must be designed, constructed and operated in a manner that prevents the entry or discharge of hazardous substances into the stormwater and/or sewerage systems unless permitted by a network utility operator.

Compliance can be achieved using precautionary methods, including clearly identified stormwater grates and access holes, roofing, sloped pavements, interceptor drains, containment and diversion valves, oil-water separators, sumps and similar systems.

e) Hazardous facilities spill containment system

Any parts of the hazardous facility site where a hazardous substance spill may occur must be serviced by a suitable spill containment system that is:

i) constructed from impervious materials resistant to the hazardous substances used, stored, manufactured, mixed, packaged, loaded, unloaded or otherwise handled on the site; and for liquid hazardous substances:

- able to contain the maximum volume of the largest tank present plus an allowance for stormwater or fire water
- for drums or other smaller containers, able to contain half of the maximum volume of substances stored, plus an allowance for stormwater or fire water

ii) able to prevent any spill or other unintentional release of hazardous substances, and any stormwater and/or fire water that has become contaminated, from entering the stormwater drainage system, unless permitted by a network utility

iii) able to prevent any spill or other unintentional release of hazardous substances, and any stormwater and/or fire water that has become contaminated from discharging into or onto land and/or water (including drainage systems, groundwater and potable water supplies) unless permitted by a resource consent.

Details of the spill containment system are to be certified by a suitably qualified engineer, to achieve the above. Suitable means of compliance include graded floors and surfaces, bunding, roofing, sumps, fire water catchments, overfill protection and alarms, and similar systems.

f) Hazardous facilities stormwater drainage

All stormwater grates on the site shall be clearly labelled “Stormwater Only”.

g) Hazardous facilities washdown areas

Any part of the hazardous facility site where vehicles, equipment or containers that are or may have become contaminated with hazardous substances are washed must be designed, constructed and managed to prevent any contaminated wash water from:

(i) entry or discharge into the stormwater drainage or the sewerage system unless permitted by a network utility operator

(ii) discharge into or onto land/or water (including groundwater and potable water supplies) unless permitted by resource consent.

Details of design, construction and management of washdown areas are to be certified by a suitably qualified engineer, to achieve the above. Suitable means of compliance include roofing, sloped pavements, interceptor drains, containment and diversion valves, oil-water separators, sumps and similar systems.

h) Hazardous facilities underground storage tanks

Underground tanks for the storage of petroleum products must be designed, constructed and managed to prevent leakage and spills and resulting adverse effects on people, ecosystems and property. Underground storage tanks shall be:

(i) constructed from impervious materials resistant to the hazardous substances to be stored

(ii) equipped with secondary containment facilities in areas of environmental sensitivity

(iii) serviced by a leak detection or monitoring system which is capable of detecting a failure or breach in the structural integrity in the primary containment vessel.

In addition to complying with the above requirements for underground tanks, the Code of Practice for "Design, Installation and Operation of Underground Petroleum Systems – Department of Labour – Occupational Safety and Health (1995)" shall also be adhered to.

i) Hazardous facilities signage

(i) Any hazardous facility must be adequately signposted to indicate the nature of the substances stored, used or otherwise handled.

Compliance can be achieved by adherence to the Code of Practice for "Warning Signs for Premises Storing Hazardous Substances" of the New Zealand Chemical Industry Council (1988), HAZCHEM signage system, or any other Code of Practice approved by the New Zealand Fire Service.

j) Hazardous facilities waste management

(a) Any process waste or waste containing hazardous substances will be managed in accordance with rules X.3.3(a) Hazardous Facilities Site Design to X.3.3(e) Hazardous Facilities Spill Containment Systems. All storage and management activities of hazardous wastes shall at all times comply with all relevant performance standards specified for hazardous facilities and activities.

(b) The storage of any waste containing hazardous substances shall be in a manner that prevents:

i) the exposure to ignition sources

ii) the corrosion or other alteration of the containers used for the storage of the waste

iii) the unintentional release of the waste.

(c) Any hazardous facility generating waste containing hazardous substances shall dispose of these wastes to authorised facilities or be serviced by an acceptable waste disposal contractor formally approved by the Local Authority. *(Insert your Council policy or protocol for approved disposal sites and contractors here.)*

Details of storage, management and disposal of hazardous wastes will be certified by a suitably qualified engineer, to achieve the above.

X.3.4 Controlled activities

The following activities are Controlled Activities provided they comply with the Permitted Activity Standards in Rule X.3.3 and will be controlled in respect of the matters identified in rule X.3.5:

(i) Any hazardous facility which has been assessed as having an Effects Ratio (Quantity Ratio) which is within the Effects Ratio (Consent Status Index) range for a Controlled Activity in the Consent Status Matrix: Table I.

(ii) Teaching and research laboratories and the associated use, handling, storage and disposal of hazardous substances (not including bulk hazardous storage facilities).

(iii) Any use or storage of radioactive materials with an activity in excess of that specified as an exempt activity in the radioactive Protection Regulations 1982 and below 100 TeraBequerel.

(iv) The retail sale of fuel, up to a storage of 100,000 litres of petrol and up to 50,000 litres of diesel in underground storage tanks, provided it can be demonstrated that the "Codes of Practice for the Design, Installation and Operation of Underground Petroleum Systems" published by the Department of Labour (Occupational Safety and Health) 1995 is adhered to.

(v) The retail sale of LPG, with a storage of up to six tonnes (single vessel storage) of LPG, provided it can be demonstrated that the most recent edition of the *"Australian Standard (AS 1596–1997) for LP Gas Storage and Handling – Siting of LP Gas Automotive Retail Outlets"* is adhered to.

X.3.5 Assessment criteria – controlled activities

a) The council reserves control over the following matters:

- The proposed operation and site layout.
- Demonstration that safe routes have been selected and will be utilised for the transport of hazardous substances on and off-site.
- The sensitivity of the surrounding natural, human and physical environment.
- Separation distances and the type of environment/number of people potentially at risk from the proposed facility.
- Potential hazards and exposure pathways arising from the proposed facility.
- Potential cumulative hazards presented in conjunction with neighbouring facilities.
- Proposed fire safety and fire water management.
- Proposed spill contingency and emergency planning.
- Proposed monitoring and maintenance schedules.
- Proposed waste disposal management.
- Compliance with relevant Codes of Practice.
- Compliance with relevant standards for the use, storage and transport of hazardous substances by retail fuel outlets for petrol (up to 100,000 litres in underground tanks) and diesel (up to 50,000 litres in underground tanks), including adherence to the *"Codes of Practice for the Design, Installation and Operation of Underground Petroleum Systems"* published by the Department of Labour (Occupational Safety and Health) 1995.
- Compliance with relevant standards for the use, storage and transport of hazardous substances by retail fuel outlets for LPG, including adherence to the most recent edition of the *" Australian Standard (AS 1596–1997) for LP Gas Storage and Handling – Siting of LP Gas Automotive Retail Outlets".*
- Compliance with relevant standards for the use, storage and transport of hazardous substances by teaching and research laboratories, including the following:

AS 2982.1:1997 (or more recent amendments/editions) – Laboratory Design and Construction

AS 2243.1:1997 (or more recent amendments/editions) – Safety in Laboratories – General

AS 2243.2:1997 (or more amendments/recent editions) – Safety in Laboratories – Chemical Aspects

AS 2243.3:1995 (or more recent amendments/editions) – Safety in Laboratories – Microbiology

AS 2243.5:1993 (or more recent amendments/editions) – Safety in Laboratories – Non-ionising Radiation

AS 2243.6:1990 (or more recent amendments/editions) – Safety in Laboratories – Mechanical Aspects

AS 2243.8:2001 (or more recent amendments/editions) – Safety in Laboratories – Fume Cupboards

AS 2243.9:1991 (or more recent amendments/editions) – Safety in Laboratories – Recirculating Fume Cabinets

AS 224310:1993 (or more recent amendments/editions) – Safety in Laboratories – Storage of Chemicals.

b) Standards and terms for controlled activities

Applications for controlled activities are to be accompanied by an Assessment of Environmental Effects (AEE) according to the Fourth Schedule of the RMA. The AEE must be appropriate to the nature and scale of the proposed facility and its associated potential or actual environmental effects, and must include the following matters:

(i) a description of the nature and scale of the proposed facility and associated operations

(ii) an inventory of hazardous substances proposed to be used, stored, transported and disposed of on the site

(iii) the bio-physical characteristics of the site and surrounding area and relevant infrastructure on and off site (e.g. drainage, roads)

(iv) the location of the facility in relation to people oriented activities (e.g. child care facilities, schools, rest homes, hospitals), sensitive environments (e.g. natural waters, ecosystems) and infrastructures (neighbouring roads, buildings etc.)

(v) description of the environment actually or potentially affected by the proposal, including pathways and receptors.

(vi) preliminary hazard and risk analysis

(vii) management of wastes containing hazardous substances

(viii) the transport of hazardous substances, where this forms a significant part of the operations

(ix) emergency and contingency planning.

X.3.6 Restricted discretionary activities

The following activities are restricted discretionary activities:

(a) Any hazardous facility which has been assessed as having an Effects Ratio (Quantity Ratio) which is within the Effects Ratio (Consent Status Index) range specified as Restricted Discretionary for the zone in which it proposes to locate, as indicated in the Consent Status Matrix – Rule X.3.1(i) Table I.

(b) Permitted or controlled activities which do not comply with one or more standards in Rule X.3.3.

X.3.7 Assessment criteria – restricted discretionary activities

(a) Restricted discretionary activities, as defined by the Consent Status Matrix will be assessed with discretion restricted to:

- the extent to which the activity meets the relevant zone performance standards under (*Your Council's Plan*)
- the extent to which the activity complies with the objectives and policies of (*This section*) and the relevant zone in (*Your Council's Plan*)
- whether the activity complies with the Standards in rule X.3.3
- the extent to which the risks presented by the proposal to people, the environment and property are to be avoided, remedied or mitigated.

(b) Restricted discretionary activities, as defined by Rule X.3.6 (b) will be assessed only in respect of the subject matter of the standard(s) with which the activity was unable to comply.

(c) All applications for Restricted Discretionary Activities shall be accompanied by an Assessment of Environmental Effects (AEE) pursuant to the Fourth Schedule of the RMA.

The AEE must be appropriate to the nature and the scale of the proposed facility and its associated actual or potential environmental effects, and must address the following matters:

(i) The proposed site and layout, with a description of the nature and scale of the proposed facility and associated operations

(ii) Quantities of hazardous substances proposed to be used, stored, transported and disposed of on the site.

(iii) Site drainage and off-site infrastructure, including the biophysical characteristics of the site and surrounding area (e.g. drainage, roads).

(iv) Transfer/transport of hazardous substances on and off the site and the selection of the least risk routes.

(v) The sensitivity of the surrounding human, natural and physical environment and proposed measures to protect them.

(vi) Separation distances from neighbouring activities and people potentially at risk from the hazardous facility, including consideration of the proximity to people oriented activities (e.g. childcare, schools, rest homes, hospitals).

(vii) Identification of on-site hazards and exposure pathways from the proposed facility, including a description of the environment actually or potentially affected by the proposal.

(viii) Potential cumulative effects with neighbouring facilities.

(ix) Preliminary hazard and risk analysis.

(x) Management of wastes containing hazardous substances.

(xi) Fire safety and fire water management.

(xii) Proposed contingency measures and emergency plans.

(xiii) Proposed monitoring and maintenance schedules.

X3.8 Discretionary activities

The following activities are discretionary activities:

- Any hazardous facility which has been assessed as having an Effects Ratio (Quantity Ratio) which is greater than the Effects Ratio (Consent Status Index) for Discretionary Activities, for the zone in which it proposes to locate, as indicated in the Consent Status Matrix, Rule X.3.1(i) Table I.
- Any storage facility for milk or other liquid organic food produced in quantities above 10,000 litres.
- Any use or storage of radioactive materials with an activity in excess of that specified as an exempt activity in the Radiation Protection Regulations 1982 and above 100 terabecquerel.
- Any other hazardous facility that is not identified as a Permitted, Controlled, Restricted Discretionary or Non Complying Activity.

X3.2.9 Assessment criteria – discretionary activities

Discretionary activities will be assessed against, but not limited to, the assessment criteria below.

a) Assessment of environmental effects

- **Impact assessment:** all applications for discretionary activities will be assessed in respect of the Assessment of Environmental Effects prepared according to Rule X.3.7(c).
- **Alternatives:** for any discretionary activity the AEE must also contain an evaluation of alternatives (sites/locations, substances, quantities, processes/equipment, site management, etc.) to determine whether there are any alternatives to the proposal particularly where it is possible that the activity is likely to result in significant environmental effects.

- **Risk assessment:** for any discretionary activity the AEE must also contain a risk assessment that systematically addresses site hazards, likely accident scenarios, exposure pathways, receiving environments and potential environmental effects. The detailed hazard and risk analysis of installations, operations and processes involving hazardous substances is to be appropriate to the type and scale of the proposed facility.

- **Risk mitigation and management:** a qualitative or, in some cases, a quantitative risk assessment may be required, depending on the scale or potential effects of the proposed development. This assessment should place emphasis on the following issues:

identification of potential hazards, failure modes and exposure pathways

assessment of the probability and potential consequences of an accident leading to a release of a hazardous substance or loss of control, including, as applicable, cumulative and/or synergistic effects

acceptability of the assessed risks, including cumulative risks

proposed risk control and environmental mitigation measures, with emphasis on sensitive activities and environments, including, as applicable, fire safety and site management systems, engineered safety measures such as containment devices, spill contingency and emergency plans, monitoring and maintenance schedules as well as training programmes.

b) Performance assessment

> In assessing discretionary activities council will evaluate the following additional matters:

i) Whether a proposal complies with the Performance Standards outlined in Rule X.3.3.

ii) The extent to which the proposed site design, construction and operation of hazardous facilities are appropriate to prevent the accidental release, or loss of control, of hazardous substances, and whether adequate emergency and spill contingency plans are provided.

iii) The extent to which the proposed site design, construction and operation of hazardous facilities are appropriate to prevent and mitigate any adverse effects resulting from activities on the site involving hazardous substances on people, property and environmentally sensitive areas.

iv) Whether off-site transport of hazardous substances has been adequately addressed.

v) The preparation of waste management plans for significant quantities of wastes containing hazardous substances, including procedures for disposal practices and use of waste contractors.

vi) Whether other alternatives have been considered adequately.

vii) Whether the risks presented by the hazardous facility to humans, the environment and property have been assessed fully and systematically, and whether they are able to be avoided, remedied and mitigated satisfactorily.

viii) Whether a suitable site management system has been proposed.

The Council will consider the use of a national or international site management standard and any subsequent amendments to these standards, such as the New Zealand Chemical Industry Council (NZCIC) responsible Care Programme, the ISO 9000 and ISO 14001 systems.

Advisory note

In addition to the provisions of this Plan's rules for hazardous substances, the following provisions for hazardous substances must also be adhered to:

- Relevant rules and provisions of a Regional Plan or the Regional Policy Statement.
- Transitional and future regulations for hazardous substances under the Hazardous Substances and New Organisms Act 1996.
- The Land Transport Act 1962 and the relevant NZ Standard for the land transport of hazardous substances.

Appendix X.A – Hazardous Facilities Screening Procedure Strategy

Hazardous substances, by their very nature, present a number of complex issues. Council has adopted an approach to managing hazardous facilities that focuses on assessing potential adverse effects of three kinds:

- effects caused by fire and/or explosion
- effects on human health
- environmental effects.

Possible adverse effects of hazardous substances can be predicted by the hazard of the substance and the anticipated consequences of its release. Adverse effects include:

- contamination of water, soil and air
- short and long term damage to ecosystems
- damage to communities
- accumulation of persistent substances in the bodies of humans and animals, resulting in chronic and/or long term damage to their health
- acute damage to human health through exposure to substances affecting skin, mucous membranes, respiratory and digestive systems
- damage to the environment, human health and property from fire or explosion events
- road accidents and traffic delays.

In order to assess the hazard posed by various substances and the risk they present, Territorial Authorities have adopted the Hazardous Facility Screening Procedures (HFSP) for use in assessing hazardous activities or facilities.

The HFSP is a tool which assesses the site-specific effects of a hazardous facility within a given community or environment.

The Consent Status Matrix is the main link between the District Plan and the Hazardous Facility Screening Procedure. The matrix contains a range of numerical values. These values serve as trigger levels to determine the consent status of an activity involving hazardous substance in a specific land use zone.

They are effectively benchmarks against which the numerical values calculated by the Hazardous Facility Screening Consent Status Table vary in accordance with the sensitivity of the different land use zones, buffer areas and the types and quantities of hazardous substances which can be used or stored in these.

The HFSP has undergone extensive technical review and scrutiny by local and overseas experts and has been successfully tested in court.

The Consents Status Matrix provides a signal to the hazardous facilities operator as to which zones are best suited for a proposed development, what controls will apply and the likely outcome of the consent application. In addition, communities will be given some certainty over where hazardous facilities are likely to be located.

Appendix X.B – Hazardous Facilities Screening Procedure – Step by Step Guide

(You should insert your HFSP Step by Step Guide here.)

Appendix X.C – Hazardous Facilities Screening Procedure – Tables

(You should insert your HFSP tables here.)

Appendix X.D – Hazardous Facilities Screening Procedure – Worksheets

(You should insert your HFSP worksheets here.)

Appendix X.E – Hazardous Facilities Screening Procedure – Transportation Provisions

The legislation, regulations and Codes of Practice addressing the transport of hazardous substances include:

- Civil Aviation Act 1964
- Civil Aviation Regulations 1953
- Dangerous Goods Act 1974 and associated regulations
- Explosives Act 1957
- Explosives Regulations 1959
- Toxic Substances Act 1979
- Toxic Substances Regulations 1983
- Transport Act 1962 and Transport Amendment Act 1989
- Traffic Regulations 1976

- Truck Loading Code (Ministry of Transport, 1985)
- Instructions for the Safe Carriage of Hazardous Goods Traffic (New Zealand Railways, 1980)
- NZS 5417:1988: Transportation Labels for Hazardous Substances (New Zealand Standards Association)
- NZS 5418:1983: Transportation Containers for Hazardous Substances (Parts 1 & 2) (New Zealand Standards Association)
- NZS 5433:1999: Code of Practice for the Transport of Dangerous Goods on Land (New Zealand Standards Association)
- Code of Practice for Vehicles Transporting LP Gas in Bulk by Road (Department of Labour)
- Corrosive Tank Wagon Code (Department of Labour, 1986)
- Flammable Tank Wagon Code (Department of Labour, 1986)
- LPG Tank Wagon Code (Department of Labour, 1986)

These controls are mainly technically orientated and do not directly address risk-related aspects. It is therefore important that local authorities recognise the risk associated with the transport of hazardous substances and utilise such tools available to them to prevent or mitigate such risks.

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Databases on CD-ROM available for purchase

Author/agency	Title	Comments
Canadian Centre for Occupational Safety and Health	MSDS	Information on Material Safety Data Sheets (product hazards, emergency and first aid response, safe working procedures).
Canadian Centre for Occupational Safety and Health	CHEM Source	Extensive hazardous substances database containing information on substance properties, human health and environmental hazards. Includes CHEMINFO and CESARS (Chemical Evaluation Search and Retrieval System).
	US Register of Toxic Effects of Chemical Substances (RTECS)	Extensive database on human health effects of hazardous substances, including toxicity, skin/eye irritation, carcinogenicity, mutagenicity, and teratogenicity.
NZ National Poisons Centre	CD-Substance	Focus on medical emergencies and clean-up procedures.
SilverPlatter	CHEM-BANK	Combination of existing hazardous substances databases; includes HSDB, CHRIS, RTECS and OHMTADS (Oil and Hazardous Materials Technical Assistance Data System).

Author/agency	Title	Comments
Committee of the EC Environmental Institute of the Joint Research Centre	ECDIN	Environmental and risk information, including ecological and economic implications
Micromedex Inc.	TOMES PLUS	Wide range of existing hazardous substances databases, including Hazardous Substances Data Bank (HSDB), Integrated Risk Information System (IRIS), Chemical Hazards Response Information System (CHRIS), and Registry of Toxic Effects of Chemical Substances (RTECS)

Databases available free on-line

Author/agency	Title	Comments
US National Library of Medicine (NML). Access via the National Library of Australia (NLA)	TOXNET http:// toxnet.nlm.nih.gov/	On-line access to a variety of hazardous substances databases including HSDB and IRIS.
USEPA	ECOTOX http://www.epa.gov/ med/databases/ databases.html	Comprehensive information on the toxicity of chemicals on aquatic organisms.

List of Abbreviations

AEE	Assessment of Environmental Effects
BOD	Biochemical Oxygen Demand
EMS	Environmental Management System
ERMA	Environmental Risk Management Authority
GHS	Global Harmonisation System
HFSP	Hazardous Facility Screening Procedure
HSE	Health and Safety in Employment Act 1992
HSNO	Hazardous Substances and New Organisms Act 1996
ISO	International Standards Organisation
MfE	Ministry for the Environment
NZCIC	New Zealand Chemical Industry Council
OECD	Organisation for Economic Co-operation and Development
OSH	Occupational Safety and Health
RMA	Resource Management Act 1991
RPS	Regional Policy Statement (under the RMA)
TA	Territorial Authority
UNRTDG	United Nations Recommendations for the Transport of Dangerous Goods
USEPA	United States Environmental Protection Agency

Glossary

Accident	A sudden event causing harm to people, property or the natural environment.
Acute toxicity	Adverse effects caused by a substance with toxic properties occurring within a short time following exposure to that substance.
Adjusted quantity	The amount (mass in tonnes or cubic metres, at 101.3 kPa and 20^{o}C, for compressed gases) of a substance that has been assessed as generating no significant off-site effects in a heavy industrial area after site- and substance-specific considerations have been taken into account.
Adjustment factor	The product of the individual factors for each Effect Type (i.e. Fire/Explosion, Human Health and Environment) that increase or decrease the likelihood and consequences of the release of a hazardous substance.
Base quantity	The amount (mass in tonnes or cubic metres, at 101.3 kPa and 20^{o}C, for compressed gases) of a substance that has been assessed as generating no significant off-site effects in a heavy industrial area before site- and substance-specific considerations have been taken into account.
Bioaccumulation	Accumulation of a substance within the tissues of living organisms.
BOD_5	The biochemical oxygen demand (measured over a five day period) which is the amount of dissolved oxygen in a body of water required for the breakdown of organic matter in the water.
Carcinogenic	Causing a statistically significant increase in the incidence of tumours – see HSNO Regulations.
Chronic toxicity	Adverse effects caused by a substance with toxic properties which occur either after prolonged exposure or an extended period after initial exposure.
Cleaner production	The use of techniques to reduce the need for raw materials and/or energy and the amount of wastes generated. These techniques may include the use of recyclable materials, the use of less hazardous substances or the reduction in their quantity, and the use of renewable resources.
Code of practice	Means any document for the purpose of specifying procedures and practices, or equipment and facilities for the management of hazardous substances, including documents issued and approved in accordance with HSNO.
Consent status index	Numerical values in the district plan that are used to determine the consent status of a facility.
Consequence	The outcome of an event or situation expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain (AS/NZS 4360:1999).

Corrosive	Capability of breaking down metal or human tissue on contact – see HSNO Regulations.
Cumulative risk	The risk posed by a hazardous facility added to or multiplied by risks from other facilities.
Ecosystem	A biotic community and its abiotic environment, considered together as a unit. Ecosystems are characterised by a flow of energy that leads to trophic status and material recycling.
Ecotoxic	Capability for toxic effects on non-human organisms and ecosystems – see HSNO Regulations.
Effect types	The effects generated when a hazardous substance is released or reacts: • fire/explosion effects concerned with damage to property, the built environment and people by substances with explosive, flammable or oxidising properties • human health effects concerned with adverse effects to the well-being and health of people by substances with toxic or corrosive properties • environmental effects concerned with damage to ecosystems or natural resources by substances with ecotoxic or corrosive properties.
Emergency plan	A regularly updated document serving as an emergency response guide by identifying and cataloguing the elements required to respond to an emergency, and defining responsibilities and specific tasks in an emergency.
Environment	Includes: • ecosystems and their constituent parts, including people and communities • all natural and physical resources
Environmental effect	Any change to the environment regardless of scale, intensity, duration or frequency, in relation to the use, development, or protection of natural and physical resources (based on the RMA).
Environmental management system	Part of the overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy (ISO/DIS 14050).
Environmentally damaging substances	Substances which are not intrinsically hazardous but may cause adverse effects if discharged into the environment in large quantities (e.g. milk and other organic liquids).
Environmentally sensitive areas	Areas that, in the judgement of the local community and/or regulatory authority, should not be subject to more than a specified low risk, or where additional safeguards are required when undertaking activities exceeding the specified low risk. Environmentally sensitive areas may include aquifers, waterways, wetlands, coastal environments, special ecosystems or species habitats.
Explosiveness	Capability of sudden expansion due to a release of internal energy – see HSNO Regulations.

Flammability	Capability to be ignited in the presence of oxygen and to sustain combustion – see HSNO Regulations.
Frequency	Measure of likelihood expressed as the number of occurrences of an event in a given time. See also Likelihood and Probability.
Harm	Injury or damage to health, property, or the environment.
Hazard	Actual or potential source of harm or a situation with a potential to cause adverse effect (modified from AS/NZS 4360:1999).
Hazard rating	The level of hazard (high, medium or low) applied to a hazardous substance for the purpose of an HFSP calculation, based on its HSNO classification.
Hazardous activity	An activity which does not include the use, storage or otherwise handling of a hazardous substance but which may pose a risk to the environment or a community (for example, earthworks).
Hazardous facility	Activities involving hazardous substances and sites, including vehicles for their transport, at which these substances are used, stored, handled or disposed of – see section 1.2.
Hazardous sub-facility	A hazardous facility that is separated by more than 30 metres from any other hazardous facility on the same site.
Hazardous substance	Any substance with hazardous properties including those substances defined as hazardous for the purpose of the HSNO Act.
Hazardous waste	As defined in hazardous waste discussion document (MfE, 1998).
HSNO	Includes both the Hazardous Substances and New Organisms Act 1996 and HSNO Regulations in relation to hazard classification and life cycle requirements for hazardous substances.
Likelihood	Qualitative description of probability or frequency (AS/NZS 4360:1999).
Off-site effects	Effects on people, property and/or the natural environment outside the boundary of the site of a hazardous facility.
Oxidising capacity	Capacity to contribute to fire or explosion due to the release of oxygen – see HSNO Regulations.
Performance requirements	Controls which say what is to be achieved (including in measurable terms), without being prescriptive (based on MfE,1994).
Precautionary approach	The need for caution in managing adverse effects of hazardous substances where there is scientific and technical uncertainty about those effects (based on HSNO).
Probability	Likelihood of a specific outcome, measured by the ratio of specific outcomes to the total number of possible outcomes. Probability is expressed as a percentage or number between 0 and 1, with 0 indicating an impossible outcome and 1 indicating an outcome is certain (based on AS/NZS 4360:1999).
Property performance requirements	Standards relating to the nature of the hazardous properties (e.g. explosive, toxic, corrosive etc) of a given hazardous substance (based on MfE, 1994)

Proposed quantity	The quantity of a hazardous substance proposed to be used or stored on a site.
Quantity ratio	The ratio of the proposed quantity of a substance over the applicable base quantity.
Receptor	Ecological entity exposed to the stressor (USEPA, 1996).
Residual risk	The risk remaining after risk treatment measures have been taken (modified AS/NZS 4360:1999).
Risk	The chance of something happening that will have an impact upon objectives. It may be an event, action, or lack of action. It is measured in terms of consequences and likelihood (AS/NZS 4360:1999). In the context of this Guide, risk is the chance of something happening that will have an impact on the environment.
Risk analysis	The systematic use of available information to determine how often specified events may occur and the magnitude of their likely consequences (AS/NZS 4360:1999).
Risk assessment	Overall process of risk identification, risk analysis and risk evaluation. (AS/NZS 4360:1999 and AS/NZS 3931:1998.)
Risk management	The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, assessing, treating and monitoring risk (AS/NZS 4360:1999).
Risk mitigation	Steps taken to reduce the probability of occurrence or the magnitude of the consequences (AS/NZS 4360:1999).
Separation distance	The distance from the edge of the area where hazardous substances are used, stored or otherwise handled to the edge of the area exposed to defined adverse effects.
Site management system	The means of ensuring the ongoing safety of a hazardous facility through sound management. A site management system should include safety policy, provide a description of organisational structure and responsibilities, include operating, emergency and monitoring procedures, and carry out regular performance auditing.
Spill containment system	A structure which will contain liquid or solid hazardous substances in the event of a spill, and prevent them from entering the stormwater system or a natural water body.
Storage	The containment of a substance, either above ground or underground, which is not being used for manufacturing or altered to another substance, but does not include use of a substance as a cooling or heating medium. Storage does include the filling and emptying of the container.

Substance	• Any element, defined mixture of elements, compounds, or defined mixtures of compounds, either naturally occurring or produced synthetically, or any mixtures thereof. • Any isotope, allotrope, isomer, congener, radical, or ion of an element or compound which has been officially declared by the Environmental Risk Management Authority to be a different substance from that element or compound. • Any mixtures or combinations of any of the above. • Any manufactured article containing, incorporating or including any hazardous substance with explosive properties (HSNO).
Unintentional release	Unplanned or unwanted release of a hazardous substance or substances that may or may not be detected immediately.
Use	The manufacturing, processing or handling of a substance for a particular activity without necessarily changing the physical state or chemical structure of the substance involved. This includes mixing, blending and packaging operations, but does not include the filling or drawing of substances from bulk storage tanks unless the processing is permanently connected to the bulk storage, and does not include loading out and dispensing of petroleum products.

Appendix A:
HFSP Rating Criteria for Hazardous Substances

The full description of HSNO classes, sub-classes and categories as well as explanations of terms used is contained in the HSNO Regulations. Further details on their use may also be found in the ERMA 'Users Guide to the HSNO Thresholds and Classifications of Hazardous Substances'.

It is important to note that:

- HSNO classes and categories do not always correspond perfectly with the UN Classification. The list provided in this Appendix should therefore only be used for HFSP purposes.
- A number of HSNO classes or sub-classes do not have an HFSP hazard rating in the land use planning context as the potential for off-site effect of these substances is low.

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
Explosive substances	1.1	1.1	Substances and articles that have a mass explosion hazard.	Fire/ explosion	High
	1.2	1.2	Substances and articles that have a projection hazard but not a mass explosion hazard.	Fire/ explosion	Medium
	1.3	1.3	Substances and articles that have a fire hazard and either a minor blast hazard or a minor projection hazard or both.	Fire/ explosion	Low
	1.5	1.5	Very insensitive substances that have a mass explosion hazard.	Fire/ explosion	Low
Flammable gases	2.1.1A High hazard	2.1	a) Ignitable when in a mixture of 13% or less by volume with air; or b) Has a flammable range with air of at least 12%, regardless of the lower flammability limit.	Fire/ explosion	High
	2.1.2A Flammable aerosols	2.1	An aerosol comprising 45% or more by mass of flammable ingredients.	Fire/ explosion	High
		LPG		Fire/ explosion	Medium
Flammable liquids	3.1.A Very high hazard	3 PGI	A flash point of less than 23°C and an initial boiling point of less than or equal to 35°C.	Fire/ explosion	High
	3.1B High hazard	3 PGII	A flash point of less than 23°C and an initial boiling point of greater than 35°C.	Fire/ explosion	High
	3.1C Medium hazard	3 PGIII	A flash point of greater than or equal to 23°C but less than or equal to 60°C.	Fire/ explosion	Medium
	3.1D Low hazard	Combustible liquids	A flash point of greater than 60°C but less than or equal to 93°C.	Fire/ explosion	Low

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
Liquid desensitised explosives	3.2A 3.2B 3.2C	3 PGI 3 PGII 3 PG III	a) A substance that: (i) is listed as a liquid desensitised explosive and is assigned Packing Group I, II or III in the UN Model Regulations; or b) A liquid desensitised explosive that: (i) is formed from an explosive of Class I by adding a desensitising agent to form a liquid that no longer meets the threshold for Class I; and (ii) is not listed in the UN Model Regulations and is not assigned a Packing Group.	Fire/ explosion	High
Flammable solids – readily combustible solids and solids that may cause fire through friction	4.1.1A Medium hazard	4.1(a) PG II	A substance that burns rapidly or the reaction spreads rapidly or may cause fire through low friction in the relevant tests of the UN Manual of Tests and Criteria.	Fire/ explosion	Medium
	4.1.1B Low hazard	4.1(a) PG III	A substance that has lower ratings than 4.1.1A in the relevant tests of the UN Manual of Tests and Criteria.	Fire/ explosion	Low
Self-reactive substances	4.1.2A 4.1.2B	4.1(b) Type A Type B	A thermally unstable substance that propagates a detonation or rapid deflagration or violent effect or thermal explosion in the relevant tests of the UN Manual of Tests and Criteria.	Fire/ explosion	High
	4.1.2C 4.1.2D	4.1(b) Type C Type D	A substance with lower ratings than the above two categories in the relevant tests.	Fire/ explosion	Medium
	4.1.2E 4.1.2F 4.1.2G	4.1(b) Type E Type F	A substance with even lower ratings than the above two categories in the relevant tests.	Fire/ explosion	Low
Solid desensitised explosives	4.1.3A 4.1.3B 4.1.3C	4.1(c) PG I PG II PG III	a) A substance with one of the specified UN serial numbers listed in the UN Model Regulations; or b) A solid desensitised explosive that is formed from an explosive of Class I by adding a desensitising agent to form a solid substance that no longer meets the threshold for Class I.	Fire/ explosion	High
Spontaneously combustible substances	4.2A Spontaneously combustible and pyrophoric substances High hazard	4.2 PG I	a) A solid substance that does not meet the criteria for subclass 4.1.2, but ignites within 5 minutes on contact with air under the relevant test conditions in the UN Manual of Tests and Criteria; or b) A substance that does not meet the criteria for subclass 4.1.2, but is a liquid which ignites or chars the filter paper under the relevant test conditions.	Fire/ explosion	High
	4.2B Spontaneously combustible and self-heating substances Medium hazard	4.2 PG II	A substance that does not meet the criteria for subclass 4.1.2 but meets specified criteria under the relevant test conditions.	Fire/ explosion	High
	4.2C Spontaneously combustible and self-heating substances Low hazard	4.2 PG III	A substance that does not meet the criteria for subclass 4.1.2, which, depending on quantity, meets specified criteria under the relevant test conditions.	Fire/ explosion	Medium

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
Solids that emit flammable gas when in contact with water	4.3A High hazard	4.3 PG I	a) A substance that emits a gas that ignites when a small quantity of the substance is brought into contact with water; or b) A substance that reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is > 10 litres/kg over any 1 minute.	Fire/ explosion	High
	4.3B Medium hazard	4.3 PG II	A substance that reacts readily with water at ambient temperatures such that the maximum rate of evolution is > 20 litres/ kg per hour.	Fire/ explosion	High
	4.3C Low hazard	4.3 PG III	A substance that reacts slowly with water at ambient temperatures so that the maximum rate of evolution of flammable gas is > 1 litre /kg per hour.	Fire/ explosion	Medium
Oxidising substances – liquids or solids	5.1.1A High hazard	5.1 PG I	a) A substance listed as 5.1 in the UN Model Regulations and assigned Packing Group I; or b) A solid that when mixed with dry cellulose either spontaneously ignites or exhibits a mean burning time less than that of a specified reference material; or c) A liquid that when mixed with dry cellulose forms a mixture that either spontaneously ignites or exhibits a mean pressure rise time less than that of a specified reference material.	Fire/ explosion	High
	5.1.1B Medium hazard	5.1 PG II	a) A substance listed as 5.1 in the UN Model Regulations and assigned Packing Group II; or b) A solid that does not meet the criteria of 5.1.1A and that when mixed with dry cellulose forms a mixture that exhibits a mean burning time equal to or less than a specified reference material; or c) A liquid that does not meet the criteria of 5.1.1A and that when mixed with dry cellulose forms a mixture that exhibits a mean pressure rise time less than or equal to that of a specified reference material.	Fire/ explosion	High
	5.1.1C Low hazard	5.1 PG III	a) A substance listed as 5.1 in the UN Model Regulations and assigned Packing Group III; or b) A solid that does not meet the criteria of 5.1.1A or B and that when mixed with dry cellulose forms a mixture that exhibits a mean burning time equal to or less than that of a specific reference material; or c) A liquid that does not meet the criteria of 5.1.1A or B and that when mixed with dry cellulose forms a mixture that exhibits a mean pressure rise time less than or equal to that of a specified reference material.	Fire/ explosion	Medium

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
Gases	5.1.2A	2.2	a) A gas that is listed as 5.1 in the UN model Regulations; or b) A gas that causes or contributes to combustion of other material at a faster rate than air.	Fire/ explosion	High
Organic peroxides	5.2A 5.2B	5.2 Type A Type B	A substance that propagates a detonation or rapid deflagration or violent effect or thermal explosion in the relevant tests of the UN Manual of Tests and Criteria.	Fire/ explosion	High
	5.2C 5.2D	5.2 Type C Type D	A substance with lower ratings than 5.2A or B in the relevant tests.	Fire/ explosion	Medium
	5.2E 5.2F 5.2G	5.2 Type E Type F Type G	A substance with even lower ratings than 5.2A or B in the relevant tests.	Fire/ explosion	Low
Toxic substances	6.1A	6.1 PGI 2.3 (gases)	Oral toxicity: LD_{50} of less than or equal to 5 mg/kg Dermal toxicity: LD_{50} of less than or equal to 50 mg/kg Inhalation toxicity (gas): LC_{50} of less than or equal to 100 ppm Inhalation toxicity (vapour): LC_{50} of less than or equal to 0.5 mg/l Inhalation toxicity (dust/mist): LC_{50} of less than or equal to 0.05 mg/l	Human health	High
	6.1B	6.1 PGII 2.3 (gases)	Oral toxicity: LD_{50} of greater than 5 mg/kg but less than or equal to 50 mg/kg Dermal toxicity: LD_{50} of greater than 50 mg/kg but less than or equal to 200 mg/kg Inhalation toxicity (gas): LC_{50} of greater than 100 ppm but less than or equal to 500 ppm Inhalation toxicity (vapour) LC_{50} of greater than 0.5 mg/l but less than or equal to 2.0 mg/l Inhalation toxicity (dust/mist) LC_{50} of greater than 0.05 mg/l but less than or equal to 0.5 mg/l	Human health	High
	6.1C	6.1 PGIII	Oral toxicity: LD_{50} of greater than 50 mg/kg but less than or equal to 300 mg/kg Dermal toxicity: LD_{50} of greater than 200 mg/kg but less than or equal to 1000 mg/kg Inhalation toxicity (gas): LC_{50} of greater than 500 ppm but less than or equal to 2500 ppm Inhalation toxicity (vapour) LC_{50} of greater than 2.0 mg/l but less than or equal to 10.0 mg/l Inhalation toxicity (dust/mist) LC_{50} of greater than 0.5 mg/l but less than or equal to 1.0 mg/l	Human health	Medium

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
	6.1D	Toxic Substances Regulations: Standard Poison	Oral toxicity: LD_{50} of greater than 300 mg/kg but less than or equal to 2000 mg/kg Dermal toxicity: LD_{50} of greater than 1000 mg/kg but less than or equal to 2000 mg/kg Inhalation toxicity (gas): LC_{50} of greater than 2500 ppm but less than or equal to 5000 ppm Inhalation toxicity (vapour) LC_{50} of greater than 10 mg/l but less than or equal to 20 mg/l Inhalation toxicity (dust/mist) LC_{50} of greater than 1.0 mg/l but less than or equal to 5.0 mg/l	Human health	Low
Corrosive substances	8.2A	8 PG I	Data indicate irreversible destruction of dermal tissue following brief exposure	Human health	High
	8.2B	8 PG II	Data indicate irreversible destruction at dermal tissue following moderate exposure	Human health	Medium
	8.2C	8 PG III	Data indicate irreversible destruction at dermal tissue following lengthy exposure (up to four hours)	Human health	Low
Ecotoxic substances	9.1A Substances that are very ecotoxic in the aquatic environment	GHS	Acute aquatic toxicity value[8] of less than or equal to 1 mg/l	Environ-ment	High
	9.1B Substances that are ecotoxic in the aquatic environment	GHS	Chronic aquatic toxicity[9] of less than or equal to 1 mg/l and a) acute aquatic toxicity value of greater than 1 mg/l but less than 10 mg/l; and b not rapidly degradable or is bioaccumulative, or is not rapidly degradable and is bioaccumulative.	Environ-ment	Medium
	9.1C Substances that are harmful in the aquatic environment	GHS	Chronic aquatic toxicity of less than or equal to 1 mg/l and: a) acute aquatic toxicity value of greater than 10 mg/l but less than 100 mg/l; and b) not rapidly degradable or is bioaccumulative or, is not rapidly degradable and is bioaccumulative.	Environ-ment	Low

8 'Acute aquatic toxicity value' means the lowest value expressed in units of milligrams of a substance per litre of water from:
(a) fish LC_{50} data after a 96-hour exposure period; or
(b) crustacean EC_{50} data after a 48-hour exposure period; or
(c) algal, or other aquatic plant EC_{50} data after a 72-hour exposure period.

9 'Chronic aquatic toxicity' means the lowest value expressed in units of milligrams of a substances per litre of water from chronic fish, crustacean, algal, or other aquatic plant NOEC (no observed effect concentration) data.

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
	9.1D Substances that are slightly harmful in the aquatic environment or are otherwise designed for biocidal action	GHS	a) Acute aquatic toxicity value of greater than 1 mg/l but less than 100 mg/l, but does not meet classification criteria for 9.1A, 9.1B or 9.1C; or b) Chronic aquatic toxicity value is less than or equal to 1 mg/l but does not meet classification criteria for 9.1B or 9.1C; or c) Not rapidly degradable and is bioaccumulative but does not meet classification criteria for 9.1A, 9.1B or 9.1C.	Environ-ment	Low

Appendix B: Hazardous Substances Hazard Ratings

Substance name	CAS No.	Substance form	Specific gravity	Effects ratings			Base quantities			Units	UN number	UN class	HSNO Categories
				Fire/ explosion	Human health	Environ-ment	Fire/ explosion	Human health	Environ-ment				
Generic liquid	–	Liquid	–	*Medium*	*Medium*	High	30	10	3	t	–	–	–
Generic solid	–	Solid	–	*Medium*	*Medium*	*High*	10	10	3	t	–	–	–
1,1,2-trichloroethane	79-00-5	Liquid	1.44	–	High	Low	–	1	100	t	–	6.1 PGIII	Toxic, corrosive, ecotoxic
1,2,4-trimethylbenzene	95-63-6	Liquid	0.88	Medium	–	Medium	30	–	30	t	–	3 PGIII	Flammable, ecotoxic
1,2-butylene oxide	106-88-7	Liquid	0.89	High	Low	*High*	10	30	3	t	3022	3 PGII	Flammable
1,2-dichloroethane	107-06-2	Liquid	1.25	High	Medium	–	10	10	–	t	1184	3 PGII	Flammable, toxic
1,2-dichloropropane	78-87-5	Liquid	1.16	High	Medium	–	10	10	–	t	1279	3 PGI	Flammable, toxic
1,3-butadiene (volume)	106-99-0	Gas	–	High	Medium	–	10,000	150	–	m^3	1010	2.1	Flammable, toxic
1-naphthylthiourea (antu)	86-88-4	Solid	n/a	–	High	*High*	–	1	3	t	1651	6.1 PGII	Toxic
2,4-d	94-75-7	Solid	1.56	–	Medium	Low	–	10	100	t	1609	6.1 PGIII	Toxic, ecotoxic
2,4-dichlorophenol	120-83-2	Solid	1.40	–	High	Medium	–	1	30	t	2020	6.1 PGIII	Toxic, ecotoxic
2,4-dinitroaniline	97-02-9	Solid	1.62	–	Medium	Low	–	10	100	t	1596	6.1 PGII	Toxic, ecotoxic
2,4-dinitrotoluene	121-14-2	Solid	1.38	–	Medium	Low	–	10	100	t	2038	6.1 PGII	Toxic, ecotoxic
2,6-dinitrotoluene	606-20-2	Solid	1.28	–	High	*High*	–	1	3	t	2038	6.1 PGII	Toxic
2-ethoxyacetate	111-15-9	Liquid	0.98	Medium	Low	Low	30	30	100	t	1172	3 PGIII	Flammable, toxic, ecotoxic
2-ethoxyethanol	110-80-5	Liquid	0.93	Medium	Medium	–	30	10	–	t	1171	3 PGII	Flammable, toxic
2-methoxyethanol	109-86-4	Liquid	0.97	Medium	Medium	–	30	10	–	t	1188	3 PGIII	Flammable, toxic
2-methoxyethyl acetate	110-49-6	Liquid	1.01	Medium	Low	–	30	30	–	t	1189	3 PGIII	Flammable
2-nitropropane	79-46-9	Liquid	0.99	Medium	High	Medium	30	1	30	t	2608	3 PGIII	Flammable, toxic, ecotoxic
4,6-dinitro-o-cresol	534-52-1	Solid	n/a	–	High	High	–	1	3	t	1598	6.1 PGII	Toxic, ecotoxic
Acetaldehyde	75-07-0	Liquid	0.78	High	*Medium*	Low	10	10	100	t	1089	3 PGI	Flammable, ecotoxic
Acetic acid	64-19-7	Liquid	1.05	Medium	Medium	–	30	10	–	t	2789	8 PGII	Flammable, corrosive, toxic
Acetic anhydride	108-24-7	Liquid	1.08	Medium	Medium	–	30	10	–	t	1715	8 PGII	Flammable, corrosive, toxic
Acetone	67-64-1	Liquid	0.79	High	–	–	10	–	–	t	1090	3 PGII	Flammable
Acetone cyanohydrin	75-86-5	Liquid	0.93	Low	High	*High*	100	1	3	t	1541	6.1 PGI	Flammable, toxic
Acetonitrile (methyl cyanide)	75-05-8	Liquid	0.79	High	Medium	–	10	10	–	t	1648	3 PGII	Flammable, toxic
Acetylene (volume)	74-86-2	Gas	–	High	–	–	10,000	–	–	m^3	1001	2.1	Flammable
Acrylamide	79-06-1	Liquid	1.05	–	Medium	–	–	10	–	t	2074	6.1 PGIII	Toxic
Acrylic acid	79-10-7	Liquid	1.05	Medium	High	High	30	1	3	t	2218	8 PGII	Flammable, toxic, corrosive, ecotoxic
Acrylic aldehyde	107-02-8	Liquid	0.84	High	High	High	10	1	3	t	1092	3 PGI	Flammable, toxic, ecotoxic
Acrylonitrile	107-13-1	Liquid	0.81	Medium	High	Medium	30	1	30	t	1093	3 PGI	Flammable, toxic, ecotoxic
Aldrin	309-00-2	Solid	1.60	–	High	High	–	1	3	t	1542	6.1 PGII	Toxic, ecotoxic
Allyl alcohol	107-18-6	Liquid	0.85	High	High	High	10	1	3	t	1098	6.1 PGI	Flammable, toxic, ecotoxic
Allyl chloride	107-05-1	Liquid	0.94	High	Low	*High*	10	30	3	t	1100	3 PGI	Flammable, toxic
Aluminium	7429-90-5	Solid	2.70	Medium	–	–	10	–	–	t	1309	4.1 PGII	Flammable
Aluminium chloride	7446-70-0	Solid	2.44	–	Medium	*High*	–	10	3	t	1726	8 PGII	Toxic, corrosive
Aluminium oxide	1344-28-1	Solid	4.00	–	–	*High*	–	–	3	t	–	–	Unable to determine
Ammonia	7664-41-7	Gas	0.77	–	Medium	–	–	10	–	t	1005	2.3	Toxic, corrosive
Ammonia solution	1336-21-6	Liquid	0.90	–	Medium	High	–	10	3	t	2672	8 PGIII	Toxic, corrosive, ecotoxic
Ammonia solution (<35%)	1336-21-6	Liquid	0.89	–	Medium	High	–	10	3	t	2672	8	Corrosive, toxic, ecotoxic
Ammonium nitrate	6484-52-2	Solid	1.73	Medium	–	*High*	10	–	3	t	1942	5.1 PGIII	Oxidising, toxic
Ammonium persulphate	7727-54-0	Solid	1.98	Medium	Low	–	10	30	–	t	1444	5.1	Oxidising, toxic
Aniline	62-53-3	Liquid	1.02	Low	Medium	High	100	10	3	t	1547	6.1 PGII	Flammable, toxic, ecotoxic
Anthracene	120-12-7	Solid	1.24	–	*Medium*	High	–	10	3	t	–		Ecotoxic

Substance name	CAS No.	Substance form	Specific gravity	Effects ratings			Base quantities			Units	UN number	UN class	HSNO Categories
				Fire/ explosion	Human health	Environ-ment	Fire/ explosion	Human health	Environ-ment				
Antimony, solid	7440-36-0	Solid	6.69	–	–	*High*	–	–	3	t	1549	6.1 PGIII	Unable to determine
Argon	7440-37-1	Gas	n/a	–	–	–	–	–	–	–	1006	–	–
Arsenic	7440-38-2	Solid	5.72	–	Medium	*High*	–	10	3	t	1558	6.1 PGII	Toxic
Arsenic trioxide	1327-53-3	Solid	3.74	–	High	Medium	–	1	30	t	1561	6.1 PGII	Toxic, ecotoxic
Asbestos	1332-21-4	Solid	n/a	–	Medium	*High*	–	10	3	t	2212	[9]	Toxic
Benzene	71-43-2	Liquid	0.88	High	High	High	10	1	3	t	1114	3 PGII	Flammable, toxic, ecotoxic
Benzoyl chloride	98-88-4	Liquid	1.20	Low	Medium	Low	100	10	100	t	1736	8 PGII	Flammable, toxic, ecotoxic
Benzoyl peroxide	94-36-0	Solid	1.33	High	–	*High*	1	–	3	t	1521	5.2	Oxidising
Benzyl chloride	100-44-7	Liquid	1.10	Medium	High	*High*	10	1	3	t	1738	6.1 PGII	Flammable, corrosive, toxic
Boric acid	10043-35-3	Solid	1.44	–	Medium	Low	–	10	100	t	–	–	Toxic, ecotoxic
Boron	7440-42-8	Solid	2.30	–	Medium	–	–	10	–	t	–	–	Toxic
Boron tribromide	10294-33-4	Liquid	2.64	–	Medium	*High*	–	10	3	t	2692	8 PGI	Corrosive, toxic
Boron trichloride (v)	10294-34-5	Gas	1.35	–	Medium	–	–	150	–	m^3	1741	2.3	Corrosive, toxic
Boron trifluoride (v)	7637-07-2.	Gas	–	–	High	–	–	50	–	m^3	1008	2.3	Toxic
Bromine	7726-95-6	Liquid	3.12	–	Medium	High	–	10	3	t	1744	8 PGI	Toxic, corrosive, ecotoxic
Bromomethane (v)	74-83-9	Gas	1.68	–	High	Medium	–	50	500	m^3	1062	2.3	Toxic, ecotoxic
Brucine	357-57-3	Solid	–	–	High	Low	–	1	100	t	1570	6.1 PGI	Toxic, ecotoxic
Butane	106-97-8	Gas	0.58	High	–	–	10,000	–	–	m^3	1011	2.1	Flammable
Butyl acrylate	141-32-2	Liquid	0.89	Medium	Low	*High*	30	30	3	t	2348	3 PGIII	Flammable, toxic
Butylbenzyl phthalate	85-68-7	Liquid	1.12	–	–	High	–	–	3	t	–	–	Toxic, ecotoxic
Butyraldehyde	123-72-8	Liquid	0.80	High	–	*High*	10	–	3	t	1129	3	Flammable, toxic
Cadmium	7440-43-9	Solid	8.70	–	High	High	–	1	3	t	2570	6.1 PGIII	Toxic, ecotoxic
Cadmium chloride	10108-64-2	Solid	4.05	–	Medium	High	–	10	3	t	2570	6.1 PGI	Toxic, ecotoxic
Calcium cyanide	592-01-8	Solid	1.85	–	High	High	–	1	3	t	1575	6.1 PGI	Toxic, ecotoxic
Calcium hypochlorite	778-54-3	Solid	2.35	High	Low	*High*	10	30	3	t	1748	5.1 PGII	Oxidising, toxic
Calcium oxide	1305-78-8	Solid	3.32	–	Medium	–	–	10	–	t	1910	8 PGIII	Corrosive
Carbofuran	1563-66-2	Solid	1.18	–	High	High	–	1	3	t	2757	6.1 PGI	Toxic, ecotoxic
Carbon dioxide (w)	124-38-9	Gas	1.53	–	–	Low	–	–	100	t	1013	2	Ecotoxic
Carbon disulphide	75-15-0	Liquid	1.26	High	–	*High*	10	–	3	t	1131	3 PGI	Flammable, toxic
Carbon tetrachloride	56-23-5	Liquid	1.59	–	–	Low	–	–	100	t	1846	6.1 PGII	Toxic, ecotoxic
Catechol	120-80-9	Solid	1.34	–	Medium	Medium	–	10	30	t	–	–	Toxic, ecotoxic
Chlordane	57-74-9	Liquid	1.60	Low	Medium	High	100	10	3	t	2762	6.1	Flammable, toxic, ecotoxic
Chlorine (w)	7782-50-5	Gas	1.40	Medium	High	High	10	1	3	t	1017	2.3	Toxic, corrosive, ecotoxic, oxidising
Chlorine dioxide (w)	10049-04-4	(Liquid)/gas	1.64	High	Medium	High	10	10	3	t	[9191]	–	Flammable, oxidising, toxic, ecotoxic
Chloroacetic acid	79-11-8	Solid	1.40	–	High	*High*	–	1	3	t	1751	8 PGII	Corrosive, toxic, ecotoxic
Chlorobenzene	108-90-7	Liquid	1.11	Medium	Low	Medium	30	30	30	t	1134	3 PGIII	Flammable, toxic, ecotoxic
Chloroethane	75-00-3	Gas	0.89	High	–	–	10	–	–	t	1037	2.1	Flammable
Chloroform	67-66-3	Liquid	1.50	–	High	Medium	–	1	30	t	1888	6.1 PGII	Toxic, ecotoxic
Chloromethane (v)	74-87-3	Gas	–	High	Medium	–	10,000	150	–	m^3	1063	2.1	Flammable, toxic
Chloromethyl methyl ether	107-30-2	Liquid	1.06	High	High	*High*	10	1	3	t	1239	6.1 PGI	Flammable, toxic
Chloropicrin	76-06-2	Liquid	1.65	–	High	*High*	–	1	3	t	1580	6.1 PGI	Toxic
Chlorosulphonic acid	7790-94-5	Liquid	1.75	–	High	*High*	–	1	3	t	1754	8 PGI	Corrosive, toxic
Chromic anhydride	1333-82-0	Solid	2.70	High	Medium	High	10	10	3	t	1463	5.1	Oxidising, corrosive, toxic, ecotoxic
Chromic fluoride	7788-97-8	Solid	n/a	–	Medium	*High*	–	10	3	t	1756	8 PGII	Corrosive
Chromium	7740-47-3	Solid	7.14	–	*Medium*	*High*	–	10	3	t	–	–	Unable to determine
Chromium (iii) nitrate	13548-38-4	Solid	n/a	Medium	Low	*High*	10	30	3	t	2720	5.1	Oxidising, toxic
Chromium oxychloride	14977-61-8	Liquid	1.91	–	Medium	*High*	–	10	3	t	1758	8 PGI	Corrosive, toxic
Chromosulphuric acid	14489-25-9	Solid	n/a	–	Medium	*High*	–	10	3	t	2240	8 PGI	Corrosive
Copper (i) cyanide	544-92-3	Solid	2.92	–	Low	*High*	–	30	3	t	1587	6.1 PGII	Toxic
Copper acetoarsenite	1299-88-3	Liquid	1.10	–	High	High	–	1	3	t	1585	6.1 PGII	Toxic, ecotoxic
Copper arsenite	10290-12-7	Solid	1.10	–	Medium	*High*	–	10	3	t	1586	6.1 PGII	Toxic
Copper chloride	7447-39-4	Solid	2.54	–	Medium	High	–	10	3	t	2802	6.1 PGII	Toxic, ecotoxic
Cresol	1319-77-3	Liquid	1.03	Low	Medium	Medium	100	10	30	t	2076	6.1 PGII	Toxic, ecotoxic, corrosive, flammable
Cumene	98-82-8	Liquid	0.86	Medium	Medium	Medium	30	10	10	t	1918	3 PGIII	Flammable, toxic, ecotoxic

Substance name	CAS No.	Substance form	Specific gravity	Effects ratings			Base quantities			Units	UN number	UN class	HSNO Categories
				Fire/ explosion	Human health	Environ-ment	Fire/ explosion	Human health	Environ-ment				
Cumene hydroperoxide	80-15-9	Liquid	1.05	Low	High	*High*	1	1	3	t	2116	5.2	Flammable, oxidising, toxic
Cyclohexane	110-82-7	Liquid	0.78	High	Low	Low	10	30	100	t	1145	3 PGII	Flammable, toxic, ecotoxic
Cypermethrin	52315-07-8	Liquid	1.24	–	Medium	High	–	10	3	t	2783	6.1 PGI	Toxic, ecotoxic
Decabromodiphenyl oxide	1163-19-5	Liquid	3.00	–	–	*High*	–	–	3	t	–	–	Unable to determine
Di-n-octyl phthalate	117-84-0	Liquid	0.98	–	–	High	–	–	3	t	–	–	Ecotoxic
Diazinon	333-41-5	Liquid	1.12	Medium	High	High	30	1	3	t	2783	6.1 PGII	Flammable, toxic, ecotoxic
Dibutyl phthalate	84-74-2	Liquid	1.05	–	Low	High	–	30	3	t	–	–	Toxic, ecotoxic
Dicamba	1918-00-9	Solid	1.57	–	Low	Low	–	30	100	t	1609	6.1 PGIII	Toxic, ecotoxic
Dichlorobenzene	25321-22-6	Liquid	1.30	Low	Low	Low	100	30	100	t	1591	6.1 PGIII	Flammable, toxic, ecotoxic
Dichloroisocyanuric acid	2782-57-2	Solid	n/a	High	Low	*High*	10	30	3	t	2465	5.1	Oxidising, toxic
Dichlorvos	62-73-7	Liquid	1.42	Low	High	High	100	1	3	t	2783	6.1 PGII	Flammable, toxic, ecotoxic
Dicrotophos	141-66-2	Liquid	1.22	Low	High	High	100	1	3	t	3018	6.1	Flammable, toxic, ecotoxic
Dieldrin	60-57-1	Solid	1.75	–	High	High	–	1	3	t	–	–	Toxic, ecotoxic
Diesel	various	Liquid	0.85	Low	Low	Medium	100	30	30	t	1270	3	Flammable, toxic, ecotoxic
Diethanolamine	111-42-2	Liquid	1.10	–	Low	–	–	30	–	t	–	–	Toxic
Diethyl adipate	141-28-6	Liquid	1.01	–	–	*High*	–	–	3	t	–	–	Unable to determine
Diethyl phthalate	84-66-2	Liquid	1.12	–	–	Medium	–	–	30	t	–	–	Ecotoxic
Diethyl sulphate	64-67-5	Liquid	1.18	–	Medium	*High*	–	10	3	t	1594	6.1 PGII	Toxic
Diethylene glycol	111-46-6	Liquid	1.12	–	–	–	–	–	–	–	–	–	Toxic
Dimethyl phthalate	131-11-3	Liquid	1.19	–	–	Low	–	–	100	t	–	–	Toxic, ecotoxic
Dimethyl sulphate	77-78-1	Liquid	1.33	Low	High	Medium	100	1	30	t	1595	6.1 PGI	Flammable, corrosive, toxic, ecotoxic
Dinitro-o-cresol	534-52-1	Solid	n/a	–	High	High	–	1	3	t	1598	6.1 PGII	Toxic, ecotoxic
Dinitrotoluene, mixed isomers	25321-14-6	Liquid	n/a	–	Medium	*High*	–	10	3	t	2038	6.1 PGII	Toxic
Endrin	72-20-8	Solid	1.70	–	High	High	–	1	3	t	2761	6.1 PGI	Toxic, ecotoxic
Epichlorohydrin	106-89-8	Liquid	1.18	Low	High	Low	100	1	100	t	2023	6.1 PGII	Flammable, toxic, ecotoxic
Ethane (v)	74-84-0	Gas	–	High	–	–	10,000	–	–	m^3	1035	2.1	Flammable
Ethanol	64-17-5	Liquid	0.79	Medium	–	–	30	–	–	t	1170	3 PGII	Flammable, toxic
Ethyl acetate	141-78-6	Liquid	0.90	High	Medium	–	10	10	–	t	1173	3 PGII	Flammable, toxic
Ethyl acrylate	140-88-5	Liquid	0.92	High	Medium	Low	10	10	100	t	1917	3 PGII	Flammable, toxic, ecotoxic
Ethyl benzene	100-41-4	Liquid	0.87	High	–	Low	10	–	100	t	1175	3 PGII	Flammable, toxic, ecotoxic
Ethyl chloroformate	541-41-3	Liquid	1.14	High	Medium	*High*	10	10	3	t	1182	3 PGII	Flammable, toxic
Ethylene (v)	74-85-1	Gas	–	High	–	–	10,000	–	–	m^3	1962	2.1	Flammable
Ethylene glycol	107-21-1	Liquid	1.11	–	Low	–	–	30	–	–	–	–	Toxic
Ethylene glycol mono-butyl ether acetate	112-07-2	Liquid	0.94	Low	Low	*High*	100	30	3	t	–	–	Flammable, toxic
Ethylene glycol monobutyl ether	111-76-2	Liquid	0.90	Low	Medium	–	100	10	–	t	2369	6.1	Flammable, toxic
Ethyleneimine	151-56-4	Liquid	0.83	High	High	High	10	1	3	t	1185	3 PGII	Flammable, toxic, ecotoxic
Ethylenethiourea	96-45-7	Solid	n/a	–	Low	*High*	–	30	3	t	–	–	Toxic
Ferric chloride	7705-08-0	Solid	2.80	–	Medium	*High*	–	10	3	t	1773	8 PGIII	Corrosive, toxic
Fluorine (v)	7782-41-4	Gas	–	–	High	–	–	50	–	m^3	1045	2.3	Toxic, oxidising, corrosive
Fluorosilicic acid	16961-83-4	Liquid	1.30	–	Medium	High	–	10	3	t	1778	8 PGII	Corrosive, toxic
Formaldehyde (15% methanol)	50-00-0	Liquid	1.07	Medium	High	High	30	1	3	t	1198	3 PGIII	Flammable, toxic, ecotoxic
Formaldehyde (37% conc., methanol-free)	50-00-0	Liquid	1.07	Low	High	High	100	1	3	t	2209	6.1	Flammable, toxic, ecotoxic
Formic acid	64-18-6	Liquid	1.22	Medium	Medium	–	30	10	–	t	1779	8 PGII	Flammable, corrosive, toxic
Glyphosate	38641-94-0	Liquid	1.17	–	–	Medium	–	–	30	t	–	–	Toxic, ecotoxic
Hexachloro-cyclopentadiene	77-47-4	Liquid	1.71	–	High	High	–	1	3	t	2646	6.1 PGI	Corrosive, toxic, ecotoxic
Hexachloroethane	67-72-1	Solid	2.09	–	–	High	–	–	3	t	9037	–	Toxic, ecotoxic
Hexamine	100-97-0	Solid	1.35	Low	Low	*High*	30	30	3	t	1328	4.1 PGIII	Flammable, toxic
Hexane	110-54-3	Liquid	0.66	High	High	Low	10	1	100	t	1208	3 PGII	Flammable, toxic, ecotoxic

Substance name	CAS No.	Substance form	Specific gravity	Effects ratings			Base quantities			Units	UN number	UN class	HSNO Categories
				Fire/ explosion	Human health	Environ- ment	Fire/ explosion	Human health	Environ- ment				
Hydrazine	302-01-2	Liquid	1.01	Medium	High	*High*	30	1	3	t	2029	8 PGI	Flammable, toxic, corrosive, ecotoxic
Hydrochloric acid (concentrated solution)	7647-01-0	Liquid	1.19	–	High	Low	–	1	100	t	1789	8 PGII	Corrosive, toxic, ecotoxic
Hydrofluoric acid	7664-39-3	Liquid	0.99	–	High	*High*	–	1	3	t	1790	8 PGI	Corrosive, toxic
Hydrogen (v)	1333-74-0	Gas	–	High	–	–	10,000	–	–	m^3	1049	2.1	Flammable
Hydrogen chloride (v)	7647-01-0	Gas	–	–	High	–	–	50	–	m^3	1050	2.3	Corrosive, toxic
Hydrogen cyanide	74-90-8	Liquid	0.69	High	High	High	10	1	3	t	1051	6.1 PGI	Flammable, toxic, ecotoxic
Hydrogen fluoride	7664-39-3	Liquid	0.99	–	High	*High*	–	1	3	t	1052	8 PGI	Corrosive, toxic
Hydrogen peroxide >52%	7722-84-1	Liquid	1.29	High	Medium	–	10	10	–	t	2015	5.1	Oxidising, corrosive, toxic
Hydrogen sulfide (v)	7783-06-4	Gas	–	High	High	High	10,000	50	150	m^3	1053	2.1	Flammable, toxic, ecotoxic
Hydroquinone	123-31-9	Solid	1.33	–	Medium	High	–	10	3	t	2662	6.1 PGIII	Toxic, ecotoxic
Iodine	5553-56-2	Solid	4.93	–	Medium	*High*	–	10	3	t	1759	8 PGI	Corrosive, toxic
Isobutanol	78-83-1	Liquid	0.80	Medium	–	–	30	–	–	t	1212	3 PGIII	Flammable, toxic
Isobutyraldehyde	78-84-2	Liquid	0.79	High	Low	*High*	10	30	3	t	2045	3 PGII	Flammable, toxic
Isopropanol	67-63-0	Liquid	0.79	High	–	–	10	–	–	t	1219	3 PGII	Flammable, toxic
Isosafrole	120-58-1	Liquid	1.12	–	Low	*High*	–	30	3	t	–	–	Toxic
Lauryl mercaptan	112-55-0	Liquid	0.85	–	*Medium*	*High*	–	10	3	t	1228	6.1 PGII	Unable to determine
Lead acetate	301-04-2	Solid	2.25	–	–	*High*	–	–	3	t	1616	9	Unable to determine
Lead arsenate	7784-40-9	Solid	5.79	–	High	Low	–	1	100	t	1617	6.1 PGII	Toxic, ecotoxic
Lead chloride	7758-95-4	Solid	5.85	–	Low	*High*	–	30	3	t	–	–	Toxic
Lead dioxide	1309-60-0	Solid	9.38	Medium	*Medium*	*High*	10	10	3	t	1872	5.1	Oxidising
Lead nitrate	10099-74-8	Solid	4.53	High	*Medium*	Medium	1	10	30	t	1469	5.1	Oxidising, ecotoxic
Lead peroxide	1309-60-0	Solid	9.38	Medium	*Medium*	*High*	10	10	3	t	1872	5.1	Oxidising
Lead sulphate	7446-14-2	Solid	6.20	–	*Medium*	*High*	–	10	3	t	1794	8 PGII	Corrosive
LPG	68476-85-7	Gas	–	Medium	–	–	30	–	–	t	1075	2.1	Flammable
M-cresol	108-39-4	Liquid	1.03	–	Medium	Low	–	10	100	t	2076	6.1 PGII	Corrosive, toxic, ecotoxic
M-xylene	108-38-3	Liquid	0.87	Medium	Low	Low	30	30	100	t	1307	3 PGII	Flammable, toxic, ecotoxic
Maleic anhydride	108-31-6	Solid	1.48	–	Medium	–	–	10	–	t	2215	8 PGIII	Corrosive, toxic
Manganese	7439-96-5	Solid	7.47	–	–	*High*	–	–	3	t	–	–	Unable to determine
Manganese nitrate	10377-66-9	Liquid	n/a	Medium	*Medium*	*High*	10	10	3	t	2724	5.1	Oxidising
Mercuric arsenate	n/a	Liquid	n/a	–	*Medium*	*High*	–	10	3	t	1623	n/a	Unable to determine
Mercuric chloride	7487-94-7	Solid	5.40	–	High	High	–	1	3	t	1624	6.1 PGII	Toxic, ecotoxic
Mercuric nitrate	10045-94-0	Solid	4.30	–	High	*High*	10	1	3	t	1625	6.1 PGII	Oxidising, toxic
Mercuric potassium cyanide	591-89-9	Solid	n/a	–	*Medium*	*High*	–	10	3	t	1626		Unable to determine
Mercurol	12002-19-6	Solid	n/a	–	*Medium*	*High*	–	10	3	t	1639	6.1 PGII	Unable to determine
Mercury	7439-97-6	Liquid	13.55	–	*Medium*	High	–	10	3	t	2809		Ecotoxic
Mercury (i) oxide	15829-53-5	Solid	9.80	–	*Medium*	*High*	–	10	3	t	1641	6.1 PGII	Unable to determine
Mercury (ii) oxide	21908-53-2	Solid	11.10	–	High	*High*	–	1	3	t	1641	6.1 PGII	Toxic
Mercury acetate	1600-27-7	Liquid	3.27	–	High	High	–	1	3	t	1629	6.1 PGII	Toxic, ecotoxic
Mercury ammonium chloride	10124-48-8	Solid	5.70	–	Medium	*High*	–	10	3	t	1630	6.1 PGII	Toxic
Mercury benzoate	583-15-3	Liquid	13.53	–	*Medium*	*High*	–	10	3	t	1631	6.1 PGII	Unable to determine
Mercury bromide	10031-18-2	Solid	7.31	–	*Medium*	*High*	–	10	3	t	1634	6.1 PGII	Unable to determine
Mercury cyanide	592-04-1	Solid	4.00	–	High	High	–	1	3	t	1636	6.1 PGII	Toxic, ecotoxic
Mercury fulminate, wetted	628-86-4	Solid	4.42	High	*Medium*	*High*	0.1	10	3	t	135	1.1	Explosive
Mercury iodide	7774-29-0	Solid	6.30	–	High	*High*	–	1	3	t	1638	6.1 PGII	Toxic
Mercury oleate	1191-80-6	Solid	n/a	–	*Medium*	*High*	–	10	3	t	1640	6.1 PGII	Unable to determine
Mercury potassium iodide	7783-33-7	Solid	4.29	–	*Medium*	*High*	–	10	3	t	1643	6.1 PGII	Unable to determine
Mercury thiocyanate	592-85-8	Solid	n/a	–	High	High	–	1	3	t	1646	6.1 PGII	Toxic, ecotoxic
Methanol	67-56-1	Liquid	0.79	High	–	–	10	–	–	t	1230	3 PGII	Flammable
Methyl acrylate	96-33-3	Liquid	0.96	High	Medium	*High*	10	10	3	t	1919	3 PGII	Flammable, toxic
Methyl bromide (v)	74-83-9	Gas	[1.68]	–	High	High	–	50	150	m^3	1062	2.3	Toxic, ecotoxic
Methyl chloride (v)	74-87-3	Gas	–	High	Medium	–	10,000	150	–	m^3	1063	2.3	Flammable, toxic
Methyl cyanide (acetonitrile)	75-05-8	Liquid	0.79	High	Medium	–	10	10	–	t	1648	3 PGII	Flammable, toxic
Methyl ethyl ketone	78-93-3	Liquid	0.80	High	–	–	10	–	–	t	1193	3 PGII	Flammable
Methyl iodide	74-88-4	Liquid	2.28	–	Medium	*High*	–	10	3	t	2644	6.1 PGII	Toxic
Methyl isobutyl ketone	108-10-1	Liquid	0.80	High	Low	–	10	30	–	t	1245	3 PGII	Flammable, toxic

Substance name	CAS No.	Substance form	Specific gravity	Effects ratings			Base quantities			Units	UN number	UN class	HSNO Categories
				Fire/ explosion	Human health	Environ-ment	Fire/ explosion	Human health	Environ-ment				
Methyl isocyanate	624-83-9	Liquid	0.96	High	High	*High*	10	1	3	t	2480	3 PGI	Flammable, toxic
Methyl mercaptan (v)	74-93-1	Gas	0.87	High	Medium	High	10,000	150	150	m^3	1064	2.1	Flammable, toxic, ecotoxic
Methyl methacrylate	80-62-6	Liquid	0.94	High	–	Low	10	–	100	t	1247	3 PGII	Flammable, toxic, ecotoxic
Methyl tert-butyl ether	1634-04-4	Liquid	0.74	High	–	*High*	10	–	3	t	2398	3 PGII	Flammable, toxic
Methylene chloride	75-09-2	Liquid	1.33	–	Low	–	–	30	–	t	1593	6.1 PGIII	Toxic
Methylenebisphenyl-isocyanate	101-68-8	Solid	1.20	–	High	*High*	–	1	3	t	2489	6.1 PGIII	Toxic
Michler's ketone	90-94-8	Solid	n/a	–	*Medium*	*High*	–	10	3	t	–	–	Ecotoxic
Molybdenum trioxide	1313-27-5	Solid	4.69	–	Medium	–	–	10	–	t	–	–	Toxic
N,n-dimethylaniline	121-69-7	Liquid	0.96	–	Low	Low	–	30	100	t	2253	6.1 PGII	Toxic, ecotoxic
N-butyl acetate	123-86-4	Liquid	0.88	High	–	Low	10	–	100	t	1123	3 PGII	Flammable, toxic, ecotoxic
N-butyl alcohol	71-36-3	Liquid	0.81	Medium	Low	–	30	30	–	t	1120	3 PGIII	Flammable, toxic
N-nitrosodiphenylamine	86-30-6	Solid	1.23	–	Low	*High*	–	30	3	t	–	–	Toxic
Naphthalene	91-20-3	Solid	1.15	Low	Low	Medium	10	30	30	t	2304	4.1 PGI	Flammable, toxic, ecotoxic
Nickel powder	7440-02-0	Solid	8.90	High	*Medium*	*High*	1	10	3	t	2881	4.2	Flammable
Nitric acid	7697-37-2	Liquid	1.49	–	High	High	10	1	3	t	2031	8 PGI	Oxidising, corrosive, toxic, ecotoxic
Nitrilotriacetic acid	139-13-9	Solid	n/a	–	Low	–	–	30	–	t	–	–	Toxic
Nitrobenzene	98-95-3	Liquid	1.20	Low	Low	Low	100	30	100	t	1662	6.1 PGII	Flammable, toxic, ecotoxic
Nitroglycerine	55-63-0	Liquid	1.59	High	High	Medium	0.1	1	30	t	3064	1.1	Explosive, toxic, ecotoxic
O-cresol	95-48-7	Solid	1.05	Low	High	*High*	100	1	3	t	2076	6.1 PGII	Flammable, toxic
O-phenylphenol	90-43-7	Solid	1.22	–	Low	Medium	–	30	30	t	–	–	Toxic, ecotoxic
O-xylene	95-47-6	Liquid	0.88	High	Low	Medium	10	30	30	t	1307	3 PGII	Flammable, toxic, ecotoxic
Oxygen (v)	7782-44-7	Gas	–	High	–	–	10,000	–	–	m^3	1072	2.2/5.1	Oxidising
Oxygen (w)	7782-44-7	Liquid		High	–	–	10	–	–	t	1073	2.2/5.1	Oxidising
P,p'-isopropylidene-iphenol	80-05-7	Solid	1.20	–	–	Medium	–	–	30	t	–	–	Toxic, ecotoxic
P,p'-methylenebis (o-chloroaniline)	101-14-4	Solid	1.44	–	Medium	*High*	–	10	3	t	–	–	Toxic
P,p'-methylenedianiline	101-77-9	Solid	1.06	–	High	*High*	–	1	3	t	2651	6.1 PGIII	Toxic
P-cresol	106-44-5	Solid	1.03	–	Medium	Medium	–	10	30	t	2076	6.1 PGII	Toxic, ecotoxic
P-nitrophenol	100-02-7	Solid	1.27	–	Medium	Low	–	10	100	t	1663	6.1 PGIII	Toxic, ecotoxic
P-phenylenediamine	106-50-3	Solid	n/a	–	Medium	Medium	–	10	30	t	1673	6.1 PGIII	Toxic, ecotoxic
P-quinone	106-51-4	Solid	1.32	–	Medium	*High*	–	10	3	t	2587	6.1 PGII	Toxic
P-xylene	106-42-3	Liquid	0.86	Medium	Low	Low	30	30	100	t	1307	3 PGII	Flammable, toxic, ecotoxic
Paraformaldehyde	30525-89-4	Solid	1.46	Low	Low	*High*	30	30	3	t	2213	9 [4.1]	Flammable, toxic
Pentachlorophenol	87-86-5	Solid	1.98	–	High	High	–	1	3	t	2020	6.1 PGIII	Toxic, ecotoxic
Peracetic acid	79-21-0	Liquid	1.15	Medium	High	*High*	1	1	3	t	3105	5.2	Flamm., Oxid., Corrosive, toxic
Perchloroethylene	127-18-4	Liquid	1.63	–	Medium	Medium	–	10	30	t	1897	6.1 PGIII	Toxic, ecotoxic
Permethrin	52645-53-1	Liquid	1.20	–	High	High	–	1	3	t	–	–	Toxic, ecotoxic
Petrol	86290-81-5	Liquid	0.73	High	Low	Medium	10	30	30	t	1203	3 PGII	Flammable
Phenol	108-95-2	Solid	1.06	–	High	Medium	–	1	30	t	1671	6.1 PGII	Toxic, ecotoxic
Phosgene	75-44-5	Gas	1.38	–	High	–	–	50	–	m^3	1076	2.3	Toxic
Phosphoric acid (conc.)	7664-38-2	Liquid	1.87	–	Medium	–	–	10	–	t	1805	8 PGIII	Corrosive
Phosphorus white	7723-14-0	Solid	1.82	High	High	*High*	1	1	3	t	1381	4.2 PGI	Flammable, toxic
Phthalic anhydride	85-44-9	Solid	1.53	–	Medium	High	–	10	3	t	2214	8 PGIII	Corrosive, toxic
Potassium chlorate	3811-04-9.	Solid	2.34	High	Low	*High*	1	30	3	t	1485	5.1	Oxidising, toxic
Potassium dichromate	7778-50-9	Solid	2.68	–	Medium	Medium	–	10	30	t	1874	9	Toxic, ecotoxic
Potassium hydroxide	1310-58-3	Solid	2.04	–	Medium	–	–	10	–	t	1813	8 PGII	Corrosive, toxic
Potassium permanganate	7722-64-7	Solid	2.70	High	Low	High	10	30	3	t	1490	5.1	Oxidising, toxic, ecotoxic
Propionaldehyde	123-38-6	Liquid	0.81	High	Low	*High*	10	30	3	t	1275	3 PGII	Flammable, toxic
Propylene (v)	115-07-1	Gas	0.51	High	–	–	10,000	–	–	m^3	1077	2.1	Flammable
Propylene oxide	75-56-9	Liquid	0.83	High	High	–	10	1	–	t	1280	3 PGI	Flammable, toxic
Pyridine	110-86-1	Liquid	0.98	High	Medium	Low	10	10	100	t	1282	3 PGII	Flammable, toxic, ecotoxic
Quinoline	91-22-5	Liquid	1.09	–	Medium	*High*	–	10	3	t	2656	6.1 PGIII	Toxic
Safrole	94-59-7	Solid	1.10	–	Low	*High*	–	30	3	t	–	–	Toxic

Substance name	CAS No.	Substance form	Specific gravity	Effects ratings			Base quantities			Units	UN number	UN class	HSNO Categories
				Fire/ explosion	Human health	Environ-ment	Fire/ explosion	Human health	Environ-ment				
Sec-butyl acetate	105-46-4	Liquid	0.87	High	–	*High*	10	–	3	t	1123	3 PGII	Flammable
Sec-butyl alcohol	78-92-2	Liquid	0.81	High	–	–	10	–	–	t	1120	3 PGIII	Flammable, toxic
Selenium hexafluoride	7783-79-1	Gas	–	–	High	–	–	50	–	m^3	2194	2.3	Toxic
Selenium oxychloride	7791-23-3	Liquid	2.44	–	Medium	*High*	–	10	3	t	2879	8 PGI	Corrosive
Silver arsenite	n/a	Liquid	n/a	*Medium*	*Medium*	*High*	10	10	3	t	1683	6.1 PGII	Unable to determine
Silver cyanide	506-64-9	Solid	3.95	–	Medium	*High*	–	10	3	t	1684	6.1 PGII	Toxic
Silver nitrate	7761-88-8	Liquid	4.33	High	High	High	10	1	3	t	1493	5.1	Oxidising, toxic, ecotoxic
Silver picrate, wetted	146-84-9	Solid	n/a	High	*Medium*	*High*	1	10	3	t	1347	4.1 PGI	Flammable
Silver powder	7440-22-4	Solid	10.49	–	*Medium*	*High*	–	10	3	t	[3077]	–	Ecotoxic
Sodium alkylbenzene sulfonates	n/a	Liquid	n/a	–	*Medium*	*High*	–	10	3	t	–	–	Unable to determine
Sodium bisulphate	7681-38-1	Solid	2.74	–	Medium	*High*	–	10	3	t	1821	8 PGIII	Corrosive
Sodium chlorate	7775-09-9.	Solid	2.50	High	Low	*High*	1	30	3	t	1495	5.1	Oxidising, toxic
Sodium dichromate	10588-01-9	Solid	2.52	–	High	Low	–	1	100	t	1497	9	Toxic, ecotoxic
Sodium hydroxide	1310-73-2	Solid	2.13	–	Medium	–	–	10	–	t	1823	8 PGII	Corrosive
Sodium hypochlorite	7681-52-9	Liquid	1.06	–	Medium	*High*	–	10	3	t	1791	8 PGII	Corrosive
Sodium metasilicate	6834-92-0	Solid	2.61	–	Medium	*High*	–	10	3	t	3253	8 PGIII	Corrosive, toxic
Sodium nitrate	7631-99-4	Solid	2.26	Medium	Low	*High*	10	30	3	t	1498	5.1	Oxidising, toxic
Sodium nitrite	7632-00-0	Solid	2.17	Medium	High	*High*	10	1	3	t	1500	5.1	Oxidising, toxic
Sodium peroxide	1313-60-6	Solid	2.80	High	*Medium*	*High*	1	10	3	t	1504	5.1	Oxidising
Sodium selenite	10102-18-8	Solid	3.10	–	High	High	–	1	3	t	2630	6.1 PGI	Toxic, ecotoxic
Styrene monomer	100-42-5	Liquid	0.91	Medium	Low	Medium	30	30	30	t	2055	3 PGIII	Flammable, toxic, ecotoxic
Styrene oxide	96-09-3	Liquid	1.05	Low	Medium	*High*	100	10	3	t	2055	3 PGIII	Flammable, toxic
Sulphur dioxide (v)	7446-09-5	Gas	1.00	–	Medium	*High*	–	150	150	m^3	1079	2.3	Toxic
Sulphuric acid	7664-93-9	Liquid	1.84	–	High	High	–	1	3	t	1830	8 PGII	Corrosive, toxic, ecotoxic
Tert-butyl acetate	540-88-5	Liquid	0.87	Medium	*Medium*	–	30	10	–	t	1123	3 PGIII	Flammable
Tert-butyl alcohol	75-65-0	Liquid	0.79	High	–	–	10	–	–	t	1122	3 PGIII	Flammable, toxic
Tetrachloroethane	79-34-5	Liquid	1.59	–	Medium	Medium	–	10	30	t	1702	6.1 PGII	Toxic, ecotoxic
Tetraethyl lead	78-00-2	Liquid	1.64	–	High	*High*	–	1	3	t	1649	6.1 PGI	Toxic, ecotoxic
Tetramethyl lead	75-74-1	Liquid	2.00	Medium	Medium	*High*	30	10	3	t	1649	6.1 PGI	Flammable, toxic
Thiourea	62-56-6	Solid	1.41	–	High	Medium	–	1	30	t	2877	6.1 PGII	Toxic, ecotoxic
Thorium dioxide	1314-20-1	Solid	10.00	–	–	*High*	–	–	3	t	–	–	Unable to determine
Titanium tetrachloride	7550-45-0	Liquid	1.73	–	High	*High*	–	1	3	t	1838	8 PGII	Corrosive, toxic
Toluene	108-88-3	Liquid	0.87	High	Low	Medium	10	30	30	t	1294	3 PGII	Flammable, toxic, ecotoxic
Toluene-2,4-diisocyanate	584-84-9	Liquid	1.22	–	High	*High*	–	1	3	t	2078	6.1 PGII	Toxic
Toluene diisocyanate, mixed isomers	26471-62-5	Liquid	1.22	–	High	*High*	–	1	3	t	2078	6.1 PGII	Toxic
Trichloroacetic acid	76-03-9	Solid	1.61	–	Medium	–	–	10	–	t	1839	8 PGII	Corrosive, toxic
Trichloroethane	25323-89-1	Liquid	1.31	–	Low	*High*	–	30	3	t	2831	6.1	Toxic
Trichloroethylene	79-01-6	Liquid	1.46	Medium	Medium	Medium	30	10	30	t	1710	6.1 PGIII	Flammable, toxic, ecotoxic
Turpentine	8006-64-2	Liquid	0.86	Medium	High	–	30	1	–	t	1299	3 PGIII	Flammable, toxic
Vinyl acetate	108-05-4	Liquid	0.93	Medium	Low	–	30	30	–	t	1301	3 PGII	Flammable, toxic
Vinylidene chloride	75-35-4	Liquid	1.21	High	Medium	Low	10	10	100	t	1303	3 PGI	Flammable, toxic, ecotoxic
Xylene, mixed isomers	1330-20-7	Liquid	0.86	Medium	Low	–	30	30	–	t	1307	3 PGII	Flammable, toxic
Zinc	7440-66-6	Solid	7.14	High	–	High	1	–	3	t	1436	4.3 PGI	Flammable, ecotoxic
Zinc ammonium chloride	52628-25-8	Solid	1.81	–	–	–	–	–	–	t	–	–	Unable to determine
Zinc arsenate	1303-39-5	Solid	3.31	–	*Medium*	*High*	–	10	3	t	1712	6.1 PGII	Unable to determine
Zinc chlorate	10361-95-2	Solid	n/a	High	*Medium*	*High*	1	10	3	t	1513	5.1	Oxidising
Zinc chloride	7646-85-7	Solid	2.91	–	Medium	*High*	–	10	3	t	2331	8 PGIII	Corrosive, toxic
Zinc cyanide	557-21-1	Solid	1.85	–	Medium	*High*	–	10	3	t	1713	6.1 PGI	Toxic
Zinc fluorosilicate	16871-71-9	Solid	2.10	–	*Medium*	*High*	–	10	3	t	2855	6.1 PGIII	Unable to determine
Zinc nitrate	7779-88-6	Solid	2.07	High	Medium	*High*	1	10	3	t	1514	5.1	Oxidising, toxic
Zinc permanganate	23414-72-4	Solid	n/a	High	*Medium*	*High*	1	10	3	t	1515	5.1	Oxidising
Zinc peroxide	1314-22-3	Solid	1.57	High	*Medium*	*High*	1	10	3	t	1516	5.1	Oxidising
Zinc phosphide	1314-84-7	Solid	4.55	–	High	*High*	–	1	3	t	1714	6.1 PGII	Toxic

Legend:
– = not applicable or below threshold for the hazard
n/a = not available
(v) = Volume
(w) = Weight

Default ratings:
Fire/explosion = medium
Human health = medium (based on lack of data for acute toxicity, not chronic toxicity alone)
Environment = high (based on lack of data for acute aquatic toxicity, not chronic or terrestrial toxicity)

Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)	Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)
(Di)potassium tetracyanomercurate (2-)	Mercuric potassium cyanide	1,1,2-trichloroethane	Trichloroethane
1,1-dichloro-2,2-dichloroethane	Tetrachloroethane	1,1-dichloroethene	Vinylidene chloride
1,1-dichloroethylene	Vinylidene chloride	1,1-dimethyl ethanol	Tertiary butyl alcohol
1,2-benzenedicarboxylic acid, diethyl ester	Diethyl phthalate	1,2-dihydroxyethane	Ethylene glycol
1,2-dimethylbenzene	O-xylene	1,2-ethandiol	Ethylene glycol
1,3-diisocyanatomethyl benzene	Toluene diisocyanate, mixed isomers	1,3-dimethylbenzene	M-xylene
1,4-benzenediol	Hydroquinone	1,4-benzoquine	P-quinone
1,4-cyclohexadiene dioxide	P-quinone	1,4-dihydroxybenzene	Hydroquinone
1,4-dimethylbenzene	P-xylene	1-benzagine	Quinoline
1-butanol	N-butyl alcohol	1-butene oxide	1,2-butylene oxide
1-dodecyl mercaptan	Lauryl mercaptan	1-hydroxy-2- methylbenzene	O-cresol
1-hydroxymethylpropane	Isobutanol	1-mercapto dodecane	Lauryl mercaptan
1-propene	Propylene	1-propenol-3	Allyl alcohol
10,11-dimethoxy strichnine	Brucine	2,2-(4,4'-dihydroxydiphenyl)propane	P,p'-isopropylidenediphenol
2,2-dihydroxydiethyl ether	Diethylene glycol	2,2'-iminodiethanol	Diethanolamine
2,2'-oxybisehtanol	Diethylene glycol	2,2'-oxydiethanol	Diethylene glycol
2,2'-oxyethanol	Diethylene glycol	2,4-dichlorophenoxyacetic acid	2,4-d
2,4-dinitrobenzenamine	2,4-dinitroaniline	2,5-furandione	Maleic anhydride
2-butanol	Sec-butyl alcohol	2-butanone	Methyl ethyl ketone
2-butoxy-1-ethanol	Ethylene glycol monobutyl ether	2-butoxyethanol, acetate	Ethylene glycol monobutyl ether acetate
2-cresol	O-cresol	2-cyano- 2-propanol	Acetone cyanohydrin
2-hydroxy-2- methylpropionitrile	Acetone cyanohydrin	2-hydroxybutane	Sec-butyl alcohol
2-hydroxyethane	Ethylene glycol	2-hydroxyethanol	Ethylene glycol
2-imidazolidine thione	Ethylenethiourea	2-mercaptoimidazoline	Ethylenethiourea
2-methyl-1-propanol	Isobutanol	2-methyl 4-pentanone	Methyl isobutyl ketone
2-methylacetonitrile	Acetone cyanohydrin	2-methylphenol	O-cresol
2-methylpropanol-2	Tert-butyl alcohol	2-phenyloxirane	Styrene oxide
2-propanone	Acetone	2-propanone, cyanohydrin	Acetone cyanohydrin
2-propen-1-one	Acrylic aldehyde	2-propenal	Acrylic aldehyde
2-propene- 1-ol	Allyl alcohol	2-propenoic acid ethyl ester	Ethyl acrylate
2-propenoic acid, butyl ester	Butyl acrylate	2-thioldihydroglyoxaline	Ethylenethiourea
3,3'-dichloro-4,4'-diaminodiphenylmethane	P,p'-methylenebis(2-chloroaniline)	3,4-methylenedioxy- 1-propenyl benzene	Isosafrole
3-butanone	Methyl ethyl ketone	3-chloropropene	Allyl chloride
3-chloropropyrene	Allyl chloride	3-methylphenol	M-cresol
4,4-bis(methylamino) benzophenone	Michler's ketone	4,4'-methylenebis(2-chloroaniline)	P,p'-methylenebis(2-chloroaniline)
4-allylpyrocatechol formaldehyde acetal	Safrole	4-methyl-2-oxopentane	Methyl isobutyl ketone
4-methyl pentanone-2	Methyl isobutyl ketone	4-propenyl-1,2-methylenedioxybenzene	Isosafrole
4-propenylcatechol methylene ether	Isosafrole	9-octadecenoic acid, mercury salt	Mercury oleate
AAM	Acrylamide	Abavit B	Mercuric chloride
Acetene	Ethylene	Acetic acid butyl ester	Tert-butyl acetate
Acetic acid ethyl ester	Ethyl acetate	Acetic acid vinyl ester	Vinyl acetate
Acetic acid, lead salt	Lead acetate	Acetic aldehyde	Acetaldehyde
Acetic ester	Ethyl acetate	Acetic ether	Ethyl acetate
Acetic peroxide	Peracetic acid	Acetosal	Tetrachloroethane
Acetyl aldehyde	Acetaldehyde	Acetyl anhydride	Acetic anhydride
Acetyl ether	Acetic anhydride	Acetylene trichloride	Trichloroethylene
Acetylenetetrachloride	Tetrachloroethane	ACL 70	Dichloroisocyanuric acid
Acquinite	Acrylic aldehyde	Acraldehyde	Acrylic aldehyde
Acroleic acid	Acrylic acid	Acrolein	Acrylic aldehyde
Acrylagel	Acrylamide	Acrylaldehyde	Acrylic aldehyde
Acrylic acid amide	Acrylamide	Acrylic acid n-butyl ester	Butyl acrylate
Acrylic acid, ethyl ester	Ethyl acrylate	Acrylic acid, methyl ester	Methyl acrylate
Acrylic amide	Acrylamide	Acrylic resin monomer	Methyl methacrylate
Actomar	Iodine	Adipic acid, diethyl ester	Diethyl adipate
Aero liquid HCN	Hydrogen cyanide	Agrothrin	Cypermethrin
Agroxene	2,4-d	Air-flo green	Copper arsenite
ALchloride	Aluminium chloride	Albone	Hydrogen peroxide >52%
ALCL3	Aluminium chloride	Alcohol of sulphur	Carbon disulphide
Aldacide	Paraformaldehyde	Aldocit	Aldrin

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Aldrec	Aldrin	Aldron	Aldrin
Aldrosol	Aldrin	Alfatox	Diazinon
Algae-k	Potassium permanganate	Algrain	Ethanol
Algran	Aldrin	Algylen	Trichloroethylene
Alkyl benzene sulphonic acid, sodium salt	Sodium alkylbenzene sulfonates	Allyl aldehyde	Acrylic aldehyde
Allylcatechol methylene ether	Safrole	Almite	Aluminium oxide
Alon	Aluminium oxide	Alpha-chlorotoluene	Benzyl chloride
Alpha- mercury (ii) iodide	Mercury iodide	Alphahydroxyisobutyronitrile	Acetone cyanohydrin
Alrato	Napthylthiourea	Alrex	Aldrin
Alumina	Aluminium oxide	Aluminium fibre	Aluminium
Aluminium sesqui oxide	Aluminium oxide	Ambush	Permethrin
Amchem grass killer	Trichloroacetic acid	Aminic acid	Formic acid
Amino mercuric chloride	Mercury ammonium chloride	Aminobenzene	Aniline
Aminoethylene	Ethyleneimine	Aminoform	Hexamine
Aminoformaldehyde	Hexamine	Aminotriacetic acid	Nitrilotriacetic acid
Ammo	Cypermethrin	Ammonia aqueous	Ammonia solution
Ammonium hydrate	Ammonia solution	Ammonium hydroxide	Ammonia solution
Ammonium peroxydisulfate	Ammonium persulphate	Ammonium peroxydisulphate	Ammonium persulphate
Ammonium salt	Ammonium nitrate	Amresco acryl-40	Acrylamide
Anamenth	Trichloroethylene	Anca 1040	Boron trifluoride
Angibid	Nitroglycerine	Anginine	Nitroglycerine
Angiolingual	Nitroglycerine	Anglisite	Lead sulphate
Anhydrol	Ethanol	Anhydrous aluminium chloride	Aluminium chloride
Anhydrous ammonia	Ammonia	Aniline oil	Aniline
Ankilostin	Perchloroethylene	Anodynon	Chloroethane
Anozol	Diethyl phthalate	Anthracin	Anthracene
Antigal	Diazinon	Antihydral	Hexamine
Antimony	Antimony, solid	Antimony black	Antimony, solid
Antimony, solid	Antimony	Antinonin	Dinitro-o-cresol
Antirust	Sodium nitrite	Antisal	Toluene
Antisal 1a	Toluene	Antisal 2b	Hydrofluoric acid
Antu	Napthylthiourea	Anturat	Napthylthiourea
Apavap	Dichlorvos	Aqua ammonia	Ammonia solution
Aqua fortis	Nitric acid	AR-toluenol	Cresol
Arborol	Dinitro-o-cresol	Arcturin	Hydroquinone
Argenti nitras	Silver nitrate	Argerol	Silver nitrate
Argucide	Potassium permanganate	Arrivo	Cypermethrin
Arsenic – 75	Arsenic	Arsenic (iii) oxide	Arsenic trioxide
Arsenic acid	Arsenic trioxide	Arsenic acid anhydride	Arsenic trioxide
Arsenic acid, zinc salt	Zinc arsenate, arsenite and mixture	Arsenic album	Arsenic trioxide
Arsenic black	Arsenic	Arsenic sesquioxide	Arsenic trioxide
Arsenious acid, trisiler (1+) salt	Silver arsenite	Arsenious oxide	Arsenic trioxide
Arsinette	Lead arsenate	Arsodent	Arsenic trioxide
As-trimethylbenzene	1,2,4-trimethylbenzene	Asarcol 15	Zinc
Ascarite	Asbestos	Aspon-chlordane	Chlordane
Astrobat	Dichlorvos	Asym-dichloroethylene	Vinylidene chloride
Atgard	Dichlorvos	Atratol	Sodium chlorate
Avantine	Isopropyl alcohol	Azabenzene	Pyridine
Azacyclopropane	Ethyleneimine	Azine	Pyridine
Aziran	Ethyleneimine	Azirane	Ethyleneimine
Aziridine	Ethyleneimine	Azotic acid	Nitric acid
B-K powder	Calcium hypochlorite	Banex	Dicamba
Banlen	Dicamba	Bantu	Napthylthiourea
Banvel 4s	Dicamba	Banvel 4ws	Dicamba
Banvel CST	Dicamba	Banvel D	Dicamba
Banvel D (velsicol)	Dicamba	Banvel herbicide	Dicamba
Banvel II herbicide	Dicamba	Barricade	Cypermethrin
Basuden	Basudin 10g	Diazinon	
Bazuden	Diazinon	BBP	Butylbenzyl phthalate
BBR3	Boron tribromide	Benfos	Dichlorvos
Benzene monochloride	Chlorobenzene	Benzene, o- dihydroxy-	Catechol
Benzene,1,2-dichloro	Dichlorobenzene	Benzene,o-dichloro	Dichlorobenzene
Benzenecarbonyl chloride	Benzoyl chloride	Benzenedicarboxylic acid di-n-octyl ester	Di-n-octyl phthalate

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Benzenehexahydride	Cyclohexane	Benzenol	Phenol
Benzinoform	Carbon tetrachloride	Benzinol	Trichloroethylene
Benzopyridine	Quinoline	Benzoquinol	Hydroquinone
Benzoquinone	P-quinone	Benzoyl superoxide	Benzoyl peroxide
Benzyl butyl phthalate	Butylbenzyl phthalate	Bercema	Methyl bromide
Bertholite	Chlorine	Berthollet salt	Potassium chlorate
Beta- ketopropanone	Acetone	Beta-trichloroethane	Trichloroethane
BF3-ether complex	Boron trifluoride diethyl etherate	BFV	Formaldehyde
Bibesol	Dichlorvos	Bicarburretted hydrogen	Ethylene
Bichloride of mercury	Mercuric chloride	Bichromate of soda	Sodium dichromate
Bidrin	Dicrotophos	Bilorin	Formic acid
Bimethyl	Ethane	Bis(acetyloxy) mercury	Mercury acetate
Bis(pentabromophenyl) ether	Decabromodiphenyl oxide	Bis-2-hydroethylamine	Diethanolamine
Bivinyl	1,3-butadiene	Blasting gelatin	Nitroglycerine
Blasting oil	Nitroglycerine	Bleach	Sodium hypochlorite
Blue-ox	Zinc phosphide	Blue powder	Zinc
Bonoform	Tetrachloroethane	Boracic acid	Boric acid
Borate (1-), (acetato-o) trifluoro-, hydrogen, (t-4)-	Boron trifluoride acetic acid complex	Borersol	1,2-dichloroethane
Borofax	Boric acid	Boron fluoride (BF3)	Boron trifluoride
Boron fluoride ethyl ether	Boron trifluoride diethyl etherate	Boron trifluoride acetic acid complex	Acetic acid, compound with boron fluoride (BF3) (8CL)
Boron trihydoxide	Boric acid	Bowl cleaner	Hydrochloric acid
Brecolane NDG	Diethylene glycol	Brevinyl	Dichlorvos
Brevinyl E50	Dichlorvos	Brifur	Carbofuran
Brocide	1,2-dichloroethane	Brom-o-gas	Methyl bromide
Brom-o-sol	Methyl bromide	Bromomethane	Methyl bromide
Brush buster	Dicamba	Burnt lime	Calcium oxide
Butalyde	Butyraldehyde	Butanal	Butyraldehyde
Butter of zinc	Zinc chloride	Buty phenylmethyl 1,2-benzenecarboxylate	Butylbenzyl phthalate
Butyl alcohol	Butanol	Butyl cellosolve	Ethylene glycol monobutyl ether
Butyl ethanoate	N-butyl acetate	Butyl glycol	Ethylene glycol monobutyl ether
Butyl glycol	Ethylene glycol monobutyl ether	Butyl hydride	Butane
Butyl hydroxide	N-butyl alcohol	Butylene hydrate	Sec-butyl alcohol
Butyral	Butyraldehyde	Butyric alcohol	N-butyl alcohol
Cadmium dichloride	Cadmium chloride	Cairox	Potassium permanganate
Calcia	Calcium oxide	Calcid	Calcium cyanide
Calcium chlorohydrochlorite	Calcium hypochlorite	Calcium chlorohypochlorite	Calcium hypochlorite
Calcium salt	Calcium hypochlorite	Calcyan	Calcium cyanide
Calcyanide	Calcium cyanide	Calochlor	Mercuric chloride
Calxusta	Calcium oxide	Calxyl	Calcium oxide
Canogard	Dichlorvos	Capsine	Dinitro-o-cresol
Caradate 30	Methylenebisphenylisocyanate	Carbicron	Bidrin
Carbinol	Methanol	Carbolic acid	Phenol
Carbomicron	Bidrin	Carbon bisulphide	Carbon disulphide
Carbon chloride	Carbon tetrachloride	Carbon dichloride oxide	Phosgene
Carbon hexachloride	Hexachloroethane	Carbon oxychloride	Phosgene
Carbona	Carbon tetrachloride	Carbonic acid dichloride	Phosgene
Carbontet	Carbon tetrachloride	Carbonyl chloride	Phenol
Cardalsid	Nitroglycerine	Cardamist	Nitroglycerine
Casporit	Calcium hypochlorite	Caustic potash	Potassium hydroxide
CCH	Calcium hypochlorite	CCL4	Carbon tetrachloride
CD 68	Chlordane	CDB 60	Dichloroisocyanuric acid
Cecolene	Trichloroethylene	Cekusan	Dichlorvos
Cellon	Tetrachloroethane	Cellosolve	2-ethoxyethanol
Celloxan	Zinc nitrate	Chameleon mineral	Potassium permanganate
Channing's solution	Mercury potassium iodide	Chauxvive	Calcium oxide
Chemichlon G	Calcium hypochlorite	Chemsect DNOC	Dinitro-o-cresol
Chile saltpeter	Sodium nitrate	Chinoline	Quinoline
Chinufur	Carbofuran	Chlon	Pentachlorophenol
Chlorallylene	Allyl chloride	Chlorate of potash	Potassium chlorate
Chlorax	Sodium chlorate	Chlordan	Chlordane
Chlordano	Chlordane	Chlorethyl	Chloroethane
Chlorilen	Trichloroethylene	Chlorindan	Chlordane

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Chlorine MOL	Chlorine	Chlorine of lime	Calcium hypochlorite
Chlorisol	Potassium permanganate	Chloroallylene	Allyl chloride
Chloroben	Dichlorobenzene	Chlorochromic anhydride	Chromium oxychloride
Chlorodimethyl ether	Chloromethyl methyl ether	Chloroethanoic acid	Chloroacetic acid
Chloroformic acid ethyl ester	Ethyl chloroformate	Chloroformyl chloride	Phosgene
Chlorohydric acid	Hydrochloric acid	Chloromethane	Methyl chloride
Chloropropylene oxide	Epichlorohydrin	Chlorosulfuric acid	Chlorosulphonic acid
Chlorvinphos	Dichlorvos	Chloryl anaesthetic	Chloroethane
CHP	Cumene hydroperoxide	Chrome	Chromium
Chromic acid, solid	Chromic anhydride	Chromic nitrate	Chromium (iii) nitrate
Chromium sulfate	Chromosulphuric acid	Chromium trinitrate	Chromium (iii) nitrate
Chromium trioxide	Chromic anhydride	Chromyl chloride	Chromium oxychloride
Ci oxidation base 26	Catechol	Ciazinon	Diazinon
Cinnamene	Styrene monomer	Cis-butenedioic anhydride	Maleic anhydride
Citrine ointment	Mercuric nitrate	Claudolite	Arsenic trioxide
Claudotite	Arsenic trioxide	Clearasil	Benzoyl peroxide
Cllosolve acetate	2-methoxyethyl acetate	Cloroben	Dichlorobenzene
Clorox	Sodium hypochlorite	CMME	Chloromethyl methyl ether
CNN52	Cypermethrin	Coated aluminium	Aluminium
Colloidal arsenic	Arsenic	Colloidal cadmium	Cadmium
Cologne spirit	Ethanol	Colonial spirits	Methanol
Columbian spirits	Methanol	Combat gas	Phosgene
Compound B	Dicamba	Condy's crystals	Potassium permanganate
Copper bichloride	Copper chloride	Copper dichloride	Copper chloride
Corrosive sublimate	Mercuric chloride	Cortilan-neu	Chlordane
Cresolum	Cresol	Cresolum crudum	Cresol
Cresylic acid	Cresol	Crisfuran	Carbofuran
Crolean	Acrylic aldehyde	Crude arsenic	Arsenic trioxide
Crystamet	Sodium metasilicate	Cubic niter	Sodium nitrate
Cumol	Cumene	Cupric arsenite	Copper arsenite
Cupricin	Copper (i) cyanide	Cuprous cyanide	Copper (i) cyanide
Curafume	Methyl bromide	Curalin M	P,p'-methylenebis(2-chloroaniline)
Curaterr	Carbofuran	Curetard A	N-nitrosodiphenylamine
Cutaval	Manganese	Cyanide of calcium	Calcium cyanide
Cyanoethylene	Acrylonitrile	Cyanomethane	Acetonitrile
Cyclon	Hydrogen cyanide	Cyclone B	Hydrogen cyanide
Cymag	Calcium cyanide	Cymbush	Cypermethrin
Cypercare	Cypermethrin	Cypercopal	Cypermethrin
Cyperkill	Cypermethrin	Cypermethrine	Cypermethrin
Cypersect	Cypermethrin	Cypona	Dichlorvos
Cyrux	Cypermethrin	Cystamin	Hexamine
Cystogen	Hexamine	DACPM	P,p'-methylenebis(2-chloroaniline)
Dacutox	Diazinon	Dassitox	Diazinon
Dazzel	Diazinon	DBP	Dibutyl phthalate
DCM	Methylene chloride	DCP	2,4-dichlorophenol
DDVP	Dichlorvos	Deactivator E	Diethylene glycol
Deactivator H	Diethylene glycol	Decabromobiphenyl oxide	Decabromodiphenyl oxide
Decabromodiphenyl oxide	Decabromobiphenyl ether	Dedevap	Dichlorvos
Deg	Diethylene glycol	Degesch calcium cyanide a-dust	Calcium cyanide
Delac J	N-nitrosodiphenylamine	Delusal	Zinc phosphide
Demon	Cypermethrin	Dep	Diethyl phthalate
Deponit	Nitroglycerine	Deriban	Dichlorvos
Derribante	Dichlorvos	Des	Dichlorvos
Desmadur 44	Methylenebisphenylisocyanate	Detal	Dinitro-o-cresol
Detia gas ex-M	Methyl bromide	Devikal	Dichlorvos
Diacetoxymercury	Mercury acetate	Diakon	Methyl methacrylate
Diamine	Hydrazine, anhydrous	Diammonium peroxydisulphate	Ammonium persulphate
Dianate	Dicamba	Dianilinomethane	P,p'-methylenedianiline
Diano	P,p'-isopropylidenediphenol	Diarex HF 77	Styrene monomer
Diarsenic trioxide	Arsenic trioxide	Diazajet	Diazinon
Diazide	Diazinon	Diazinone	Diazinon
Diazitol	Diazol	Diazinon	
Diazotizing salts	Sodium nitrite	Dibenzoyl peroxide	Benzoyl peroxide
Dichlor-mulsion	1,2-dichloroethane	Dichlorman	Dichlorvos

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Dichloro-s-triazine-2,4,6-trione	Dichloroisocyanuric acid	Dichlorocadmium	Cadmium chloride
Dichlorocyanuric acid	Dichloroisocyanuric acid	Dichlorodioxochromium	Chromium oxychloride
Dichloroisocyanuric acid and salts	Dichloroisocyanuric acid	Dichloromercury	Mercuric chloride
Dichloromethane	Methylene chloride	Dichlorovas	Dichlorvos
Dichlorovos	Dichlorvos	Dichlorphos	Dichlorvos
Dicid	Diazinon	Dicol	Diethylene glycol
Dicyanomercury	Mercury cyanide	Dieldrex	Dieldrin
Dieldrite	Dieldrin	Dielmoth	Dieldrin
Diesel oil	Diesel	Diethyl	Butane
Diethyl hexanedioate	Diethyl adipate	Diethylolamine	Diethanolamine
Digenos	Diethylene glycol	Diglycol	Diethylene glycol
Digol	Diethylene glycol	Dihydroazirene	Ethyleneimine
Dihydrogen hexafluorosilicate	Fluorosilicic acid	Dihydrogen monosulphide	Hydrogen sulfide
Dihydrogen sulphide	Hydrogen sulfide	Diiodine	Iodine
Diisocyanatotoluene	Toluene diisocyanate, mixed isomers	Dilantin	Dichlorobenzene
Dilantin DB	Dichlorobenzene	Dilatin	Dichlorobenzene
Dilead orthoarsenate	Lead arsenate	Dillex	Dinitro-o-cresol
Dimethyl	Ethane	Dimethyl carbinol	Isopropyl alcohol
Dimethyl ketone	Acetone	Dimethylbenzyl hydroperoxide	Cumene hydroperoxide
Dimethyleneimine	Ethyleneimine	Dimethylmethame	LPG
Dimethylphenylamine	N,n-dimethylaniline	Dimpylate	Diazinon
Dinitrophenyl methane	Dinitrotoluene, mixed isomers	Dinitrotoluol	Dinitrotoluene, mixed isomers
Dioctyl o-benzenedicarboxylate	Di-n-octyl phthalate	Diphenylmethane diisocyanate	Methylenebisphenylisocyanate
Diphenylnitrosamine	N-nitrosodiphenylamine	Dipofene	Diazinon
Dipotassium tetraiodomercurate	Mercury potassium iodide	Dipropyl	Hexane
Dirax	Napthylthiourea	Disodium metasilicate	Sodium metasilicate
Disodium monosilicate	Sodium metasilicate	Disodium selenium trioxide	Sodium selenite
Dissolvant APV	Diethylene glycol	Dithiocarbonic anhydride	Carbon disulphide
Divipan	Dichlorvos	Dizinon	Diazinon
DMA	N,n-dimethylaniline	DMP	Dimethyl phthalate
DNOP	Di-n-octyl phthalate	Dormol	Formaldehyde
Dormone	2,4-d	Dowchlor	Chlordane
Dowfume	Methyl bromide	Dowicide 7	Pentachlorophenol
Dowicide A	O-phenylphenol	Dowtherm E	Dichlorobenzene
Dowtherm SR1	Ethylene glycol	Drexel plant bed gas	Methyl bromide
Dropleaf	Sodium chlorate	DS	Diethyl sulphate
Duo-kill	Dichlorvos	Duravos	Dichlorvos
Dutch liquid	1,2-dichloroethane	Dutch oil	1,2-dichloroethane
Dysect	Cypermethrin	Dyzol	Diazinon
EB	Ethyl benzene	ECH	Epichlorohydrin
EDCO	Methyl bromide	EGM	2-methoxyethanol
Ehtylene dihydrate	Ethylene glycol	Ektafos	Bidrin
Ektsolve EB acetate	Ethylene glycol monobutyl ether acetate	Elayl	Ethylene
Eldopaque	Hydroquinone	Eldoquin	Hydroquinone
Elgatol	Dinitro-o-cresol	Elipol	Dinitro-o-cresol
Embofume	Methyl bromide	Emerald green	Copper acetoarsenite
Endrex	Endrin	Endricol	Endrin
Engraver's acid	Nitric acid	Epichlorhydrin	Epichlorohydrin
Epiclear	Benzoyl peroxide	Epoxybutane	1,2-butylene oxide
Epoxyethyl benzene	Styrene oxide	Epoxystyrene	Styrene oxide
Equigel	Dichlorvos	Eranol	Iodine
Erinitrit	Sodium nitrite	Erythrene	1,3-butadiene
Essence of mirbane	Nitrobenzene	Estosteril	Peracetic acid
Estrosel	Dichlorvos	Estrosol	Dichlorvos
Ethanal	Acetaldehyde	Ethane-1,2-diol	Ethylene glycol
Ethane peroxoic acid	Peracetic acid	Ethanenitrile	Acetonitrile
Ethanoic acid	Acetic acid	Ethanoic anhydrate	Acetic anhydride
Ethanoic anhydride	Acetic anhydride	Ethanol,2,2'-oxybis'-	Diethylene glycol
Ethanol-2,2'-oxydi-	Diethylene glycol	Ethene	Ethylene
Ethenyl acetate	Vinyl acetate	Ethenyl benzene	Styrene monomer
Ethenyl ethanoate	Vinyl acetate	Ethenyl trichloride	Trichloroethylene
Ethine	Acetylene	Ethoxycarbonyl chloride	Ethyl chloroformate
Ethoxycarbonylethylene	Ethyl acrylate	Ethyl alcohol	Ethanol
Ethyl aldehyde	Acetaldehyde	Ethyl carbonochloridate	Ethyl chloroformate

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Ethyl cellosolve acetate	2-ethoxyacetate	Ethyl chlorocarbonate	Ethyl chloroformate
Ethyl chloromethanoate	Ethyl chloroformate	Ethyl glycol acetate	2-ethoxyacetate
Ethyl hydrate	Ethanol	Ethyl hydride	Ethane
Ethyl hydroxide	Ethanol	Ethyl methyl ketone	Methyl ethyl ketone
Ethyl phthalate	Diethyl phthalate	Ethyl propanoate	Ethyl acrylate
Ethyl sulfate	Diethyl sulphate	Ethylene alcohol	Ethylene glycol
Ethylene carboxymide	Acrylamide	Ethylene dichloride	1,2-dichloroethane
Ethylene diglycol	Diethylene glycol	Ethylene glycol acetate monomethyl ether	2-methoxyethyl acetate
Ethylene glycol butyl ether acetate	Ethylene glycol monobutyl ether acetate	Ethylene glycol monoethyl ether acetate	2-ethoxyacetate
Ethylene glycol, monomethyl ether	2-methoxyethanol	Ethylene tetrachloride	Perchloroethylene
Ethylenecarboxylic acid	Acrylic acid	Ethylenimine	Ethyleneimine
Ethylethylene glycol	2-ethoxyethanol	Ethylethylene oxide	1,2-butylene oxide
Ethylimine	Ethyleneimine	Ethyne	Acetylene
Etileno	Ethylene	Etu	Ethylenethiourea
Eureka products, criosine	Methanol	Evercyn	Hydrogen cyanide
Evits	Phosphoric acid	Exodin	Diazinon
Extrar	Dinitro-o-cresol	Fannoform	Formaldehyde
Fasciolin	Carbon tetrachloride	Fast white	Lead sulphate
Fastac	Cypermethrin	Fecama	Dichlorvos
Fenom	Cypermethrin	Fermentation alcohol	Ethanol
Ferric chloride	Ferric chloride, anhydrous	Fibreglass resin	Styrene monomer
Filmarine	Sodium nitrite	Fleck-flip	Trichloroethylene
Flectron	Cypermethrin	Flock-flip	Trichloroethylene
Fluate	Trichloroethylene	Flukoids	Carbon tetrachloride
Fluor	Fluorine	Fluorhydric acid	Hydrofluoric acid
Flytrol	Diazinon	Formagene	Paraformaldehyde
Formalin	Formaldehyde	Formalithh	Formaldehyde
Forme aldehyde	Formaldehyde	Formic anamminide	Hydrogen cyanide
Formin	Hexamine	Formina	Formic acid
Formisoton	Formic acid	Formol	Formaldehyde
Formonitrile	Hydrogen cyanide	Formyltrichloride	Chloroform
Forpen-50	Pentachlorophenol	Fouramine PCH	Catechol
Freers elm arrester	Methanol	French green	Copper acetoarsenite
Freon 10	Carbon tetrachloride	Freon 150	1,2-dichloroethane
Freon 20	Chloroform	Fridex	Ethylene glycol
Fuel oil	Diesel	Fulminate of mercury	Mercury fulminate, wetted
Fungifen	Pentachlorophenol	Fungol	Zinc fluorosilicate
Fur yellow	P-phenylenediamine	Furadan	Carbofuran
Furadan 3D	Carbofuran	Furadan 4F	Carbofuran
Furadan G	Carbofuran	Furodan	Carbofuran
Furro D	P-phenylenediamine	Fyde	Formaldehyde
Galeson	Diazinon	Gamma chloropropylene oxide	Epichlorohydrin
Gardentox	Diazinon	Gas oil	Diesel
Gasoline	Petrol	Geigy	Diazinon
Geigy 24480	Diazinon	Germalgene	Trichloroethylene
German saltpeter	Ammonium nitrate	Glialka	Glyphosate
Glifinox	Glyphosate	Glonoin	Nitroglycerine
Glycel	Glyphosate	Glycerol epichlorohydrin	Epichlorohydrin
Glycerol trinitrate	Nitroglycerine	Glyceryl trinitrate	Nitroglycerine
Glycidyl chloride	Epichlorohydrin	Glycine	Glyphosate
Glycol butyl ether	Ethylene glycol monobutyl ether	Glycol dichloride	1,2-dichloroethane
Glycol ether	Diethylene glycol	Glycolethylether	Diethylene glycol
Glyphosate	Glyphosate	Grain alcohol	Ethanol
Gray arsenic	Arsenic	Green oil	Anthracene
Grundier	Pentachlorophenol	GTN	Nitroglycerine
Halon 1001	Methyl bromide	Halon 104	Carbon tetrachloride
Haltox	Methyl bromide	Hedolit	Dinitro-o-cresol
Hemostyp	N-butyl alcohol	Herco prills	Ammonium nitrate
Herkal	Dichlorvos	Herkol	Dichlorvos
Heterin	Hexamine	Hexadrin	Endrin
Hexafluorosilicate	Fluorosilicic acid	Hexahydrobenzene	Cyclohexane
Hexamethyleneamine	Hexamine	Hexanapthene	Cyclohexane
Hexanedioic acid, diethyl ester	Diethyl adipate	Hexone	Methyl isobutyl ketone

Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)	Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)
Hexyl hydride	Hexane	HHDN	Aldrin
Hioxyl	Hydrogen peroxide >52%	Homeheating oil no. 2	Diesel
HTH	Calcium hypochlorite	Hy-chlor	Calcium hypochlorite
Hydrargyrum ammoniatum	Mercury ammonium chloride	Hydrargyrym precipitatum album	Mercury ammonium chloride
Hydrazine base	Hydrazine	Hydrazine, anhydrous	Hydrazine
Hydrocarbon propellant A-17	Butane	Hydrochloride	Hydrochloric acid
Hydrocyanic acid	Hydrogen cyanide	Hydrogen carboxylic acid	Formic acid
Hydrogen dioxide	Hydrogen peroxide >52%	Hydrogen fluoride	Hydrofluoric acid
Hydrogen gas	Hydrogen	Hydrogen hexafluorosilicate	Fluorosilicic acid
Hydrogen nitrate	Nitric acid	Hydrogen peroxide	Hydrogen peroxide >52%
Hydroperoxide	Hydrogen peroxide >52%	Hydrosulfuric acid	Hydrogen sulfide
Hydroxy benzene	Phenol	Hydroxymethylbenzene	Cresol
Hydroxytoluene	M-cresol	Hypochlorous acid	Calcium hypochlorite
Illoxol	Dieldrin	Imperator	Cypermethrin
Imperial green	Copper acetoarsenite	Inhibine	Hydrogen peroxide >52%
Intox 8	Chlordane	Iodo methane	Methyl iodide
Iosan superdip	Iodine	Iscobrome	Methyl bromide
Isobutyl alcohol	Isobutanol	Isobutyl methyl ketone	Methyl isobutyl ketone
Isobutylaldehyde	Isobutyraldehyde	Isocyanatomethane	Methyl isocyanate
Isocyanic acid, methyl-phenylene ester	Toluene diisocyanate, mixed isomers	Isocyanic acid, methyl ester	Methyl isocyanate
Isocyanomethane	Methyl isocyanate	Isopropanol	Isopropyl alcohol
Isopropanol	Isopropyl alcohol	Isopropyl acetone	Methyl isobutyl ketone
Isopropylbenzene	Cumene	Isopropylbenzene hydroperoxide	Cumene hydroperoxide
Isopropylcarbinol	Isobutanol	Isothiocyanic acid, 4-methyl-m-phenylene ester	Toluene diisocyanate
Ivalon	Formaldehyde	Izal	Phenol
Izosafrol	Isosafrole	Jasad	Zinc
Jaysols	Ethanol	Kalif super	Cypermethrin
Kayafume	Methyl bromide	Kayazinon	Diazinon
Kenofuran	Carbofuran	Ketone dimethyl	Acetone
Ketone propanone	Acetone	Kill kantz	Napthylthiourea
Kilrat	Zinc phosphide	Kiwi lustr 277	O-phenylphenol
Knox-out	Diazinon	Kortofin	Aldrin
Krecalvin	Dichlorvos	Kresolum venale	Cresol
Kripid	Napthylthiourea	Krysid	Napthylthiourea
Lactonitrile, 2-methyl	Acetone cyanohydrin	Lanadin	Trichloroethylene
Lauryl mercaptide	Lauryl mercaptan	Lauxtol	Pentachlorophenol
Lawn-keep	2,4-d	Lead (ii) sulphate	Lead sulphate
Lead (iv) oxide	Lead dioxide	Lead bottoms	Lead sulphate
Lead brown	Lead dioxide	Lead dibasic acetate	Lead acetate
Lead dichloride	Lead chloride	Lead oxide	Lead peroxide
Lead oxide, brown	Lead dioxide	Lead superoxide	Lead peroxide
Lead tetraethide	Tetraethyl lead	Lenitral	Nitroglycerine
Lethurin	Trichloroethylene	Leucoline	Quinoline
Levoxine	Hydrazine	Lighter gas	Butane
Lime	Calcium oxide	Lime chloride	Calcium hypochlorite
Liquified petroleum gas	LPG	Liroprem	Pentachlorophenol
Lossantin	Calcium hypochlorite	LPG	Butane
Lucidol	Benzoyl peroxide	Lunar caustic	Silver nitrate
Lutrol-9	Ethylene glycol	Lye	Potassium hydroxide
Lysoform	Formaldehyde	M-cresylic acid	M-cresol
M-xylol	M-xylene	Macondry	2,4-d
Macrogol 400 B-PC	Ethylene glycol	Mafu	Dichlorvos
Mafustrip	Dichlorvos	Manganese dinitrate	Manganese nitrate
Manganous dinitrate	Manganese nitrate	Marvex	Dichlorvos
Mayer's reagent	Mercury potassium iodide	MBX	Methyl bromide
MCA	Chloroacetic acid	MDBA	Dicamba
MEBR	Methyl bromide	Mecuriacetate	Mercury acetate
Mediben	Dicamba	Meetco	Methyl ethyl ketone
MEG	Ethylene glycol	MEK	Methyl ethyl ketone
Mendrin	Endrin	Mercaptomethane	Methyl mercaptan
Merco prills	Ammonium nitrate	Mercuric benzoate	Mercury benzoate
Mercuric cyanate	Mercury fulminate, wetted	Mercuric diacetate	Mercury acetate
Mercuric oxide	Mercury (ii) oxide	Mercuric sulfocyanate	Mercury thiocyanate

Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)	Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)
Mercurous bromide	Mercury bromide	Mercurous oxide	Mercury (i) oxide
Mercury (ii) o-arsenate	Mercuric arsenate	Mercury biniodide	Mercury iodide
Mercury dicyanide	Mercury cyanide	Mercury dinitrate	Mercuric nitrate
Mercury dithiocyanate	Mercury thiocyanate	Mercury oxide, red/yellow	Mercury (ii) oxide
Mercury perchloride	Mercuric chloride	Merrillite	Zinc
Metabrom	Methyl bromide	Metacide	Toluene
Metallic arsenic	Arsenic	Meth-o-gas	Methyl bromide
Methamine	Hexamine	Methanal	Formaldehyde
Methane carbonitrile	Acetonitrile	Methane carboxylic acid	Acetic acid
Methane tetrachloride	Carbon tetrachloride	Methane tetrachloro	Carbon tetrachloride
Methane trichloride	Chloroform	Methane trichloro	Chloroform
Methanethiol	Methyl mercaptan	Methanoic acid	Formic acid
Methenamine	Hexamine	Methenyl chloride	Chloroform
Methenyl trichloride	Chloroform	Methogas	Methyl bromide
Methoxy chloromethane	Chloromethyl methyl ether	Methoxycarbonylethylene	Methyl acrylate
Methyl acetone	Methyl ethyl ketone	Methyl alcohol	Methanol
Methyl alcolhol	Methanol	Methyl aldehyde	Formaldehyde
Methyl carbylamine	Methyl isocyanate	Methyl cyanide	Acetonitrile
Methyl ethoxol	2-methoxyethanol	Methyl ethyl carbinol	Sec-butyl alcohol
Methyl fume	Methyl bromide	Methyl hydroxide	Methanol
Methyl ketone	Acetone	Methyl methacrylate monomer	Methyl methacrylate
Methyl methane	Ethane	Methyl oxitol	2-methoxyethanol
Methyl propenoate	Methyl acrylate	Methyl sulfhydrate	Methyl mercaptan
Methyl sulphate	Dimethyl sulphate	Methyl trichloride	Chloroform
Methylacetaldehyde	Propionaldehyde	Methylbenzene	Toluene
Methylcarbinol	Ethanol	Methyldinitrobenzene	Dinitrotoluene, mixed isomers
Methylene oxide	Formaldehyde	Methylenum chloratum	Methylene chloride
Methylethylene	Propylene	Methylethylmethane	Butane
Methylol	Methanol	Methylolpropane	N-butyl alcohol
Methylphenol	Cresol	MIBK	Methyl isobutyl ketone
MIC	Methyl isocyanate	MIK	Methyl isobutyl ketone
MME	Methyl methacrylate	Molasses alcohol	Ethanol
Molecular chlorine	Chlorine	Molybdena	Molybdenum trioxide
Molybdenum (vi) oxide	Molybdenum trioxide	Molybdic acid anhydride	Molybdenum trioxide
Molybdic anhydride	Molybdenum trioxide	Molybdic oxide	Molybdenum trioxide
Mon 2139	Glyphosate	Monobromomethane	Methyl bromide
Monochloroacetic acid	Chloroacetic acid	Monochlorobenzene	Chlorobenzene
Monochloromethane	Methyl chloride	Monoethylene glycol	Ethylene glycol
Monohydroxymethane	Methanol	Monoiodomethane	Methyl iodide
Monophenol	Phenol	Morbicid	Formaldehyde
Motor fuel	Petrol	Motor spirit	Petrol
Motorfuel antiknock component	Tetraethyl lead	MTBE	Methyl tert-butyl ether
Muriatic acid	Hydrochloric acid	Muriatic ether	Chloroethane
Muster	Glyphosate	Myoglycerin	Nitroglycerine
Myrmicyl	Formic acid	N,n-dimethylbenzeneamine	N,n-dimethylaniline
N-butane	Butane	N-butanol	N-butyl alcohol
N-butyl benzyl phthalate	Butylbenzyl phthalate	N-butylaldehyde	Butyraldehyde
N-dodecanethiol	Lauryl mercaptan	N-hexane	Hexane
N-nitroso-n-phenyl-benzenamine	N-nitrosodiphenylamine	N-phosphonomethylglycine	Glyphosate
Naphtox	Napthylthiourea	Napthalin	Napthalene
Narcotile	Chloroethane	Narcylen	Acetylene
Natal	Trichloroacetic acid	Natratine	Sodium nitrate
Natural anglesite	Lead sulphate	Natural montroydite	Mercury (ii) oxide
NB	Nitrobenzene	NCI-CO8673	Diazinon
Necatorina	Carbon tetrachloride	Necatorine	Carbon tetrachloride
Necidol	Diazinon	Nendrin	Endrin
Neocidol	Diazinon	Nerkol	Dichlorvos
Nessler reagent	Mercury potassium iodide	Niagara 10242	Carbofuran
Niagara NIA-10242	Carbofuran	Niglycon	Nitroglycerine
Nipsan	Diazinon	Nital	Nitric acid
Niter cake	Sodium bisulphate	Nitrador	Dinitro-o-cresol
Nitram	Ammonium nitrate	Nitric acid	Ammonium nitrate
Nitric acid, chromium (3+) salt	Chromium (iii) nitrate	Nitric acid, lead (2+) salt	Lead nitrate
Nitric acid, manganese (2+) salt	Manganese nitrate	Nitric acid, mercury (2+) salt	Mercuric nitrate

Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)	Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)
Nitric acid, zinc salt	Zinc nitrate	Nitrobenzol	Nitrobenzene
Nitrofan	Dinitro-o-cresol	Nitrolin	Nitroglycerine
Nitrous fumes	Nitric acid	Nitryl hydroxide	Nitric acid
No-pest	Dichlorvos	Norkool	Ethylene glycol
Norway saltpeter	Ammonium nitrate	NRDC 149	Cypermethrin
Nucidol	Diazinon	Number 2 burner fuel	Diesel
Nurelle	Cypermethrin	Nuvan	Dichlorvos
O-cresylic acid	O-cresol	O-dichlor benzol	Dichlorobenzene
O-dichlorobenzene	Dichlorobenzene	O-dichlorobenzol	Dichlorobenzene
O-hydroxydiphenyl	O-phenylphenol	O-hydroxytoluene	O-cresol
O-methylphenol	O-cresol	O-xenol	O-phenylphenol
O-xylol	O-xylene	Octachloro-4,7- methanohydroindane	Chlordane
Octachloro-4,7-methanotetrahydroindane	Chlordane	Octachloro tetrahydro methanoindan	Chlordane
Octalene	Aldrin	Octalox	Dieldrin
Oil of mirbane	Nitrobenzene	Oktanex	Endrin
Oktaterr	Chlordane	Oleate of mercury	Mercury oleate
Olefiant gas	Ethylene	Oleic acid, mercury (2+) salt	Mercury oleate
Oleodiazinon	Diazinon	Optimum	Acrylamide
Orced	Dichloroisocyanuric acid	Ortho-benzenediol	Catechol
Ortho-dihydroxybenzene	Catechol	Ortho-phosphoramide	Phosphoric acid
Orthoboric acid	Boric acid	Orthodichlorobenzene	Dichlorobenzene
Orthodichlorobenzol	Dichlorobenzene	Orthosil	Sodium metasilicate
Oxirane (chloromethyl)-	Epichlorohydrin	Oxomethane	Formaldehyde
Oxone	Sodium peroxide	Oxybenzene	Phenol
Oxylite	Benzoyl peroxide	Oxymethylene	Formaldehyde
Oxytreat 35	Hydrazine	P-aminoaniline	P-phenylenediamine
P-diaminobenzene	P-phenylenediamine	P-xylol	P-xylene
Palatinol BB	Butylbenzyl phthalate	Papite	Acrylic aldehyde
Paraform	Paraformaldehyde	Paranapthalene	Anthracene
Paraphenylenediamine	P-phenylenediamine	Paris green	Copper acetoarsenite
PCE	Perchloroethylene	Pennfloat M	Lauryl mercaptan
Pennfloat S	Lauryl mercaptan	Penta concentrate	Pentachlorophenol
Penta ready	Pentachlorophenol	Pentachloroethane	Hexachloroethane
Perchlor	Perchloroethylene	Perchloroethylene	Tetrachlororethylene
Perchloromethane	Carbon tetrachloride	Perhydrol	Hydrogen peroxide >52%
Permanganate of potash	Potassium permanganate	Permanganic acid (HMNO4), zinc salt	Zinc permanganate
Permanganic acid, potassium salt	Potassium permanganate	Permasan	Pentachlorophenol
Peroxan	Hydrogen peroxide >52%	Peroxide	Hydrogen peroxide >52%
Peroxyacetic acid	Peracetic acid	Persadox	Benzoyl peroxide
Pestmaster	Methyl bromide	Petrohol	Isopropyl alcohol
Phenethylene oxide	Styrene oxide	Phenic acid	Phenol
Phenol methyl-	Cresol	Phenyl alcohol	Phenol
Phenyl chloride	Chlorobenzene	Phenyl hydrate	Phenol
Phenyl hydroxide	Phenol	Phenyl methane	Toluene
Phenylamine	Aniline	Phenylethane	Ethyl benzene
Phenylethylene	Styrene monomer	Phenylic acid	Phenol
Phosphonomethyliminoacetic acid	Glyphosate	Phthalandione	Phthalic anhydride
Phthalic acid anhydride	Phthalic anhydride	Phthalic acid, benzyl butyl ester	Butylbenzyl phthalate
Phthalic acid, diethyl ester	Diethyl phthalate	Phthalol	Diethyl phthalate
Picragol	Silver picrate, wetted	Picrotol	Silver picrate, wetted
Pillarfuran	Carbofuran	Pittcide	Calcium hypochlorite
Placidol E	Diethyl phthalate	Plumbous acetate	Lead acetate
Plumbous arsenate	Lead arsenate	Plumbous chloride	Lead chloride
Plumbous nitrate	Lead nitrate	Pluracol 245	P,p'-isopropylidenediphenol
Poly-solve B	Ethylene glycol monobutyl ether	Poly-solve E	2-ethoxyethanol
Poly-solve E acetate	2-ethoxyacetate	Polyciser 162	Di-n-octyl phthalate
Polymerised formaldehyde	Paraformaldehyde	Polyoxymethylene glycol	Paraformaldehyde
Polytrin	Cypermethrin	Potassa	Potassium hydroxide
Potassium bichromate	Potassium dichromate	Potassium cyanomercurate	Mercuric potassium cyanide
Potassium hydrate	Potassium hydroxide	Potassium mercuriiodide	Mercury potassium iodide
Potassium oxymuriate	Potassium chlorate	Potato alcohol	Ethanol
Potcrate	Potassium chlorate	PPD	P-phenylenediamine
Prop-2-en-1-AL	Acrylic aldehyde	Propaldehyde	Propionaldehyde
Propane	LPG	Propanenitrile, 2-hydroxy-2-methyl	Acetone cyanohydrin

Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)	Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)
Propanone	Acetone	Propenal	Acrylic aldehyde
Propeneamide	Acrylamide	Propenenitrile	Acrylonitrile
Propenoic acid	Acrylic acid	Propenoic acid amide	Acrylamide
Propenoic acid methyl ester	Methyl acrylate	Propenyl alcohol	Allyl alcohol
Propional	Propionaldehyde	Propionic aldehyde	Propionaldehyde
Proponaldehyde	Propionaldehyde	Propyl carbinol	N-butyl alcohol
Propyl hydride	LPG	Propyl methanol	N-butyl alcohol
Propyl oxirane	1,2-butylene oxide	Protium	Hydrogen
Prussic acid	Hydrogen cyanide	Pseudocumene	1,2,4-trimethylbenzene
Psi-cumene	1,2,4-trimethylbenzene	Pyrocatechinic acid	Catechol
Pyrocatechol	Catechol	Pyrofax	Butane
Pyroligneous acid	Acetic acid	Pyroxylic spirits	Methanol
Quick lime	Calcium oxide	Quicksilver	Mercury
Quinolin	Quinoline	Quintox	Dieldrin
R 600	Butane	Rafex	Dinitro-o-cresol
Ramp	Ethylene glycol	Rat-tu	Napthylthiourea
Ratol	Zinc phosphide	Rattrack	Napthylthiourea
Red chromate of potash	Potassium dichromate	Red mercuric iodide	Mercury iodide
Red shield	Dieldrin	Regulus of antimony	Antimony, solid
Resotropin	Hexamine	Rhenogran ETU	Ethylenethiourea
Rhenosorb C	Calcium oxide	Rhenosorb F	Calcium oxide
Rhyuno oil	Safrole	Rikabanol	P,p'-isopropylidenediphenol
Ripcord	Cypermethrin	Robac 22	Ethylenethiourea
Rodeo	Glyphosate	Rondo	Glyphosate
Rotox	Methyl bromide	Round-up	Glyphosate
Rumetan	Zinc phosphide	Rycopal	Cypermethrin
Safrene	Safrole	Salfie	Aluminium oxide
Salt of saturn	Lead acetate	Sanceller 22	Ethylenethiourea
Sancticizer 160	Butylbenzyl phthalate	Sand acid	Fluorosilicic acid
Santaphen 20	Pentachlorophenol	Santar	Mercury (ii) oxide
Sarolex	Diazinon	Scheeles green	Copper arsenite
Secondary propyl alcohol	Isopropyl alcohol	Seedrin	Aldrin
Seleninyl chloride	Selenium oxychloride	Selenious acid, disodium salt	Sodium selenite
Selenium chloride oxide	Selenium oxychloride	Selenium fluoride	Selenium hexafluoride
Sentry	Calcium hypochlorite	Sewer gas	Hydrogen sulfide
Shell mibk	Methyl isobutyl ketone	Sherpa	Cypermethrin
Shikomol	Safrole	Silicic acid, disodium salt	Sodium metasilicate
Silicofluoric acid	Fluorosilicic acid	Sinox	Dinitro-o-cresol
Siperin	Cypermethrin	Skekg	Epichlorohydrin
Skellysolve B	Hexane	Smeesana	Napthylthiourea
Soda niter	Sodium nitrate	Sodium acid sulfate	Sodium bisulphate
Sodium bichromate	Sodium dichromate	Sodium dioxide	Sodium peroxide
Sodium hydrogen sulfate	Sodium bisulphate	Sodium metasilicate pentahydrate	Sodium metasilicate
Sodium pyrosulfate	Sodium bisulphate	Sodium superoxide	Sodium peroxide
Soilgrin	Aldrin	Solo san soo	Potassium permanganate
Solozone	Sodium peroxide	Solvanol	Diethyl phthalate
Solvulose	2-ethoxyethanol	Sonac	Phosphoric acid
Sonic	Glyphosate	Soxinol 22	Ethylenethiourea
Spasor	Glyphosate	Spectricide	Diazinon
Spirit of hartshorn	Ammonia	Spirits of salt	Hydrochloric acid
Spirits of wine	Ethanol	Steara pbq	P-quinone
Stibium	Antimony, solid	Sting	Glyphosate
Stink damp	Hydrogen sulfide	Stutox	Zinc phosphide
Styrolene	Styrene monomer	Styropor	Styrene monomer
Sugar of lead	Lead acetate	Sulfonated alkyl benzene, sodium salt	Sodium alkylbenzene sulfonates
Sulfuretted hydrogen	Hydrogen sulfide	Sulfuric acid diethyl ester	Diethyl sulphate
Sulfuric chlorohydrin	Chlorosulphonic acid	Sulfurous acid anhydride	Sulphur dioxide
Sulfurous oxide	Sulphur dioxide	Sulphocarbonic anhydride	Carbon disulphide
Sulphur hydride	Hydrogen sulfide	Sulphuret of carbon	Carbon disulphide
Superlysoform	Formaldehyde	Superoxol	Hydrogen peroxide >52%
Surflon-B17	Methanol	Synchlor	Chlordane
T-butanol	Tert-butyl alcohol	T-butyl	Tert-butyl acetate
T-butyl hydroxide	Tert-butyl alcohol	Tar camphor	Napthalene
Task	Dichlorvos	Tatchlor 4	Chlordane

Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)	Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)
Tatuzinho	Aldrin	TCM	Chloroform
TDI	Toluene diisocyanate, mixed isomers	Tecane	Trichloroacetic acid
Tecsol	Ethanol	Tekresol	Cresol
TEL	Tetraethyl lead	Tequinol	Hydroquinone
Terabol	Methyl bromide	Termitox	Dieldrin
Terr-o-gas	Methyl bromide	Tert-butyl methyl ether	Methyl tert-butyl ether
Tetlen	Perchloroethylene	Tetra olive NZG	Anthracene
Tetrachlorocarbon	Carbon tetrachloride	Tetrachloroethylene	Perchloroethylene
Tetrachloromethane	Carbon tetrachloride	Tetrachlorotitanium	Titanium tetrachloride
Tetraethyl plumbane	Tetraethyl lead	Tetrafinol	Carbon tetrachloride
Tetraform	Carbon tetrachloride	Tetramethyl plumbane	Tetramethyl lead
Tetrasol	Carbon tetrachloride	Tetravos	Dichlorvos
Tetrosin OE	O-phenylphenol	Thiocarbamide	Thiourea
Thiomethanol	Methyl mercaptan	Thiomethyl alcohol	Methyl mercaptan
Thorianite	Thorium dioxide	Thorium anhydride	Thorium dioxide
Thorotrast	Thorium dioxide	Three elephant	Boric acid
Tipula	Aldrin	Titanic chloride	Titanium tetrachloride
Titripex 1	Nitrilotriacetic acid	TL1450	Methyl isocyanate
TL337	Ethyleneimine	TL4N	Diethylene glycol
TML	Tetramethyl lead	Toluol	Toluene
Tolylene diisocyanate	Toluene diisocyanate, mixed isomers	Tonox	P,p'-methylenedianiline
Topane	O-phenylphenol	Topclip parasol	Cypermethrin
Topiclor	Chlordane	Toppel	Cypermethrin
Torsite	O-phenylphenol	Toxichlor	Chlordane
Transderm-nitro	Nitroglycerine	Tri(carboxymethyl)glycine	Nitrilotriacetic acid
Tri-brom	Methyl bromide	Tribromoborane	Boron tribromide
Trichloren	Trichloroethylene	Trichloroethene	Trichloroethylene
Triclene	Trichloroethylene	Tricresolum	Cresol
Trielin	Trichloroethylene	Trifluoroborane	Boron trifluoride
Trifluoroboron	Boron trifluoride	Trifluoroboron-diethyl ether complex	Boron trifluoride diethyl etherate
Triglycine	Nitrilotriacetic acid	Triglycollamic acid	Nitrilotriacetic acid
Trikresolum	Cresol	Trilon A	Nitrilotriacetic acid
Trimar	Trichloroethylene	Trimethyl carbinol	Tert-butyl alcohol
Trimethyl methanol	Tertiary butyl alcohol	Trimethylmethanol	Tert-butyl alcohol
Trinitrin	Nitroglycerine	Triplus	Trichloroethylene
Trizinc diphosphide	Zinc phosphide	Troclosene	Dichloroisocyanuric acid
Trona	Boron tribromide	Tumbleleaf	Sodium chlorate
Tumbleweed	Glyphosate	Ucar 17	Ethylene glycol
Ucar bisphenol HP	P,p'-isopropylidenediphenol	Umbrathor	Thorium dioxide
Univerm	Carbon tetrachloride	Unslaked lime	Calcium oxide
Urisol	Hexamine	USAF RH-8	Acetone cyanohydrin
Ustaad	Cypermethrin	Vam	Vinyl acetate
Varioform 1	Ammonium nitrate	Vasoglyn	Nitroglycerine
Velsicol 1068	Chlordane	Velsicol 58-CS-11	Dicamba
Velsicol compound "R"	Dicamba	Vermoestricid	Carbon tetrachloride
Vestrol	Trichloroethylene	Vi-cad	Cadmium chloride
Vinegar acid	Acetic acid	Viniciser 85	Di-n-octyl phthalate
Vinyl benzene	Styrene monomer	Vinyl carbinol	Allyl alcohol
Vinyl cyanide	Acrylonitrile	Vinyl formic acid	Acrylic acid
Vinyl trichloride, beta-T	1,1,2-trichloroethane	Vinylamine	Ethyleneimine
Vinylethylene	1,3-butadiene	Vosol	Acetic acid
Vulcatarol	N-nitrosodiphenylamine	Vultrol	N-nitrosodiphenylamine
Walko tablets	Potassium permanganate	Waterglass	Sodium metasilicate
Wc-reiniger	Phosphoric acid	Weed-RHAP	2,4-d
Weeviltox	Carbon disulphide	Westron	Tetrachloroethane
White arsenic	Arsenic trioxide	White mercury, precipitated	Mercury ammonium chloride
White phosphorus	Phosphorus white	Winterwash	Dinitro-o-cresol
Wood alcohol	Methanol	Wood naptha	Methanol
Wood preservative	Pentachlorophenol	Wood spirit	Methanol
Woodtreat	Pentachlorophenol	Yaltox	Carbofuran
Yellow phosphorus	Phosphorus white	Zaclondiscoids	Hydrogen cyanide
Zesett	Vinyl acetate	Zinc butter	Zinc chloride
Zinc chloride, anhydrous	Zinc chloride	Zinc dicyanide	Zinc cyanide
Zinc dinitrate	Zinc nitrate	Zinc dioxide	Zinc peroxide

Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)	Brand name, abbreviation or common name	Synonym, chemical name or active ingredient (as listed in substance ratings sheet)
Zinc hexafluorosilicate	Zinc fluorosilicate	Zinc powder	Zinc
Zinc silicofluorate	Zinc fluorosilicate	Zintrac	Zinc chloride
ZP	Zinc phosphide	ZPO	Zinc peroxide
Zytox	Methyl bromide		

Appendix C: Rating Guide

1 Introduction

Assigning hazard ratings to hazardous substances is an essential part of undertaking a HFSP evaluation. The user has four options for undertaking hazard ratings:

1 Find substance in Appendix B/ the HFSP Calculation Sheet (limited number only). 2 Obtain HSNO Classification (will only gradually become available) and refer to Appendix A. 3 Use default ratings: • Fire/Explosion – Medium • Human Health – Medium • Environment – High	Hazard rating is supplied
4 Research Hazard Rating according to the instructions in this rating guide.	Hazard rating must be developed by user

This guide provides assistance with carrying out Option 4.

2 Researching and developing a HFSP Hazard Rating

Rating a substance for HFSP purposes can be a complex task, depending on the nature of the substance and the information available, and in most cases it will be easier to apply the default ratings. However, by following the three steps outlined below this is streamlined as much as possible:

Step 1: Sourcing relevant information about a hazardous substance and its effects. In the interest of consistency and accessibility, databases that are freely accessible through the Internet are recommended.

Step 2: Collation of the information into a work sheet (Form 1).

Step 3: Rating of the substance through identifying relevant information and matching it up with applicable rating criteria from Appendix A. A flow chart is provided to assist with this process.

To illustrate how a hazard rating can be undertaken, the example of chlorpyrifos, the active ingredient in some pesticides (e.g. Lorsban) is used. A blank copy of Form 1 is provided at the end of this guide.

It is important to note, however, that information necessary to rate a substance for the HFSP is not always available. In such cases, the default rating for the Effects Group in which data is missing must be applied.

Step 1: Use the information sources in the order listed below to find the necessary substance information

(a) United Nations Recommendations on the Transport of Dangerous Goods (11th ed)

The UNRTDG book lists substances that have a UN Class and UN Number assigned to it. It is available in hard copy for purchase. As an alternative, the NZ Standard 5433:1999 Code of Practice for the Transport of Dangerous Goods on Land[10] may be used as it provides essentially the same information as the UNRTDG book.

Use instructions

Substances are listed alphabetically (see Alphabetical Index of Substances and Articles), and by UN Number (see Dangerous Goods Lists). Note that not every substance has a UN classification, hence may not be listed in this document.

Search results:	No entry under 'chlorpyrifos'.

(b) TOXNET Toxicology Data Network (http://toxnet.nlm.nih.gov/)

This website provides free access to a number of databases with chemical, toxicological and ecotoxicologial information.[11]

Use instructions

The first access point is ChemIDplus (see 'Search Databases' on the left of the screen – note that some browsers may display an intermediary screen asking for the display format for chemical structures. Choose "Chime" and submit). The search function accepts chemical names, CAS Registry Numbers and chemical formulas. (Note that the 'Structure Input Box' must be fully loaded before the search can begin.) A range of choices will appear at the top of the page to select the wanted information:

- Entire record – provides the CAS Number and a list of synonyms.
- Notes – gives basic information on the nature of the substance
- **Locator codes** – provides a choice of databases available for consultation. The information required for assigning a hazard rating will be found in one of the databases listed here.

[10] Or the corresponding IMDG or IATA documents.

[11] A number of other databases listed in the bibliography are also useful but are only available for purchase.

Of the databases displayed under Locator Codes on the left side of the screen, the following are recommended (in order of usefulness):

- **HSDB** – provides comprehensive information about a substance, including ecotoxicology data if available and in-depth human toxicology information (but often no LD_{50} information). Sections of relevance to HFSP rating are:

Synonyms and Identifiers

Chemical/Physical Properties

Human health Effects (Human Toxicity Excerpts)

Animal Toxicity Studies (Non-Human Toxicity Excerpts)

- **EPA ENVIROFACTS** – provides a hyperlink to the Environmental Defence Fund's **Chemical Scorecard**, which in turn provides hyperlinks to the **IPCS International Chemical Safety Card** and **New Jersey Fact Sheets**.
- **ATSDR Toxicology Profiles** – provides extensive information on human health effects (including LD_{50} data) and information on chemical/physical properties of the substance, downloadable as .pdf files.
- **EXTOXNET** – provides comprehensive information on the human health and ecotoxic effects of pesticides.
- **IRIS** – provides basic information about health effects.

Search results: Data are listed in Form 1 below (Step 2).

Step 2: Assemble substance information

Form 1 lists the data points necessary to assign hazard ratings to hazardous substances for the purposes of the HFSP. It is not always possible or indeed necessary to find all the information listed. For example, a single LD_{50} value is generally sufficient to assign a Human Health Hazard Rating. Where no information at all is found that is relevant for an Effects Type the default rating for that Effects Group should be assigned.

If a range of data points is available – usually for toxicity and ecotoxicity information where data points for different species may be supplied – it is important to choose the most stringent value to ensure that the precautionary approach adopted by the HFSP is reflected. For example, if the substance is shown to have an LD_{50} value for mice of 50 mg/l and an LD_{50} of 300 mg/l for rabbits, the lower value (for mice) must be selected.

Form 1: Substance Information			Source
Name		Chlorpyrifos	
CAS Number		2921-88-2	EXTOXNET
UN Number		2783 (Organophosphorus pesticide, solid, toxic)	UNRTDG
UN Class		6.1	UNRTDG
UN Packaging Group		Not specified	
Specific Gravity		1.398	EXTOXNET
Boiling Point		–	
Flash Point		Greater than 200^{o}C	EXTOXNET
Vapour Pressure		1.87 x 10^{-5} mm Hg @ 20^{o}C	EXTOXNET
Toxicity Data	LD_{50} (Oral)	82–270 mg/l *(rats)* 60 mg/l *(mice)*	EXTOXNET
	LD_{50} (Dermal)	> 2,000 mg/l *(rats)*	EXTOXNET
	LC_{50} (Gas Inhalation Toxicity)	–	
	LC_{50} (Vapour Inhalation Toxicity)	–	
	LC_{50} (Dust/Mist Inhalation Toxicity)	–	
Ecotoxicity Data	LC_{50} Fish (96 hours)[12]	0.0071–0.051 mg/l *(rainbow trout)*	EXTOXNET
	EC_{50} Crustacean (48 hours)	–	
	EC_{50} Algae/aquatic plant (72 hours)	–	
	NOEC Fish/Crustacean/Algae/Aquatic Plant[13]	–	
	BCF (Bioconcentration Factor)[14]	2.50–3.54	
	Log K_{ow}	–	
	BOD_5[15]	–	
	COD	–	

Step 3: Evaluate substance

The Evaluation Flow Chart assists with the systematic evaluation of the data recorded in Form 1 by matching up the rating criteria provided in Appendix A with the substance information. It is important to note that substances have to be evaluated for **all** hazards – for example, a substance may be flammable and toxic and ecotoxic, hence the entire flow chart must be worked through systematically.

---

12 LC_{50} and EC_{50} values measure *acute* aquatic toxicity.

13 NOEC measure *chronic* aquatic toxicity.

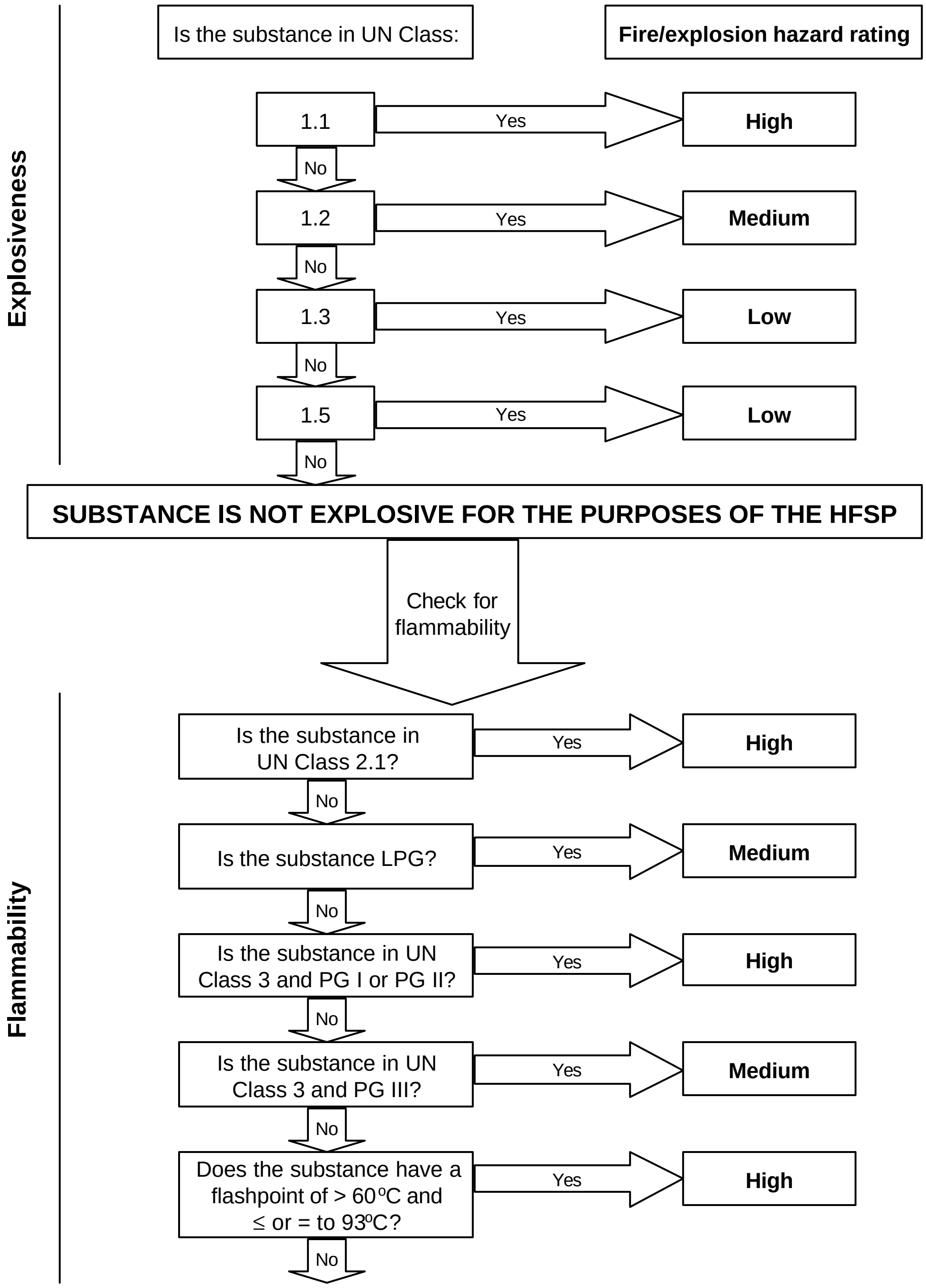
14 BCF and log K_{ow} measure whether a substance is bioaccumulative. A BCF of greater than or equal to 500 or the log K_{ow} of greater than or equal to 4 is indicative of bioaccumulation.

15 BOD_5 and COD measure whether a substance is readily degradable. Refer to HSNO Regulations for further detail.

Using the example of chlorpyrifos, the following hazard rating emerges:

- Explosiveness: None – not a Class 1 substance.
- Flammability: None – not a Class 3 substance; flashpoint is very high.
- Oxidising capacity: None – not a Class 5 substance.
- Toxicity: **Medium** (Human Health Effects Type)
- Corrosiveness: None – not a Class 8 substance.
- Ecotoxicity: **High** (Environment Effects Type)

Hazard rating flow chart



What classification and properties apply to the substance?

- Listed in the UNRTDG (11th ed), Section 2.3.1.4 as a liquid desensitised explosive, and
- UN Class 3, and
- PG I or PG II or PG III?

Yes → **High**

No ↓

- Formed from an explosive in UN Class 1 by adding a desensitising agent so that it forms a liquid that no longer meets the criteria of UN Class 1, but
- not listed in the UNRTDG (11th ed)?

Yes → **High**

No ↓

- Readily combustible solid or a solid that may cause fire through friction, and
- UN Class 4.1(a), and
- PG II?

Yes → **Medium**

No ↓

- Readily combustible solid or a solid that may cause fire through friction, and
- UN Class 4.1(a), and
- PG III?

Yes → **Low**

No ↓

- Self-reactive, and
- UN Class 4.1(b), and
- Type A or Type B?

Yes → **High**

No ↓

- Self-reactive, and
- UN Class 4.1(b), and
- Type C or Type D?

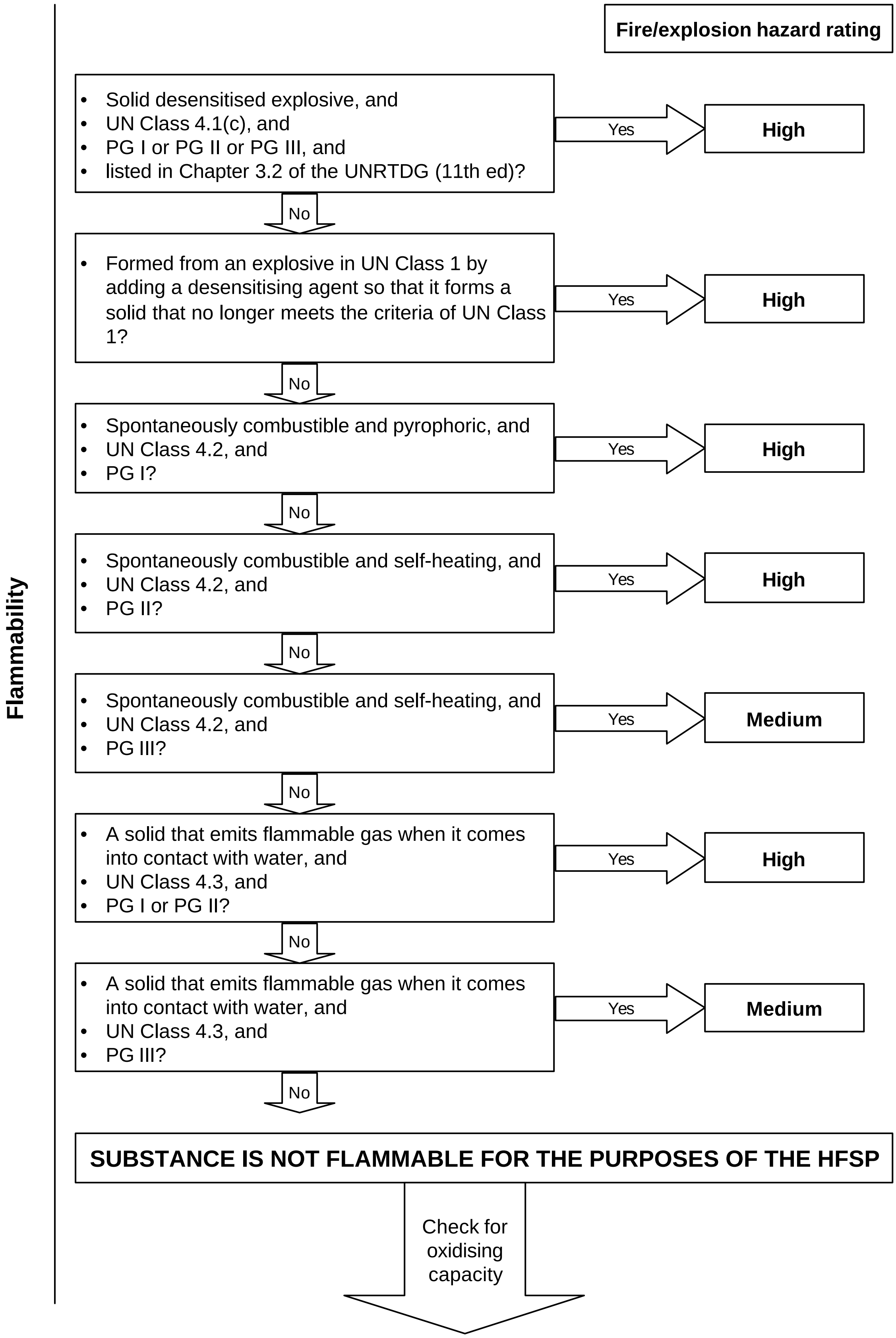
Yes → **Medium**

No ↓

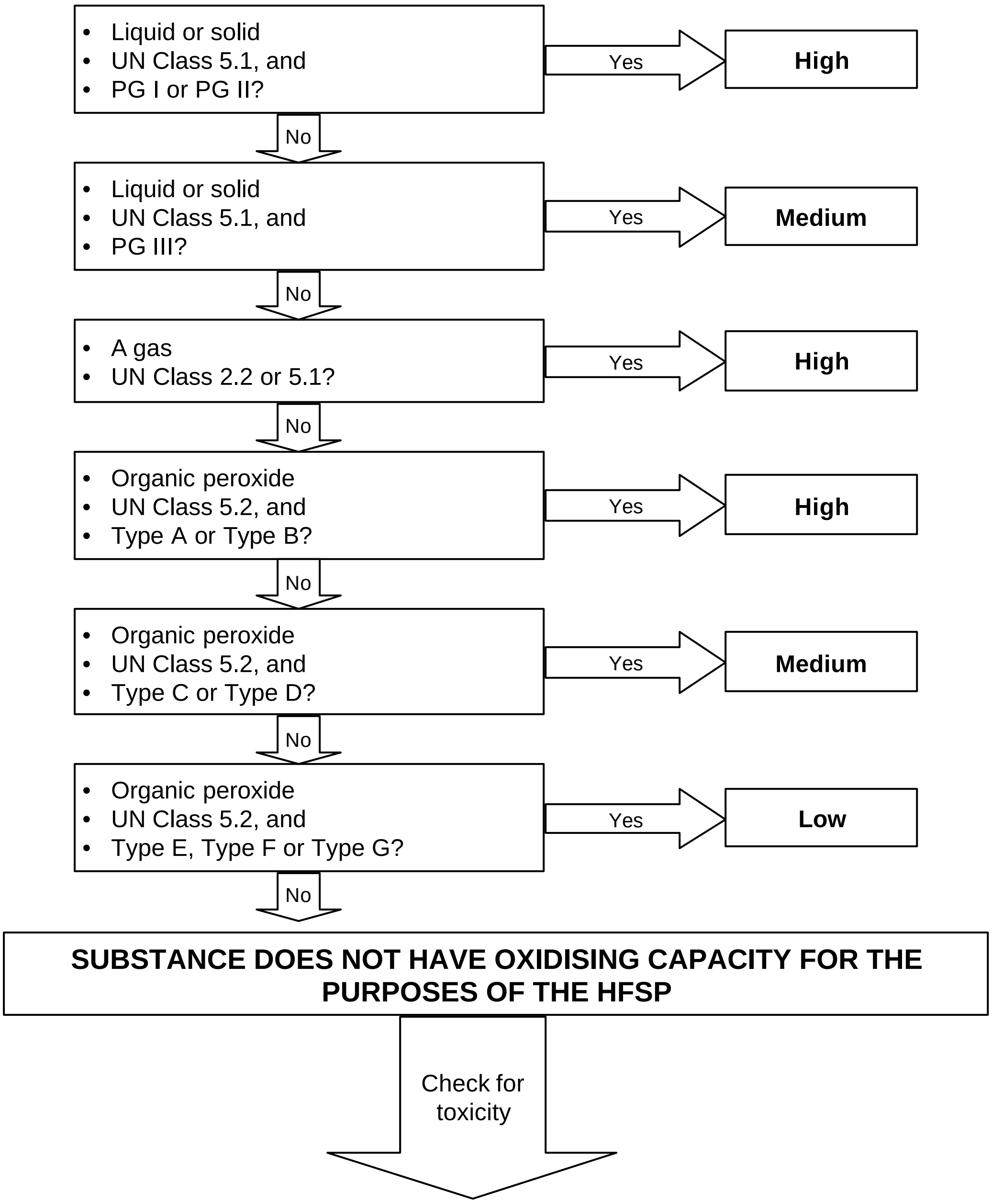
- Self-reactive, and
- UN Class 4.1(b), and
- Type E or Type F?

Yes → **Low**

No ↓


Flammability
Fire/explosion hazard rating
• Solid desensitised explosive, and
• UN Class 4.1(c), and
• PG I or PG II or PG III, and
• listed in Chapter 3.2 of the UNRTDG (11th ed)?
Yes
High
No
• Formed from an explosive in UN Class 1 by adding a desensitising agent so that it forms a solid that no longer meets the criteria of UN Class 1?
Yes
High
No
• Spontaneously combustible and pyrophoric, and
• UN Class 4.2, and
• PG I?
Yes
High
No
• Spontaneously combustible and self-heating, and
• UN Class 4.2, and
• PG II?
Yes
High
No
• Spontaneously combustible and self-heating, and
• UN Class 4.2, and
• PG III?
Yes
Medium
No
• A solid that emits flammable gas when it comes into contact with water, and
• UN Class 4.3, and
• PG I or PG II?
Yes
High
No
• A solid that emits flammable gas when it comes into contact with water, and
• UN Class 4.3, and
• PG III?
Yes
Medium
No
SUBSTANCE IS NOT FLAMMABLE FOR THE PURPOSES OF THE HFSP
Check for oxidising capacity

What classification and properties apply to the substance?



Human health hazard

Toxicity

What classification and properties apply to the substance?

- UN Class 6.1
- PG I or PG II, or
- UN Class 2.3, and/or
- Oral toxicity $LD_{50} \leq 50$ mg/kg and/or
- Dermal toxicity $LD_{50} \leq 200$ mg/kg and/or
- Inhalation toxicity (gas) $LC_{50} \leq 500$ ppm and/or
- Inhalation toxicity (vapour) $LC_{50} \leq 2.0$ mg/l and/or
- Inhalation toxicity (dust/mite) $LC_{50} \leq 0.5$ mg/l

Yes → **High**

No ↓

- UN Class 6.1
- PG III, or
- UN Class 2.3, and/or
- Oral toxicity $LD_{50} > 50$ mg/kg and ≤ 300 mg/kg and/or
- Dermal toxicity $LD_{50} > 200$ mg/kg and ≤ 1000 mg/kg and/or
- Inhalation toxicity (gas) $LC_{50} > 500$ ppm and ≤ 2500 ppm and/or
- Inhalation toxicity (vapour) $LC_{50} > 2.0$ mg/l and ≤ 10.0 mg/l and/or
- Inhalation toxicity (dust/mite) $LC_{50} > 0.5$ mg/l and ≤ 1.0 mg/l

Yes → **Medium**

No ↓

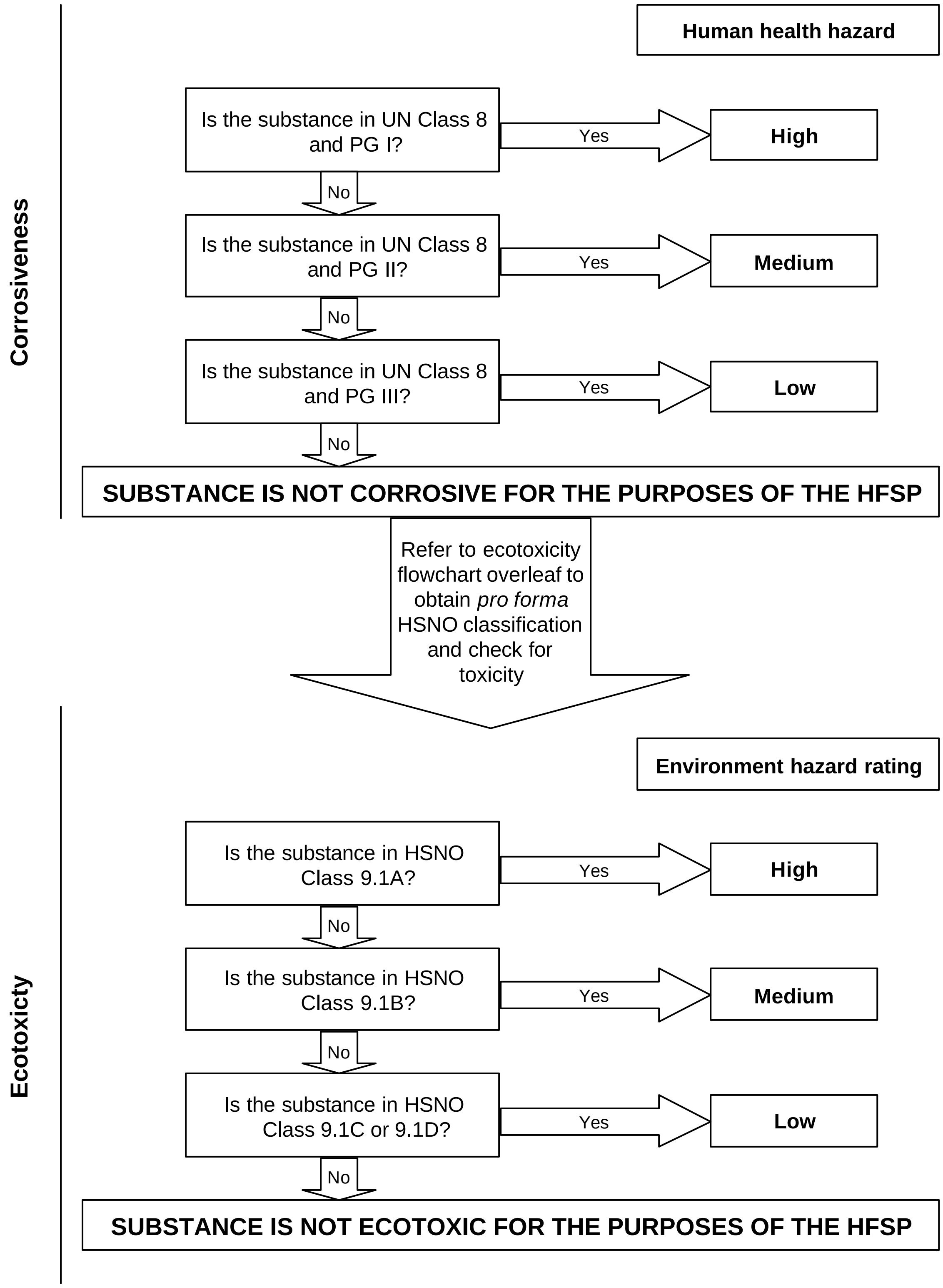
- A standard poison under the Toxic Substances Regulations and/or
- Oral toxicity $LD_{50} > 300$ mg/kg and ≤ 2000 mg/kg and/or
- Dermal toxicity $LD_{50} > 1000$ mg/kg and ≤ 2000 mg/kg and/or
- Inhalation toxicity (gas) $LC_{50} > 2500$ ppm and ≤ 5000 ppm and/or
- Inhalation toxicity (vapour) $LC_{50} > 10$ mg/l and ≤ 20 mg/l and/or
- Inhalation toxicity (dust/mite) $LC_{50} > 1.0$ mg/l and ≤ 5.0 mg/l

Yes → **Low**

No ↓

SUBSTANCE IS NOT TOXIC FOR THE PURPOSES OF THE HFSP

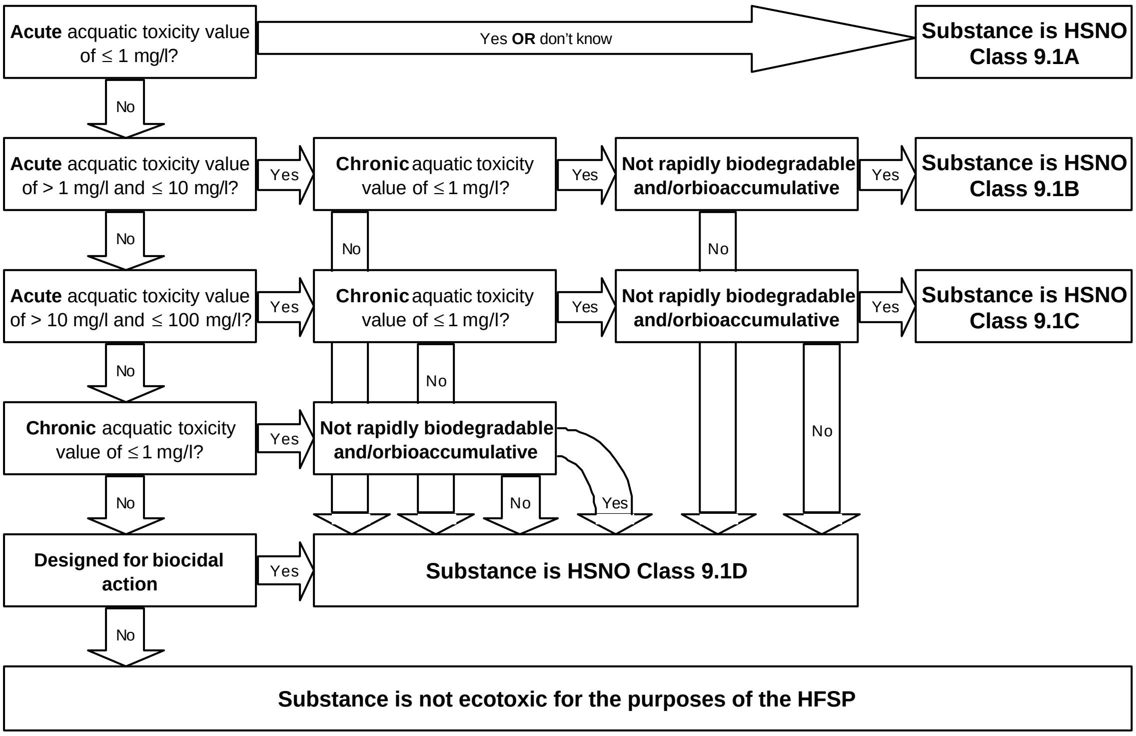
↓ Check for corrosiveness


Human health hazard
Corrosiveness
Is the substance in UN Class 8 and PG I?
Yes
High
No
Is the substance in UN Class 8 and PG II?
Yes
Medium
No
Is the substance in UN Class 8 and PG III?
Yes
Low
No
SUBSTANCE IS NOT CORROSIVE FOR THE PURPOSES OF THE HFSP
Refer to ecotoxicity flowchart overleaf to obtain pro forma HSNO classification and check for toxicity
Environment hazard rating
Ecotoxicty
Is the substance in HSNO Class 9.1A?
Yes
High
No
Is the substance in HSNO Class 9.1B?
Yes
Medium
No
Is the substance in HSNO Class 9.1C or 9.1D?
Yes
Low
No
SUBSTANCE IS NOT ECOTOXIC FOR THE PURPOSES OF THE HFSP

Ecotoxicity flowchart

Acute aquatic toxicity is measured by:	• LC_{50} (any fish species) (96 hours) and/or • EC_{50} (any crustacean species) (48 hours) and/or • EC_{50} (any aquatic algae or plant species) (72 hours)
Chronic aquatic ecotoxicity is measured by:	• NOEC (any fish, crustacean or aquatic algae or plant species)
Degradability and bioaccumulation may be measured by:	• BCF (Bioconcentration Factor) and/or • log K_{ow}.

Which ecotoxic properties apply?



Note: If information is not known or not given, follow YES arrow.

Form 1: Template

Form 1: Substance Information			Source
	Name CAS Number UN Number UN Class UN Packaging Group Specific Gravity Boiling Point Flash Point Vapour Pressure	 mm Hg @ 20°C	
Toxicity Data	LD_{50} (Oral) LD_{50} (Dermal) LC_{50} (Gas Inhalation Toxicity) LC_{50} (Vapour Inhalation Toxicity) LC_{50} (Dust/Mist Inhalation Toxicity)	mg/l *(species)* mg/l *(species)* ppm *(species)* ppm *(species)* ppm *(species)*	
Ecotoxicity Data	LC_{50} Fish (96 hours)[16] EC_{50} Crustacean (48 hours) EC_{50} Algae/aquatic plant (72 hours) NOEC Fish/Crustacean/Algae/Aquatic Plant[17] BCF (Bioconcentration Factor)[18] Log K_{ow} BOD_5[19] COD	mg/l *(species)* mg/l *(species)* mg/l *(species)* mg/l *(species)*	

16 LC_{50} and EC_{50} values measure *acute* aquatic toxicity.

17 NOEC measure *chronic* aquatic toxicity.

18 BCF and K_{ow} measure whether a substance is bioaccumulative. A BCF of greater than or equal to 500 or the log K_{ow} of greater than or equal to 4 is indicative of bioaccumulation.

19 BOD_5 and COD measure whether a substance is readily degradable. Refer to HSNO Regulations for further detail.

Appendix D: Spreadsheet for HFSP Calculations

Applicant number	
Applicant	
Contact name	
Postal address	
Site address	
Phone number	
Fax number	
E-mail	
Comment	

Ref No.	Substances on this site	CAS no.	Effect type	Hazard rating	Base quantity	Form	Distance to boundary less than 30 m? Yes/No	Adjacent to water? Yes/No	Type of activity A/Ground B/Ground use	FF	FH	FE	Product of adjustment factors	Adjusted quantity A	Proposed quantity	Fire/ explosion quantity ratio FQ	Human health quantity ratio HQ	Environ-ment quantity ratio EQ
1			Fire/explosion Human health Environment															
2			Fire/explosion Human health Environment															
3			Fire/explosion Human health Environment															
4			Fire/explosion Human health Environment															
5			Fire/explosion Human health Environment															
6			Fire/explosion Human health Environment															
7			Fire/explosion Human health Environment															
8			Fire/explosion Human health Environment															
9			Fire/explosion Human health Environment															

Appendix E: Case Studies

Case Study 1: A galvanising business in a heavy industrial area

This example applies the HFSP to a proposed galvanising business in a heavy industrial area, close to a stream, to find out if the application requires a land use consent for the use of hazardous substances. The activity will include the use of baths of hydrochloric acid and molten zinc.

Step 1: Describe hazardous substances likely to determine consent status

List the substances proposed to be used or stored on the site which are likely to determine the consent status.

Comment

The HFSP has been calibrated on the weight of the pure substance (except for compressed gases, which are measured in cubic metres). Therefore, volumes need to be converted to weights, using the specific gravity, or density, of the substance. For mixtures, the weight of the pure substance is derived from its relative percentage in the mixture. However, it should be remembered that there are some cases where the substance rating already accounts for the dilution, notably for substances with corrosive properties, oxidising capacity and some toxic substances, in particular those used as pesticides.

In this case study, ammonium hydroxide containing more than 10% but less than 35% of ammonia in solution has a specific gravity of 0.89. Hydrogen peroxide is also classified according to concentration, while a 33% hydrochloric acid solution is generally regarded as commercial strength, and this concentration would rarely be exceeded. Consequently, no dilution factor needs to be applied, and the conversion of litres to tonnes yields the following weights.

Substance	Litres	Specific gravity	Tonnes
Hydrochloric acid [33%]	3000	1.19	3.57
Hydrogen peroxide [70%]	25	1.29	0.032
Ammonium hydroxide [30%]	25	0.89	0.022

The substance list can be presented in a simple format, as follows.

Name	Quantity (tonnes or cubic metres)	Form (liquid, powder, solid, gas)	Location
Hydrochloric acid [33%]	3.57 t	Liquid	Inside, < 30 m from boundary
Hydrogen peroxide [70%]	0.032 t	Liquid	Inside, < 30 m from boundary
Ammonium hydroxide [30%]	0.022 t	Liquid	Inside, < 30 m from boundary
Sodium hydroxide	1 t	Solid	Inside, < 30 m from boundary
Zinc ammonium chloride	1 t	Solid	Inside, < 30 m from boundary

Step 2: Identify hazard rating

Use the information recorded in Appendix B or the rating criteria in Appendix A to find the Effect Types and corresponding hazard ratings for the substances being assessed, and note them in a table as shown below.

Name	Hazard rating		
	Fire/explosion effect type	Human health effect type	Environment effect type
Hydrochloric acid [33%]	–	High	Low
Hydrogen peroxide [70%]	High	Medium	–
Ammonium hydroxide [30%]	–	Medium	High
Sodium hydroxide	–	Medium	–
Zinc ammonium chloride	–	–	–

Comment

The rating of substances for the purposes of the HFSP is done according to the criteria in Appendix A. For some commonly used substances the rating has already been established, and these are provided in Appendix B.

It is noted that, in terms of the application of the HFSP, the assessment of hydrochloric acid alone would have indicated the need for a land use consent. In this instance the HFSP would not need to be applied to other substances.

Step 3: Find base quantities

Use Table 3 in the main document to find the Base Quantities for each substance and record in a table, as below.

Name	Base quantity (tonnes or litres)		
	Fire/explosion effect type	Human health effect type	Environment effect type
Hydrochloric acid [33%]	–	1	100
Hydrogen peroxide [70%]	1	10	–
Ammonium hydroxide [30%]	–	10	3
Sodium hydroxide	–	10	–
Zinc ammonium chloride	–	–	–

Step 4: Calculate adjusted quantity by multiplying base quantities with adjustment factors

Refer to Table 4 in the main document to find the Adjustment Factors. This needs to be done in two steps:

1 listing the values for individual Adjustment Factors for the applicable Effect Types; and

2 multiplying the individual factors to obtain one overall Adjustment Factor for each Effect Type.

Comment

The choice of Adjustment Factors depends on substance and site-specific aspects. In this case, no separation distance to the site boundary is greater than 30 metres. This influences the choice of Adjustment Factor FF3 for the Fire/Explosion Effect Type. Although the Human Health Effect Type also includes an Adjustment Factor for separation distance, this is only applicable to gases to account for the effects of toxic gases on human health. Also of interest is the proximity of a stream, which influences the choice of Adjustment Factor FE2 for the Environmental Effect Type. Finally, all substances are stored above ground with the exception of the hydrochloric acid and the molten zinc (zinc ammonium chloride), which is constantly in use.

Record the Adjusted Quantities in a table such as the one below.

Name	Adjusted quantity (tonnes or litres)		
	Fire/explosion effect type	Human health effect type	Environment effect type
Hydrochloric acid [33%]	–	0.3	9
Hydrogen peroxide [70%]	1	10	–
Ammonium hydroxide [30%]	–	10	0.9
Sodium hydroxide	–	30	–
Zinc ammonium chloride	–	–	–

Step 5: Calculate quantity ratios

Calculation of Quantity Ratios requires dividing the Proposed Quantity of a substance by the Adjusted Threshold for each Effect Type. Record the results in a table, as shown below.

Name	Quantity ratio (QR)		
	Fire/explosion effect type	Human health effect type	Environment effect type
Hydrochloric acid [33%]	–	11.900	0.3967
Hydrogen peroxide [70%]	0.0320	0.003	–
Ammonium hydroxide [30%]	–	0.003	0.0356
Sodium hydroxide	–	0.033	–
Zinc ammonium chloride	–	–	–
Total QR	**0.0320**	**11.939**	**0.4323**

Step 6: Determine the proposal’s consent status

Select the highest Total Quantity Ratio of the three Effect Types and compare it with the ratios in the Consent Status Matrix to see whether the facility requires a resource consent. If the Quantity Ratio for one or more of the Effect Type exceeds the index for the zone where the facility is proposed, a resource consent will be required.

Discussion

Largely as a result of the large quantity of hydrochloric acid used on the site, the Quantity Ratios for the Human Health Effect Type is greater than the consent status index generally set for industrial areas. The proposed development would therefore require a resource consent.

A sample sheet showing the above calculations as carried out with the HFSP Spreadsheet Calculation Package is provided below.

Applicant Contact name		Case Study No. 1 A galvanising business in a heavy industrial area																
Ref No.	**Substances on this site**	**CAS no.**	**Effect type**	**Hazard rating**	**Base quantity**	**Form**	**Distance to boundary less than 30 m? Yes/No**	**Adjacent to water? Yes/No**	**Type of activity A/Ground B/Ground use**	**FF**	**FH**	**FE**	**Product of adjustment factors**	**Adjusted quantity A**	**Proposed quantity**	**Fire/ explosion quantity ratio FQ**	**Human health quantity ratio HQ**	**Environ-ment quantity ratio EQ**
1	**Hydrochloric acid** (concentrated solution)	7647-01-0	Fire/explosion	–	–	Liquid	y		u						3.570			
			Human health	High	1					1.00	1.00	0.30	0.3	0.30			11.9000	
			Environment	Low	100			y		1.00	0.3	0.30	0.09	9.00				0.3967
2	**Hydrogen peroxide >52%**	7722-84-1	Fire/explosion	High	1	Liquid	y		a	1.00	1.00	1.00	1	1.00	0.032	0.0320		
			Human health	Medium	10					1.00	1.00	1.00	1	10.00			0.0032	
			Environment	–	–			y										
3	**Ammonia solution (<35%)**	1336-21-6	Fire/explosion	–	–	Liquid	y		a						0.032			
			Human health	Medium	10					1.00	1.00	1.00	1	10.00			0.0032	
			Environment	High	3			y		1.00	0.3	1.00	0.3	0.90				0.0356
4	**Sodium hydroxide**	1310-73-2	Fire/explosion	–	–	Solid	y		a						1.000			
			Human health	Medium	10					3.00	1.00	1.00	3	30.00			0.0333	
			Environment	–	–			y										
5	**Zinc ammonium chloride**	52628-25-8	Fire/explosion	–	–	Solid	y		u						1.000			
			Human health	–	–													
			Environment	–	–			y										
Total quantity ratios																**0.0320**	**11.9397**	**0.4322**

Case Study 2: A panel-beating and spray-painting shop in a commercial area

This example uses a moderately sized panel-beating and spray-painting facility in a commercial area to demonstrate the HFSP. The storage of degreasers, thinners and paints is the major aspect of this operation. The facility is not near a water body.

Step 1: Describe hazardous substances likely to determine consent status

List the substances proposed to be used or stored on the site which are likely to determine the consent status.

Comment

For most substances in this case study, the proprietary name is not known, and information is only available with respect to the generic properties of the substances. For this reason, the paints (solvent-based) are conservatively assumed to be both flammable and corrosive. The degreaser has been rated according to the general properties of solvents. As organic solvents generally have a specific gravity of less than 1, an averaged specific gravity value of 0.75 has been assigned for conversion purposes. The thinner, including the waste thinner, has been rated on the basis of its main component xylene.

As the specific gravity of the paints is not known, the conversion of proposed quantities is based on an estimated specific gravity of 1.

The substance list can be presented in a simple format such as the following.

Name	Quantity (tonnes or cubic metres)	Form (liquid, powder, solid, gas)	Location
Degreaser (solvent)	0.015 t	Liquid	Inside, < 30 m from boundary
Thinner (xylene based)	0.1 t	Liquid	Inside, < 30 m from boundary
Waste thinner (xylene based)	0.05 t	Liquid	Inside, < 30 m from boundary
Lacquer paints	0.1 t	Liquid	Inside, < 30 m from boundary
Enamel paints	0.06 t	Liquid	Inside, < 30 m from boundary
Fibreglass resin (styrene)	0.01 t	Solid	Inside, < 30 m from boundary
Acetylene	8 m^3	Gas	Inside, < 30 m from boundary
Oxygen	8 m^3	Gas	Inside, < 30 m from boundary

Step 2: Identify hazard rating

Use the information recorded in Appendix B or the rating criteria in Appendix A to find the Effect Types and corresponding hazard ratings for the substances being assessed, and note them in a table such as the one below.

Name	**Hazard rating**		
	Fire/explosion effect type	**Human health effect type**	**Environment effect type**
Degreaser (solvent)	*Medium*	*Medium*	*High*
Thinner (xylene based)	Medium	Low	–
Waste thinner	Medium	Low	–
Lacquer paints	*Medium*	*Medium*	*High*
Enamel paints	*Medium*	*Medium*	*High*
Fibreglass resin (styrene)	Medium	Low	Medium
Acetylene	High	–	–
Oxygen	Medium	–	–

Comment

Because substance specific information for some of the materials used on the site is not available, a precautionary approach in assigning hazard ratings is required. This is represented by a medium hazard ratings for the Fire/Explosion and Human Health Effect Types, and a high hazard rating for the Environmental Effect Type. In the table above, default settings are indicated by *italics.*

Step 3: Find base quantities

Use Table 3 in the main document to find the Base Quantities for each substance and record them in a table such as shown below.

Name	**Base quantity (tonnes or m^3)**		
	Fire/explosion effect type	**Human health effect type**	**Environment effect type**
Degreaser (solvent)	30	10	3
Thinner (xylene based)	30	30	–
Waste thinner	30	30	–
Lacquer paints	30	10	3
Enamel paints	30	10	3
Fibreglass resin (styrene)	30	30	30
Acetylene	10,000	–	–
Oxygen	10,000	–	–

Step 4: Calculate adjusted quantity by multiplying base quantities with adjustment factors

Refer to Table 4 in the main document to find the Adjustment Factors. This needs to be done in two steps:

1 listing the values for individual Adjustment Factors for the applicable Effect Types, and

2 multiplying the individual factors to obtain one overall Adjustment Factor for each Effect Type.

Comment

In this case, no special circumstances apply. The facility is less than 30 metres from the site boundary, and information obtained from the council's district plan shows that the site is not located in the vicinity of a water body. Inquiries at the regional council have ascertained that the facility is not sited near a potable water resource.

Most of the substances used on the site are in liquid form, with the exception of acetylene and oxygen (gases) and fibreglass resin (solid). Although the substances are in use, the amount used represents only a part of the whole quantity. According to the guidance provided in the step-by-step guide to the HFSP, the substances held on the site are therefore regarded as being in storage.

Most Adjustment Factors, except for those relating to substance form in the case of fibreglass and the gases, are therefore set at 1. It should be noted that Adjustment Factor FH2 for the Human Health Effect Type does not apply at all in this case because all substances that have been assigned a hazard level for this Effect Type are either liquids or solids.

Record the Adjusted Quantities in a table as below.

Name	Adjusted quantity (tonnes or cubic metres)		
	Fire/explosion effect type	Human health effect type	Environment effect type
Degreaser (solvent)	30	10	3
Thinner (xylene based)	30	30	–
Waste thinner	30	30	–
Lacquer paints	30	10	3
Enamel paints	30	10	3
Fibreglass resin (styrene)	90	90	90
Acetylene	1000	–	–
Oxygen	1000	–	–

Step 5: Calculate quantity ratios

Calculation of Quantity Ratios requires dividing the Proposed Quantity of a substance by the Adjusted Threshold for each Effect Type. Record this in a table such as the one below.

Name	Quantity ratio (Q)		
	Fire/explosion effect type	Human health effect type	Environment effect type
Degreaser (solvent)	0.0005	0.0015	0.0050
Thinner (xylene based)	0.0033	0.0033	–
Waste thinner	0.0017	0.0017	–
Lacquer paints	0.0033	0.0100	0.0333
Enamel paints	0.0020	0.0060	0.0200
Fibreglass resin (styrene)	0.0001	0.0001	0.0001
Acetylene	0.0027	–	–
Oxygen	0.0027	–	–
Total Q	**0.0163**	**0.0226**	**0.0584**

Step 6: Determine the proposal's consent status

Select the highest Total Quantity Ratio of the three Effect Types and compare it with the ratios in the Consent Status Matrix to see whether the facility requires a resource consent.

If the Quantity Ratio for one or more of the Effect Type exceeds the consent status index for the zone where the facility is proposed, a resource consent will be required.

Discussion

The proposed panel-beating shop has low Quantity Ratios for the Fire/Explosion and Human Health Effect Types. The Quantity Ratio for the Environmental Effect Type is somewhat higher, but still below 0.5, which is a common threshold for permitted activities in industrial zones. A consent may, however, be required for some commercial and all residential and other zones. The spray-painting booth may also require an air discharge consent, depending on regional rules.

A sample sheet showing the above calculations as carried out with the HFSP Spreadsheet Calculation Package is provided on the next page.

Applicant	Case Study No. 2
Contact name	A panel-beating and spraypainting shop in a commercial area

Substances on this site	CAS no.	Effect type	Hazard rating	Base quantity	Form	Distance to boundary less than 30 m? Yes/No	Adjacent to water? Yes/No	Type of activity A/Ground B/Ground use	FF	FH	FE	Product of adjustment factors	Adjusted quantity A	Proposed quantity	Fire/ explosion quantity ratio FQ	Human health quantity ratio HQ	Environ-ment quantity ratio EQ
Generic liquid Degreaser (solvent)	–	Fire/explosion	Medium	30	Liquid	n		a	1.00	1.00	1.00	1	30.00	0.015	0.0005		
		Human health	Medium	10					1.00	1.00	1.00	1	10.00			0.0015	
		Environment	High	3			n		1.00	1.00	1.00	1	3.00				0.0050
Xylene, mixed isomers Xylene-based thinner	1330-20-7	Fire/explosion	Medium	30	Liquid	n		a	1.00	1.00	1.00	1	30.00	0.100	0.0033		
		Human health	Low	30					1.00	1.00	1.00	1	30.00			0.0033	
		Environment	–	–			n										
Xylene, mixed isomers Xylene-based thinner – waste	1330-20-7	Fire/explosion	Medium	30	Liquid	n		a	1.00	1.00	1.00	1	30.00	0.050	0.0017		
		Human health	Low	30					1.00	1.00	1.00	1	30.00			0.0017	
		Environment	–	–			n										
Generic liquid Lacquer paint	–	Fire/explosion	Medium	30	Liquid	n		a	1.00	1.00	1.00	1	30.00	0.100	0.0033		
		Human health	Medium	10					1.00	1.00	1.00	1	10.00			0.0100	
		Environment	High	3			n		1.00	1.00	1.00	1	3.00				0.0333
Generic liquid Enamel paint	–	Fire/explosion	Medium	30	Liquid	n		a	1.00	1.00	1.00	1	30.00	0.060	0.0020		
		Human health	Medium	10					1.00	1.00	1.00	1	10.00			0.0060	
		Environment	High	3			n		1.00	1.00	1.00	1	3.00				0.0200
Styrene monomer Fibreglass resin	100-42-5	Fire/explosion	Medium	30	Solid	n		a	3.00	1.00	1.00	3	90.00	0.010	0.0001		
		Human health	Low	30					3.00	1.00	1.00	3	90.00			0.0001	
		Environment	Medium	30			n		3.00	1.00	1.00	3	90.00				0.0001
Acetylene	74-86-2	Fire/explosion	High	10,000	Gas	n		a	0.10	3.00	1.00	0.3	3,000.00	8.000	0.0027		
		Human health	–	–													
		Environment	–	–			n										
Oxygen	7782-44-7	Fire/explosion	Medium	10,000	Gas	n		a	0.10	3.00	1.00	0.3	3,000.00	8.000	0.0027		
		Human health	–	–													
		Environment	–	–			n										
Total quantity ratios															**0.0163**	**0.0226**	**0.0584**

Case Study 3: A chemical warehouse in an industrial area

In this example, the HFSP is applied to a chemical warehouse proposed for an industrial zone. The warehouse will be used to store a wide range of chemicals, including pesticides. Minor scale mixing and filling of containers may also be carried out in the facility on an occasional basis.

Step 1: Describe hazardous substances likely to determine consent status

List the substances proposed to be used or stored on the site which are likely to determine the consent status.

Comment

For this case study the issue is the large number of substances stored. In accordance with the HFSP, the procedure is carried out on 10 'priority substances'. These are the substances with the most hazardous properties and/or those stored in the largest quantities.

In this context, it is important to remember the necessary conversions of volumes to weights, using the specific gravity, or density, of the substance. In this case, however, no specific gravity for cypermethrin and glyphosate could be found, and an estimated specific gravity of 1 was used for the conversion.

The substance list can be presented in a simple format such as the following.

Name	**Quantity (tonnes or cubic metres)**	**Form (liquid, powder, solid, gas)**	**Location**
Diazinon	1.3 t	Liquid	Inside, > 30 m from boundary
Dichlorvos	0.84 t	Liquid	Inside, > 30 m from boundary
Cypermethrin	0.525 t	Liquid	Inside, > 30 m from boundary
Dicamba	0.72 t	Solid	Inside, > 30 m from boundary
1,1,2 Trichloroethane	3.6 t	Liquid	Inside, > 30 m from boundary
Catechol	0.3 t	Solid	Inside, > 30 m from boundary
Iodine (crude)	2 t	Solid	Inside, > 30 m from boundary
Iodine (solution)	0.2 t	Liquid	Inside, > 30 m from boundary
Phosphoric acid	1 t	Solid	Inside, > 30 m from boundary
Potassium hydroxide	1 t	Solid	Inside, > 30 m from boundary

Step 2: Identify hazard rating

Use the information recorded in Appendix B or the rating criteria in Appendix A to find the Effect Types and corresponding hazard ratings for the substances being assessed, and note them in a table such as the one below.

Name	**Hazard rating**		
	Fire/explosion effect type	**Human health effect type**	**Environment effect type**
Diazinon	Medium	High	High
Dichlorvos	Low	High	High
Cypermethrin	–	Medium	High
Dicamba	–	Low	Low
1,1,2 Trichloroethane	–	High	Low
Catechol	–	Medium	Medium
Iodine (crude)	–	Medium	*High*
Iodine (solution)	–	Medium	*High*
Phosphoric acid	–	Medium	–
Potassium hydroxide	–	Medium	–

Comment

In the case of iodine, no information with respect to environmental effects was found, and the precautionary hazard rating was assigned for this Effect Type only.

Step 3: Find base quantities

Use Table 3 in the main document to find the Base Quantities for each substance and record them in a table such as shown below.

Name	Base quantity (tonnes or m^3)		
	Fire/explosion effect type	Human health effect type	Environment effect type
Diazinon	30	1	3
Dichlorvos	100	1	3
Cypermethrin	–	10	3
Dicamba	–	30	100
1,1,2 Trichloroethane	–	1	100
Catechol	–	10	30
Iodine (crude)	–	10	3
Iodine (solution)	–	10	3
Phosphoric acid	–	10	–
Potassium hydroxide	–	10	–

Step 4: Calculate adjusted quantity by multiplying base quantities with adjustment factors

Refer to Table 4 in the main document to find the Adjustment Factors. This needs to be done in two steps:

1. listing the values for individual Adjustment Factors for the applicable Effect Types, and
2. multiplying the individual factors to obtain one overall Adjustment Factor for each Effect Type.

Comment

The relevant district plan shows that the site is not located in the vicinity of a water body. Inquiries at the regional council have ascertained that the facility is not sited near a potable water resource.

This facility is located on a large site, and the processing and storage areas are more than 30 metres from the site boundary as well as being inside a warehouse. However, in this particular case, the large separation distance to the site boundary does not influence the choice of Adjustment Factors. Separation distance influences Adjustment Factor FF3 for the Fire/Explosion Effect Type, which does not apply to any of the substances stored on the site. For the Human Health Effect Type, separation distance influences Adjustment Factor FH2 only if the substance is a gas. As none of the substances listed are gases, this Adjustment Factor does not apply.

Record the Adjusted Quantities in a table as shown below.

Name	Adjusted quantity (tonnes or m^3)		
	Fire/explosion effect type	Human health effect type	Environment effect type
Diazinon	30	1	3
Dichlorvos	100	1	3
Cypermethrin	–	10	3
Dicamba	–	90	300
1,1,2 Trichloroethane	–	1	100
Catechol	–	30	90
Iodine (crude)	–	30	9
Iodine (solution)	–	10	3
Phosphoric acid	–	30	–
Potassium hydroxide	–	30	–

Step 5: Calculate quantity ratios

Calculation of Quantity Ratios requires dividing the proposed quantity of a substance by the Adjusted Threshold for each Effect Type. Record them in a table such as the one below.

Name	Quantity ratio (QR)		
	Fire/explosion effect type	Human health effect type	Environment effect type
Diazinon	0.0433	1.3000	0.4333
Dichlorvos	0.0084	0.8400	0.2800
Cypermethrin	–	0.0525	0.1750
Dicamba	–	0.0080	0.0024
1,1,2 Trichloroethane	–	3.6000	0.0360
Catechol	–	0.0100	0.0033
Iodine (crude)	–	0.0667	0.2222
Iodine (solution)	–	0.0200	0.0667
Phosphoric acid	–	0.0333	–
Potassium hydroxide	–	0.0333	–
Total QR	**0.0517**	**5.9638**	**1.2189**

Step 6: Determine the proposal's consent status

Select the highest Total Quantity Ratio of the three Effect Types and compare it with the Consent Status Indices to see whether the facility requires a resource consent.

If the Quantity Ratio for one or more of the Effect Types exceeds the consent status index for the zone where the facility is proposed, a resource consent will be required.

Discussion

Based on the calculated Quantity Ratios for the Human Health and Environmental Effect Types, the proposed facility would – on the basis of the 10 substances assessed – require a consent in all zones. Even the large separation distances available in this situation do not decrease the Quantity Ratios as separation distance is only of importance with respect to fire and explosion effects, and in the case of gases for the Human Health Effect Type.

It is noted that, as per the example above, a number of substances on their own would push the Quantity Ratios above the Consent Status Indices. In this instance the HFSP would not need to be applied to all substances.

A sample sheet showing the above calculations as carried out with the HFSP Spreadsheet Calculation Package is provided on the next page.

Applicant		Case Study No. 3																
Contact name		A chemical warehouse in an industrial area																
Ref No.	**Substances on this site**	**CAS no.**	**Effect type**	**Hazard rating**	**Base quantity**	**Form**	**Distance to boundary less than 30 m? Yes/No**	**Adjacent to water? Yes/No**	**Type of activity A/Ground B/Ground use**	**FF**	**FH**	**FE**	**Product of adjustment factors**	**Adjusted quantity A**	**Proposed quantity**	**Fire/ explosion quantity ratio FQ**	**Human health quantity ratio HQ**	**Environ-ment quantity ratio EQ**
1	**Diazinon**	333-41-5	Fire/explosion	Medium	30	Liquid	y		a	1.00	1.00	1.00	1	30.00	1.300	0.0433		
			Human health	High	1					1.00	1.00	1.00	1	1.00			1.3000	
			Environment	High	3			n		1.00	1.00	1.00	1	3.00				0.4333
2	**Dichlorvos**	62-73-7	Fire/explosion	Low	100	Liquid	y		a	1.00	1.00	1.00	1	100.00	0.840	0.0084		
			Human health	High	1					1.00	1.00	1.00	1	1.00			0.8400	
			Environment	High	3			n		1.00	1.00	1.00	1	3.00				0.2800
3	**Cypermethrin**	52315-07-8	Fire/explosion	–	–	Liquid	y		a						0.525			
			Human health	Medium	10					1.00	1.00	1.00	1	10.00			0.0525	
			Environment	High	3			n		1.00	1.00	1.00	1	3.00				0.1750
4	**Dicamba**	1918-00-9	Fire/explosion	–	–	Solid	y		a						0.720			
			Human health	Low	30					3.00	1.00	1.00	3	90.00			0.0080	
			Environment	Low	100			n		3.00	1.00	1.00	3	300.00				0.0024
5	**1,1,2-Trichloro-ethane**	79-00-5	Fire/explosion	–	–	Liquid	y		a						3.600			
			Human health	High	1					1.00	1.00	1.00	1	1.00			3.6000	
			Environment	Low	100			n		1.00	1.00	1.00	1	100.00				0.0360
6	**Catechol**	120-80-9	Fire/explosion	–	–	Solid	y		a						0.300			
			Human health	Medium	10					3.00	1.00	1.00	3	30.00			0.0100	
			Environment	Medium	30			n		3.00	1.00	1.00	3	90.00				0.0033
7	**Iodine** Crude	5553-56-2	Fire/explosion	–	–	Solid	y		a						2.000			
			Human health	Medium	10					3.00	1.00	1.00	3	30.00			0.0667	
			Environment	High	3			n		3.00	1.00	1.00	3	9.00				0.2222
8	**Iodine** Solution	5553-56-2	Fire/explosion	–	–	Liquid	y		a						0.200			
			Human health	Medium	10					1.00	1.00	1.00	1	10.00			0.0200	
			Environment	High	3			n		1.00	1.00	1.00	1	3.00				0.0667
9	**Phosphoric acid**	7664-38-2	Fire/explosion	–	–	Solid	y		a						1.000			
			Human health	Medium	10					3.00	1.00	1.00	3	30.00			0.0333	
			Environment	–	–			n										
10	**Potassium hydroxide**	1310-58-3	Fire/explosion	–	–	Solid	y		a						1.000			
			Human health	Medium	10					3.00	1.00	1.00	3	30.00			0.0333	
			Environment	–	–			n										
Total quantity ratios																**0.0517**	**5.9638**	**1.2189**

Appendix F: Section 32 Explanation

1 Introduction

This report documents the development of the Hazardous Facility Screening Procedure from its origin to its current form.

In early 1991, the Auckland City Council began the development of its District Plan. As part of this process, the Council adopted a new, effects-based approach to the management of hazardous substances to better reflect the philosophy of the Resource Management Act 1991 (RMA). The Auckland City Council developed a model termed the Preliminary Risk Assessment Procedure (PRAP) to serve as a tool for deciding whether a proposed development involving hazardous substances should be permitted, or be subject to a consent application.

A number of submissions on the Auckland City District Plan subsequently identified shortcomings in this model, and a review of the procedure began in November 1993. The original PRAP was revised, and is now named Hazardous Facility Screening Procedure (HFSP).

In 1995, the HFSP was embedded in a framework for managing substances and the document entitled *Land Use Planning for Hazardous Facilities*, also known as the 'Red Book', was published. A review of that document and the HFSP was undertaken in 1999 to reflect upcoming changes under the HSNO legislation and accommodate feedback received from users of the HFSP. This revised version was available only in electronic form from the Ministry for the Environment website (Land Use Planning Guide for Hazardous Facilities, Interim Draft December 1999). However, it took another two years before the HSNO Regulations were finalised. The 1999 interim draft was revised accordingly and subsequently published early in 2002.

This background report outlines the history of the HFSP and its development, and the scientific basis of and justification for the HFSP.

2 Background

2.1 What are hazardous substances?

In the past, hazardous substances have been defined by pieces of legislation such as the Dangerous Goods and Toxic Substances Acts. These Acts were principally concerned with the risk that substances and activities pose to property, people and human health. Historically, emphasis has been placed on minimising risk to human life, while relatively little regard has been paid to the risk of environmental damage. As a result, threats to the environment were often poorly controlled.

Legislative changes have moved away from this anthropocentric view of the world, with consideration now being given to the environment as a whole. The RMA, as amended by the Hazardous Substances and New Organisms Act 1996 (HSNO), defines a hazardous substance as:

'Hazardous substance' includes, but is not limited to, any substance defined in section 2 of the Hazardous Substance and New Organisms Act 1996 as a hazardous substance.

For the purposes of the HFSP, the RMA definition for hazardous substances is adopted. This means that environmentally damaging substances such as oils or high BOD substances may also be considered hazardous for resource management purposes, in addition to those hazardous substances covered by the HSNO legislation. The HSNO Act provides the following definition of a hazardous substance:

"Hazardous substance" means, unless expressly provided otherwise by regulations, any substance –

(a) With one or more of the following intrinsic properties:
  - *(i) Explosiveness*
  - *(ii) Flammability*
  - *(iii) A capacity to oxidise*
  - *(iv) Corrosiveness*
  - *(v) Toxicity (including chronic toxicity)*
  - *(vi) Ecotoxicity, with or without bioaccumulation or*

(b) Which on contact with air or water (other than air or water where the temperature or pressure has been artificially increased or decreased) generates a substance with any one or more of the properties specified in paragraph (a) of this definition.

2.2 History of the HFSP

When the Auckland City Council (ACC) began work on its District Plan in 1991, the requirements of the RMA led to the consideration and adoption of a new approach to the assessment and management of hazardous substances and facilities that use or store these substances. It was intended to provide a focus on off-site effects, including effects on the environment. It is important to note that on-site effects on human health are addressed by the Health and Safety in Employment Act 1992 (HSE Act) and are basically not considered by the HFSP.

An integral part of the ACC approach was the attempt to develop a simple system of preliminary risk assessment that could be applied to any hazardous facility. The proposed system relied on the separate assessment of the hazard potential of a substance, its physical form, and the manner in which it was used or stored.

After the release of a discussion document, the Auckland City Council held a number of seminars for industry groups, community and environmental groups, the Auckland Regional Council and adjoining territorial local authorities. This consultation led to the development of the initial "risk assessment procedure" that was subsequently redrafted for inclusion into the Proposed District Plan (see Auckland City Council, 1992).

In brief,[20] the procedure worked on the principle that potential adverse effects of a hazardous substance could be determined by its hazard potential and the risk of the substance:

- becoming exposed to an ignition source
- being left unprotected against contact with other substances which might cause a physical or chemical reaction
- coming in contact with the human skin, mucous membranes, respiratory or digestive systems, or
- being released into the environment.

The hazard potential was defined by the intrinsic properties of the substance, while the risk of causing damage through the above events was determined by the amount stored or used and the manner in which the substances were handled.

The PRAP involved the determination of the hazard potential of a substance in three categories:

- Explosion/Fire: with emphasis on damage to property, the built environment and people
- Health: with emphasis on the well-being, health and safety of human beings and
- Environment: with emphasis on possible adverse effects on ecosystems and natural resources.

This was followed by the identification of a Standard Threshold together with a Risk Factor in order to calculate an Effective Threshold for the control of hazardous facilities and substances. The Standard Threshold (T) was based on the physical characteristics of a substance and the potential effects that these might generate. This threshold formed the basic standard against which a site- and use-specific Risk Factor (M) was applied. This risk factor took into account the conditions under which the particular substance was used or stored. The result was an Effective Threshold (L) which was specific for each facility, substance and activity. The Effective Threshold for a proposed development could then be compared with levels identified in a consent status table which indicated whether the proposal would be permitted, controlled, discretionary or prohibited in the zone it wanted to establish in.

2.3 The initial review process

Submissions on the proposed Auckland City District Plan identified some shortcomings in the model and a concern about the general lack of scientific justification for this approach. At this stage, other territorial local authorities in New Zealand had adopted the PRAP method in their own district plans, and the need for an independent review became evident.

The review was initiated by Environment Waikato and the Auckland Regional Council in November 1993. A core group consisting of staff of these two councils, the Auckland City Council and a consultant was formed. This group subsequently approached other territorial local authorities and regional councils for assistance with funding of the review project. Financial contributions from 36 local and regional councils were obtained, and four independent risk assessment experts from Australia and New Zealand were contacted to assist with a full technical review of the PRAP and to develop a revised procedure, should this become

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[20] A full description of the original PRAP is provided in the discussion document entitled *The Management of Hazardous Substances and Facilities,* Auckland City Council, April 1992.

necessary. The process was carried out in close co-operation with the Ministry for the Environment.

As part of the review process, an evaluation of the 'traditional' New Zealand list approach and overseas screening methods for hazardous substances was undertaken to assess their applicability to the New Zealand regulatory environment. These included the traditional list approach as used by the US Environmental Protection Agency (USEPA), the UK CIMAH regulations, the Dow/Mond Indices, the US National Fire Protection Association (USNFPA) regulations, and the New South Wales SEPP 33 Guidelines.[21] None of these methods were thought to be suitable to provide an adequate focus on the environment and to satisfy the effects-based approach required by the RMA.

One of the findings of the review referred to the purpose of the procedure, which is the screening of proposed developments involving hazardous substances to determine whether a consent is required or not, rather than an actual risk assessment of the proposed facility. To better reflect this purpose, the procedure was renamed the Hazardous Facility Screening Procedure, or HFSP.

Throughout the review process and subsequent revision of the original method, advice was sought from a number of interested parties, including the New Zealand Fire Service and various industry representatives. In July and August 1994, two workshops were held to introduce the reworked procedure to interested parties and to provide an opportunity for input. A second draft document was circulated in October 1994 to elicit further comment, and submissions on the Auckland City Isthmus Plan were heard in December 1994. A comprehensive review of these submissions was undertaken, and in some cases further meetings were held with submitters. As a result, the review process has been lengthy, but has incorporated a wide range of input from those involved in hazardous substances management.

Comments and submissions were taken into account as much as possible. *Land Use Planning for Hazardous Facilities* was released in June 1995.

2.4 The second review

In 1997/98, the Auckland Regional Council carried out a survey of HFSP users to identify relevant issues with the document overall and the HFSP in particular. Various comments were made about a lack of user-friendliness of the planning document and perceived complexities of the procedure. A review was initiated and funded by the Ministry for the Environment with the aim of producing a revised planning guide, to be published by the Ministry. A complementary *Assessment Guide for Hazardous Facilities* was also prepared.

The review started in 1998 and concentrated on the presentation of the planning guide and the HFSP. Various aspects of the procedure were identified which could be simplified without compromising its purpose and integrity. A significant aspect of the review was the modification of the hazardous substance classification criteria used for the HFSP to account for the changes brought about by the HSNO legislation.

21 NSW Department of Planning, 1997: State Environmental Planning Policy No. 33, Hazardous and Offensive Development Application Guidelines.

The draft of the new Planning Guide was scrutinised by a group of peer reviewers from industry, central and local government and published on the MfE website as an interim draft awaiting the completion of the HSNO regulations.

When the HSNO regulations came into force in July 2001, the Ministry for the Environment and ERMA NZ began to collaborate in developing various training material and courses to assist practitioners with working under the new hazardous substance regulations. As part of this, the interim version of the *Land Use Planning Guide for Hazardous Facilities* was checked again to ensure that it is compatible with the HSNO regulations. The Guide was published in early 2002.

3 Evaluation of management approaches

The challenge of developing an appropriate control mechanism for facilities using or storing hazardous substances lies in the eventual ease of administering and complying with the process. What is needed is an approach that identifies those facilities and activities that are liable to cause problems and allows others to operate without undue interference. Any system that generates an unwieldy bureaucracy is bound to fail, while at the same time decision-making should be carried out on the basis of objective evaluation of a proposal.

The basic approaches to managing hazardous substances are summarised below.

3.1 Performance-based approach

A performance-based approach involves the setting of acceptable risk contours either around industrial/commercial areas, or between industrial areas and residential or retail areas. Any performance standard would be based on the requirement that no hazardous activity should lead to risk levels in excess of some limit outside of the relevant contour. A similar but higher risk parameter could also be set at the site boundaries. The advantage of this approach is that operators are provided with some certainty regarding what is expected of them. Cumulative effects from a number of facilities in close proximity are also taken into account.

However, the certainty provided by this approach depends on the accuracy and consistency with which risks can be measured, and generally requires a full quantitative risk assessment, which would be onerous for small facilities. In addition, the characteristics of risk (i.e. the actions leading to the risk, the probability of mishap and the severity of the outcome) may change between activities or substances, thus making it difficult to quantify different types of risk in a common way.

The chief disadvantages of this approach, therefore, are the cost of adequately determining existing and acceptable levels of risk and of defending such assessments against technical or legal challenges.

3.2 Process- or substance-based approach

The process- or substance-based approach uses a more qualitative assessment, and is similar to the approach used in most district schemes of the past. This approach relies heavily on process and substance lists such as those used by the Auckland Regional Council in New Zealand, the USEPA, the CIMAH and USNFPA regulations and the Dow/Mond Indices, and quantity thresholds to determine consent procedures.

A number of problems arise with this approach, not the least of which is identifying the effects the rules are designed to control. It may also be difficult to justify, in quantitative terms, a certain threshold limit as the relationship between these limits and the implied level of acceptable risk may be vague. A further problem with substance or process lists is that they take no account of the more variable aspects of risk such as management practices, safety procedures etc. Substance lists in particular can never be complete because of the number of new chemicals being produced, and cannot take account of any cumulative risk presented by numerous substances held on the same site.

The use of substance lists does have the advantage that overseas information and experience can be readily adopted. This is likely to reduce a council's information costs and may make this approach more legally defensible.

3.3 Effects-based approach

The third alternative may be seen as a hybrid approach involving the partial identification of potential effects and the application of threshold quantities to control these effects. This approach, which has been chosen for the HFSP, relies on an assessment of both the intrinsic hazard of a substance, and the risk inherent in any activity using that substance. The results from these assessments are then compared against a series of threshold quantities. These thresholds are determined on the basis of the effect (or range of effects) being controlled for, rather than on the basis of substances or processes, as is the case with the substance approach.

The principal advantage with this approach is that it focuses on effects rather than the activity or substances used, and so is more comfortably in line with the requirements of the RMA. However, difficulties exist with selecting appropriate thresholds for each of the effects being controlled, which should be determined by reference to the physicochemical characteristics of substances which typically generate the effect in question, as well as local and site-specific conditions. The Dow/Mond Indices and the SEPP 33 Guidelines take this approach in part, but lack the focus on human health and environmental effects that has been developed for the HFSP.

4 Development of the hazardous facility screening procedure

4.1 Introduction

The HFSP has been developed over a period of one year, following a review of its predecessor, the Auckland City Council's Preliminary Risk Assessment Procedure. Although the HFSP retains many features of the PRAP model, a number of key aspects have been modified to align the new method with accepted risk management theory.

An attempt was also made to simplify the method as much as possible without compromising the scientific integrity of the approach. It is important to recognise the purpose of the HFSP as a screening tool that determines whether a proposed development involving hazardous substances will be permitted in a given area or whether it will require a consent application. The HFSP cannot be used directly to decide the outcome of an application.

4.2 Concept

The HFSP focuses on the potential adverse effects of the use or storage of hazardous substances in a given area or environment. In doing so, it takes into account the hazard of a substance, site-specific conditions and the risk it poses, where:

- hazard is principally defined by the intrinsic properties of a substance
- risk is defined by the probability of the release of the substance combined with the potential consequences of that release.

Potential effects are categorised into three types:

- Fire/Explosion Effects: concerned with damage to property, the built environment and safety of people
- Human Health Effects: concerned with the well-being, health and safety of people
- Environmental Effects: concerned with damage to ecosystems and natural resources.

In general, any substance to be used or stored on a site is assessed for its potential effects for each of these types, and is then assigned a Base Quantity (B) which defines the amount that would be allowed to be used or stored on the site, if the site was located in a typical heavy industrial zone. This quantity is then adjusted according to site- and substance-specific characteristics, resulting in a value termed the Adjusted Quantity (A). In the next step, the quantity of the substance that is proposed to be used or stored on the site (Proposed Quantity Q) is divided by the Adjusted Quantity (A), resulting in a Quantity Ratio (Q) for each Effect Type which is a dimensionless numerical value pertaining to the substance being assessed. The Quantity Ratios for the different substances to be held on the site are then added together, and the sum of these is compared with a Consent Status Index in a Consent Status Matrix table. Consent Status Matrix tables are unique to each council, as the chosen indices depend on the risk levels considered to be appropriate by the local community.

In summary, the HFSP is a method that assesses the potential adverse effects of the use or storage of hazardous substances in a site-specific context, based on accepted risk management theory and scientific evidence. The HFSP can be applied to all substances, and the calculations to arrive at the Quantity Ratio value which can be looked up in the Consent Status Matrix table is comparatively simple.

4.2.1 Classification of hazardous substances

The classification of hazardous substances in the HFSP is based predominantly on the classification system adopted in the HSNO classification scheme. They in turn adopt criteria of the United Nations Recommendations for the Transport of Dangerous Goods (UNRTDG), 11th Revised Edition, and the criteria for the classification of environmental toxicants are based on the Global Harmonisation System Organisation promoted by the Organisation for Economic Co-operation and Development (OECD).

The HFSP does not rely on the primary risk of a hazardous substance as per the UNRTDG for control, but classifies all potential hazards of a substance in a manner compatible with the hazard classes under the HSNO legislation.

4.2.2 Definition of base quantities

The HFSP Base Quantities have been derived using the professional experience and judgement of the risk experts involved in the review process, and are to some extent based on the New South Wales SEPP 33 Guidelines. These Guidelines were developed using risk modelling by the SAFETI risk assessment computer programme.

Other sources such as the UK CIMAH regulations were also consulted. It should be noted, however, that both the CIMAH regulations and the SEPP 33 Guidelines were developed to regulate large industrial hazardous facilities; as a result, some of the values adopted in these documents were deemed to be inappropriate for the small and medium-sized facilities that are screened by the HFSP.

To ensure that the HFSP Base Quantities are applicable to the majority of developments in New Zealand, discussions were held with Dangerous Goods Officers and the Technical Liaison Officer of the New Zealand Fire Service in the Auckland Region. Further validation of Base Quantities was obtained through comparisons with threshold quantities used elsewhere in the world and those provided in the Auckland Regional Council (ARC) Substances List.

Another feature relating to the setting of the Base Quantities is, with some exceptions, the application of a logarithmic scale to reflect the difference in risk between highly hazardous substances and those having a lower hazard. This approach is based on the assumption that the effects of hazardous substances decrease exponentially with distance, as is demonstrated with respect to the effects of heat radiation. In the HFSP, and therefore applicable to screening purposes only, the logarithmic scale is expressed by using a respective weighting of 1:3:10 for low, medium and highly hazardous substances throughout.

It is noted that some consolidation of hazard categories has occurred in comparison with the 1995 'Red Book'. In the 1995 document, highly hazardous substances were split into two categories, which has now been reversed in line with the HSNO approach.

4.2.2.1 Base thresholds for explosive substances

a) HSNO classification

For a full description of this class of substances the wording of the relevant HSNO Regulations should be referred to.

Subclass 1.1	*Substances and articles that have a mass explosion hazard.* Examples: TNT, ANFO, Powergel, Tovex, HE primers and boosters and gun (black) powder.
Subclass 1.2	*Substances and articles that have a projection hazard but not a mass explosion hazard.* Examples: bombs, grenades, rockets, and some pyrotechnics.
Subclass 1.3	*Substances and articles that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.* Examples: propellant powder, some display fireworks, classified shot gun and rifle powder.
Subclass 1.4	*Substances and articles that present no significant explosive hazard.* Examples: toy fire works, safety cartridges.

Subclass 1.5 *Very insensitive substances that have a mass explosion hazard.* Examples: proprietary explosives such as Powergel Gold.

Subclass 1.6 *Extremely insensitive artic les that do not have mass explosion hazard.*

Subclasses 1.4 and1.6 have not been included in the HFSP because by definition they do not represent a significant mass explosion hazard and are not expected to have significant off-site effects. This approach has also been adopted in the SEPP 33 Guidelines.

b) Determination of base quantities and comparison with other substances lists

Source*	**Subclass 1.1**	**Subclass 1.2**	**Subclass 1.3**
HFSP	0.1 t	1 t	3 t
SEPP 33	0.1 t	1 t	5 t
ARC	0.5 (TNT equivalent) **		
USEPA			
CIMAH			5 t

* ARC: Auckland Regional Council (1988): *Substances List.* USEPA: USEPA (January 1992) Title III List of Lists, Consolidated List of Chemicals subject to Reporting under the Emergency Planning and Community Right to Know Act. EPA 560/4-92-011. CIMAH: Control of Industrial Major Accident Hazards Regulations 1984. United Kingdom.

** The ARC Substances List listed three explosive substances; all other substances were screened at 0.5 (TNT equivalent).

It has been considered desirable that ultimately there is a linkage between the past licensing levels for explosive substances under the Explosives Act 1957 and the Base Quantities in the HFSP, and that planning applications involving explosive substances are dealt with jointly by the local regulatory authority and the relevant explosives experts in the Department of Labour. However, as the Explosives Act used a classification for explosive substances that is different from the current HSNO/UN classification system, it is difficult to establish this linkage. Therefore, the Base Quantities for explosive substances in the HFSP have been based on the SEPP 33 Guidelines, and have been agreed to by the risk experts, Dangerous Goods Officers and the Technical Liaison Officer of the New Zealand Fire Service.

The SEPP 33 Guidelines provide an acceptable threshold for Subclass 1.1 explosives in a heavy industrial area. The threshold is based on a modelled overpressure of 7 kPa at the site boundary, assuming a 10-metre distance from the boundary and a typical explosion scenario.

The CIMAH regulations (as referred to in an early draft of the Code of Practice for Managing Hazards to Prevent Major Industrial Accidents, Department of Labour – OSH) provide threshold quantities for explosive substances that range up to 5 tonnes. Explosive substances are listed in the category ‘Group 4 – Explosive Substances’, but as individual substances are not identified by the UN classification no values have been noted for Subclasses 1.1 and 1.2.

4.2.2.2 Base quantities for gases

a) HSNO classification

For a full description of this class of substances the relevant HSNO Regulations should be referred to.

Class 2.1.1A *Flammable gases: high hazard*

Gases or gas mixtures which at 20°C and a standard pressure of 101.3 kPa:

- are ignitable when in a mixture of 13% or less by volume with air, or
- have a flammable range with air of at least 12% regardless of the lower flammability limit.

Class 2.1.2A *Flammable aerosols*

b) Determination of base quantities and comparison with other substances lists

Source	**Classes 2.1.1 A and 2.1.2 A**
HFSP:	
compressed gas	10,000 m³
liquefied gas	10 t
SEPP 33:	
compressed gas	10 m³
liquefied gas	1 t *
ARC	0.25–2 t **
USEPA	
CIMAH	20 t

* SEPP 33 does not have adjustment factors. The HFSP Base Quantity has been set to be the same as the SEPP 33 threshold once the Adjustment Factor for substance form (FF1) is applied.

** ARC Substances List: 250 kg for hydrogen, 1 t for acetylene, 2 t for ethylene.

c) Class 2.1.1A and 2.1.2A: Flammable gases and flammable aerosols

In the HFSP, Class 2.1 gases can be assessed by their weight (tonne) or volume (m³), whichever is convenient, depending on whether the gas is liquefied or compressed. Because it is a dimensionless number, the Quantity Ratio will be unaffected by the choice of measurement units.

The HFSP uses an Adjustment Factor (FF1) for substance form to derive an Adjusted Quantity (A) for gases that is similar to the quantities given in the ARC Substances List and the initial screening quantities developed for the SEPP 33 Guidelines. Overall, the derivation of Base Quantities for flammable gases has been based on the latter. The SEPP 33 Guidelines provide acceptable thresholds for these gases in a heavy industrial area, based on a modelled heat radiation at the site boundary of 12.6 kW/m² over 30 seconds, assuming a 10 metre distance from the boundary and a typical release scenario. It should be noted that the SEPP 33 threshold for compressed gases (10m³) is much lower than that adopted for the HFSP (10,000m³) because it is based on a specific release scenario (i.e.. a jet fire from a puncture) rather than the total storage volume.

d) *LPG*

In the HFSP, LPG is treated separately because it is more strictly regulated than other flammable gases. LPG is given a Base Quantity of 30 tonnes which equates to 3 tonnes after applying the Adjustment Factor FF1 for substance form. This quantity is compatible with similar allowable quantities used in various district schemes in the past in New Zealand.

4.2.2.3 Base quantities for flammable liquids

This group includes flammable liquids comprising liquids, mixtures of liquids, or liquids containing solids in suspension which give off a flammable vapour at specific temperatures.

a) *HSNO classification*

For a full description of this class of substances the relevant HSNO Regulations should be referred to.

Class 3.1A: *Flash point: < 23°C*
Initial boiling point: < 35°C

Class 3.1B: *Flash point: < 23°C*
Initial boiling point: > 35°C

Class 3.1C: *Flash point: ≥ 23°C; ≤ 60°C*

Class 3.1D *Flash point: > 60°C but ≤ 93°C*

Class 3.2A *Liquid desensitised explosives: high hazard*

Class 3.2B *Liquid desensitised explosives: medium hazard*

Class 3.2C *Liquid desensitised explosives: low hazard*

b) *Determination of base quantities and comparison with other substances lists*

Source	3.1A (Class 3 PG I)	3.1B (Class 3 PG II)	3.1C (Class 3 PG III)	3.1D (Combustible liquids)
HFSP	10 t	10 t	30 t	100 t
SEPP 33	9 t	15 t	15 t	100 t*
ARC**	2 t	2 t	4 t	10 t
USEPA***				
CIMAH	5000 t	5000 t	20 t	

* Class 3 C is not considered in the SEPP 33 Guidelines, but was modelled in the earlier drafts.

** Values in the ARC Substances List are based on above ground storage.

*** The USEPA does not have planning threshold quantities for flammable liquids in a manner similar to the HFSP. Instead, the release of a flammable liquid must be reported to the National Response Centre under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, or 'Superfund') if the release quantity is equal to or greater than their Reportable Quantity (RQ). Generally the RQs range from 1–2500 kg.

HFSP Base Quantities for flammable liquids were developed using the professional experience and judgement of the risk experts involved in the review process, and are predominantly based on the SEPP 33 Guidelines. The SEPP 33 thresholds for flammable liquids in a heavy industrial area are based on a modelled heat radiation of 12.6 kW/m^2 over 30 seconds at the site boundary, assuming a distance of 10 metres from the boundary and a typical release scenario. The Guidelines also demonstrate that there is a logarithmic relationship between the quantities of flammable liquids and the distance to the site boundary, given a specific heat radiation at the boundary.

In discussion with the peer review risk experts it was therefore decided that a logarithmic scale overall better reflects the actual differences in risk between highly hazardous and other hazardous substances, as long as this concept is applied to a screening process only. A logarithmic scale has been introduced to the HFSP by using a relative weighting of 1:3:10 for low, medium and highly hazardous substances.

On this basis, the quantity of 15 t for category C (UN Class 3 PGIII) substances, as used in the SEPP 33 Guidelines, is not appropriate and has been increased, while the Base Quantity for category B (UN Class 3 PGII) substances has been decreased. The approach of the HFSP to category B (UN Class 3 PGII) substances is therefore slightly more conservative than that of the SEPP 33 Guidelines.

Base quantities for liquid desensitised explosives are the same as for solid desensitised explosives (refer 4.2.2.4) as these substances have a closer relationship with each other than with those in Class 3 generally.

4.2.2.4 Base quantities for flammable solids

This group includes flammable solids, flammable solids that are self-reactive, flammable solid desensitised explosives, flammable spontaneously combustible substances, and flammable solids that are dangerous when wet.

a) HSNO classification

For a full description of this class of substances the relevant HSNO Regulations should be referred to.

Class 4.1.1A	*readily combustible solids and solids that may cause fire through friction: medium hazard*
Class 4.1.1B	*readily combustible solids and solids that may cause fire through friction: low hazard*
Class 4.1.2A	*self-reactive substances: Type A*
Class 4.1.2B	*self-reactive substances: Type B*
Class 4.1.2C	*self-reactive substances: Type C*
Class 4.1.2D	*self-reactive substances: Type D*
Class 4.1.2E	*self-reactive substances: Type E*
Class 4.1.2F	*self-reactive substances: Type F*
Class 4.1.2G	*self-reactive substances: Type G*
Class 4.1.3A	*solid desensitised explosives: high hazard*
Class 4.1.3B	*solid desensitised explosives: medium hazard*

Class 4.1.3C *solid desensitised explosives: low hazard*

Class 4.2A *spontaneously combustible substances: pyrophoric substances: high hazard*

Class 4.2B *spontaneously combustible substances: self-heating substances: medium hazard*

Class 4.2C *spontaneously combustible substances: self-heating substances: low hazard*

Class 4.3A *solids that emit flammable gas when in contact with water: high hazard*

Class 4.3B *solids that emit flammable gas when in contact with water: medium hazard*

Class 4.3C *solids that emit flammable gas when in contact with water: low hazard*

The HSNO classification for flammable solids is more complex than the UN Classes for these substances, and this has been reflected by the HFSP through using the same sub-classes as those in the HSNO Regulations. However, the systems which have been used to derive the base quantities focus on the UN Classes, and comparison is made on this basis.

b) Determination of base quantities and comparison with other substances lists

Source	**UN Class 4.1**	**UN Class 4.2**	**UN Class 4.3**
HFSP	1/10/30 t	1/10 t	1/10 t
SEPP 33	10 t	1 t	1 t
ARC	0.1 t*		
USEPA	0.25 t		
CIMAH			

* The ARC Substances List names only phosphorus in this class of substances.

The HFSP Base Quantities have been derived using the professional experience and judgement of the risk experts involved in the review process, and are to a large extent based on the SEPP 33 Guidelines.

4.2.2.5 Base quantities for oxidising agents and organic peroxides

a) HSNO classification

For a full description of this class of substances the relevant HSNO Regulations should be referred to.

Class 5.1.1A *Oxidising substances that are liquids or solids: high hazard*

Class 5.1.1B *Oxidising substances that are liquids or solids: medium hazard*

Class 5.1.1C *Oxidising substances that are liquids or solids: low hazard*

Class 5.1.2A *Oxidising substances that are gases*

Class 5.2A *Organic peroxides: Type A*

Class 5.2B *Organic peroxides: Type B*

Class 5.2C *Organic peroxides: Type C*

Class 5.2D *Organic peroxides: Type D*

Class 5.2E *Organic peroxides: Type E*

Class 5.2F *Organic peroxides: Type F*

Class 5.2G *Organic peroxides: Type G*

b) Determination of base quantities and comparison with other substances lists

Source	Class 5.1	Class 5.2
HFSP	1/10/10 t (10,000 m ^{3})*	1/10/30 t
SEPP 33	5 t	10 t
ARC	0.5 t	0.025 t
USEPA		
CIMAH		5 t

* For permanent/compressed gases, measured at 20°C and 101.3 kPa.

For Class 5.1 substances, the threshold quantities in the HFSP and SEPP 33 Guidelines are roughly within the same order of magnitude. The actual base quantity is aligned with the HSNO divisions within UN Class 5.1. A similar approach has been adopted for UN Class 5.2, based on discussion with staff from the Environmental Risk Management Authority (ERMA).

A base quantity has also been introduced for permanent/compressed gases with the capacity to oxidise. These substances are rare. The value is the same as for flammable gases.

4.2.2.6 Base quantities for toxic substances

This group includes poisonous substances that are liable to cause death or injury or harm to human health if swallowed, inhaled, or contacted by skin.

a) HSNO classification

For a full description of this class of substances the relevant HSNO Regulations should be referred to. Gases with toxic properties (UN Class 2.3) are also included in HSNO Class 6.1.

Class 6.1A:	Oral toxicity LD_{50} (mg/kg):	≤ 5
	Dermal toxicity LD_{50} (mg/kg):	≤ 50
	Inhalation toxicity dust/mist LC_{50} (mg/l):	≤ 0.05
	Inhalation toxicity vapours LC_{50} (mg/l):	≤ 0.5
	Inhalation toxicity gases LC_{50} (ppm):	≤ 100
Class 6.1B:	Oral toxicity LD_{50} (mg/kg):	> 5 – 50
	Dermal toxicity LD_{50} (mg/kg):	> 50 – 200
	Inhalation toxicity dust/mist LC_{50} (mg/l):	> 0.05 – 0.5
	Inhalation toxicity vapours LC_{50} (mg/l):	> 0.5 – 2
	Inhalation toxicity gases LC_{50} (ppm):	> 100 – 500
Class 6.1C:	Oral toxicity LD_{50} (mg/kg):	> 50 – 300
	Dermal toxicity LD_{50} (mg/kg):	> 200 – 1,000
	Inhalation toxicity dust/mist LC_{50} (mg/l):	> 0.05 – 1
	Inhalation toxicity vapours LC_{50} (mg/l):	> 2 – 10
	Inhalation toxicity gases LC_{50} (ppm):	> 500 – 2500

Class 6.1D: Oral toxicity LD_{50} (mg/kg): > 300 – 2000
Dermal toxicity LD_{50} (mg/kg): > 1000 – 2000
Inhalation toxicity dust/mist LC_{50} (mg/l): > 1 – 5
Inhalation toxicity vapours LC_{50} (mg/l): > 10 – 20
Inhalation toxicity gases LC_{50} (ppm): > 2500 – 5000

HSNO acute toxicity category 6.1E is not used for the HFSP as substances in this category have lesser potential for off-site effects and are considered to be appropriately controlled by other statutes.

b) Determination of base quantities and comparison with other substances lists

Source	**Class 6.1 A (PG I)**	**Class 6.1 B (PG II)**	**Class 6.1 C (PG III)**	**Class 6.1 D**	**[UN Class 2.3]**
HFSP	1 t/ 50 m³*	1 t/ 50 m³*	10 t/ 150 m³*	30 t/ 500 m³	
SEPP 33	1 t	1 t	5 t		20m³
ARC	0.001–0.1 t	0.001–0.1t**			2.3(a): 0.001–0.01 t 2.3(b): 0.2–1 t
USEPA	0.05 t***				2.3(a): 0.005–0.25 t 2.3(b): 0.05–0.5 t
CIMAH	0.001–20 t	5–20 t	5–20 t		0.001–0.01 t

* For permanent/compressed gases, measured at 20°C and 101.3 kPa.

** The ARC Substances List lists substances as being very toxic or toxic.

*** Based on threshold quantities for TDI, Toluene-2,6-diisocyanate and Sodium selenite. TDI is generally accepted as an appropriate base for setting land use planning threshold quantities for very toxic substances.

Base quantities for toxic substances in the HFSP have been based on the professional experience and judgement of the risk experts involved in the review process, and on thresholds used in other countries. The rationale for the classification of toxic substances under the HSNO Act has also been taken into account and were confirmed by discussion with staff from the Environmental Risk Management Authority (ERMA).

As is the case throughout the HFSP, the Base Quantities are roughly based on a logarithmic scale (Low = 1, Medium = 10, High = 30), as it is assumed that the release of a toxic substance and subsequent exposure of a receptor follows a logarithmic model.

It should be noted that the CIMAH regulations used in the UK allow wide variation for the base threshold quantities. The HFSP has generally followed the same approach but has used the logarithmic scale to be consistent with the approach adopted for the other substances.

The ARC Substances List and the US substances list identify highly toxic substances only, and do not cover the full range of toxic substances used by industry. This explains why the quantities appear to be low, which is appropriate for highly toxic substances. In contrast, the HFSP considers the full range of toxic substances, and allows a progressive increase in the threshold quantities depending on toxicity rating. For highly toxic substances the HFSP threshold quantity values are similar to threshold quantities used elsewhere in the world.

It is noted that the Base Quantities for Class 6.1 C substances adopted in the HFSP is higher than those in the SEPP 33 Guidelines. The thresholds for Class 6.1 substances in the SEPP 33 Guidelines are not based on scientific evidence or modelling, but professional judgement. It is also important to note that the SEPP 33 Guidelines only consider the primary hazard of a substance rather than the full spectrum of hazards. The HFSP takes account of multiple hazards of a substance in the way that Base Quantities of different Effect Types and hazard levels have been, as far as possible, calibrated against each other.

Overall, for the most toxic substances, the HFSP closely follows the thresholds set by the ARC Substances List, and the USEPA and CIMAH thresholds which are highly conservative. However, the HFSP permits comparatively larger quantities of less toxic substances so as not to unnecessarily restrict the handling of common substances with a low or medium toxicity rating, such as petrol.

c) UN Class 2.3: Toxic gases

As is the case for Class 2.1 gases, the HFSP uses an Adjustment Factor (FH1) for substance form to set an Adjusted Quantity (A) for gases that are in the same order of magnitude as the initial screening quantities developed for the SEPP 33 Guidelines. The Guidelines adopt $20m^3$ for all toxic gases, except for chlorine, ammonia and sulphur dioxide. In the ARC list the quantities ranged from 200–500 kg. The CIMAH regulations give threshold levels ranging from 1 kg to 50 tonnes, presumably because the regulations were developed for large scale industries located in suitably zoned areas. Nevertheless, the regulations provided useful information for the determination of HFSP Base Quantities.

4.2.2.7 Base quantity for corrosives

a) HSNO classification

For a full description of this class of substances the relevant HSNO Regulations should be referred to.

Class 8.2A, 8.2B and 8.2C	Substances that are corrosive to dermal tissue following different durations of exposure

b) Determination of base thresholds and comparison with other substances lists

Source	Class 8.2 A	Class 8.2 B	Class 8.2 C
HFSP	1 t	10 t	30 t
SEPP 33	10 t	50 t	100 t
ARC			
USEPA	0.05–0.5 t		
CIMAH	5 t*		

* These substances were classified as being highly reactive in the list that was referenced. This list is from an early draft of the Code of Practice *Managing Hazards to Prevent Major Industrial Accidents*, OSH. The current code does not contain such a list.

The base quantity has been validated against threshold quantities used elsewhere in the world and the ARC Substances List, and have also been agreed to after discussions with Dangerous Goods Inspectors and with the risk experts involved in the review process.

4.2.2.8 Base quantity for ecotoxic substances

Ecotoxic substances are substances exhibiting a toxic effect on species other than humans, based primarily on the toxicity to aquatic life and selected terrestrial species.

a) HSNO classification

For a full description of this class of substances the relevant HSNO Regulations should be referred to.

Class 9.1A Substances that are very ecotoxic in the aquatic environment

Class 9.1B Substances that are ecotoxic in the aquatic environment

Class 9.1C Substances that are harmful in the aquatic environment

Class 9.1D Substances that are slightly harmful to the aquatic environment or are otherwise designed for biocidal action

b) Determination of base quantities and comparison with other substances lists

Source	Category A	Category B	Category C
HFSP SEPP 33* ARC USEPA CIMAH	3 t	30 t	100 t

* The SEPP 33 Guidelines do not cover environmentally damaging substances. Effects from such substances are addressed by separate legislation in New South Wales.

Generally, ecotoxic and environmentally damaging substances are not considered in the references that have been used for the calibration of the HFSP. However, the RMA requires that all effects are taken into account, which is a major shift from previous approaches to hazardous substances management in that historically only effects on human health and safety and to property were addressed.

In determining the base quantities for the Environmental Effect Type, the logarithmic scale used throughout the HFSP has been employed. The concept has been discussed previously, and is considered appropriate in an environmental context as well because the effects from the loss of containment of an ecotoxic or environmentally damaging substance, following mixing and dilution, follow a logarithmic model.

The base quantities values have been agreed to after discussions with Dangerous Goods Inspectors and the risk experts involved in the review process.

4.2.3 Derivation of adjustment factors

The Adjustment Factors (F) have been developed in conjunction with the Base Quantities; therefore, the explanation for the Adjustment Factors should be read in conjunction with the explanation for the Base Quantities. Adjustment Factors were calibrated so that the generated Adjusted Quantities (the product of Base Quantities and Adjustment Factors) are representative of hazardous substance quantities which would generate no significant off-site effects in the case of a release, if held on a facility in a typical heavy industrial zone, and after taking into account substance- and site-specific considerations. The values were validated against overseas criteria.

The Adjustment Factors also account for different ranges of industry types. Not all industries are sited in similar locations, have the same characteristics or use hazardous substances in the same way. Hence, there is a need for Adjustment Factors to account for these variations so that the focus of controls may be on potential effects, rather than being based on substances or industries lists. Previous control systems treated all industries in a similar manner regardless of the manner in which substances were used or stored, and did not take into account the sensitivity of the surrounding environment.

The Adjustment Factors take into account:

- the physical state of the substance
- the temperature of storage or use
- separation distances to the site boundary
- sensitivity of the surrounding environment.

The derivation of Adjustment Factors has been based on both risk modelling data and professional expertise and experience. The New Zealand and Australian experts involved in the review process in 1994 provided substantial input in this area. Comment was also sought from professionals with sound practical experience in hazardous substances management, such as Dangerous Goods Inspectors and the New Zealand Fire Service Hazardous Substances Liaison Officer based in Auckland.

4.2.3.1 Derivation of adjustment factors for the fire/explosion effect type

a) FF1: Substance form – solids = 1

Flammable solids do not add significantly to risks because of their substance form. In an incident in which such substances are ignited, solid flammable substances will essentially remain where they are placed. Their main risk is destruction of property; hence the value of 1.

b) FF1: Substance form – liquids and powders = 1

Although they are somewhat more mobile than solids, liquids and powders are not considered to add considerably to risks. Essentially, their main risk is destruction to property and heat effects. In most cases of land-based incidences involving bulk quantities of flammable liquids, their mobility is impaired by secondary containment systems, and fire effects are generally contained within the bunded compound area. For these reasons, a value of 1 has been assigned.

c) FF1: Substance form – gas (at 101.3 kPa and 20°C) = 0.1

The use of this factor is for the potential loss of control or containment of flammable gases stored in large quantities. Flammable gases have the ability to mobilise and quickly expand into a gas cloud which, if ignited, and dependent on the surroundings, can cause significant fire/explosion damage. The value of 0.1 is also based on the professional experience and judgement of the peer reviewers, and on calibration and validation against the SEPP 33 Guidelines.

d) Weight (tonnes) or volume (cubic metres) measure

Generally, most substances are packaged or delivered on the basis of weight. For the HFSP, tonne is the base unit used. However, for gases that are compressed, a cubic volume has been used to assist with the use of the model, because converting cubic metres to mass for compressed gases is a complex calculation. For the HFSP, compressed gases should be assessed by volume, i.e. cubic metres, rather than attempting to convert back to the weight of the compressed gas. In contrast, liquefied gases should be assessed by their weight. It should be noted that using tonnes or cubic metres does not affect the determination of the Quantity Ratio, as this is a dimensionless numerical value.

e) Flammable vapours

The HFSP is not intended to consider flammable vapours arising from the storage or use of flammable liquids. Vapours are generally released in smaller quantities in a loss of containment situation, unlike a leakage occurring from a storage tank containing a compressed or liquefied gas. Vapour build-up is considered to be a worker safety issue controlled by the Health and Safety in Employment Act. If vapours ignite upon the loss of containment of a flammable liquid, the effect would initially be confined as a pool fire type situation. For these reasons, flammable vapours are not considered for this Adjustment Factor.

f) FF2: Separation distance to site boundary

This Adjustment Factor has been included to give some bonus to proposed developments that offer adequate separation distance of their plant or storage area to the site's boundary. For fire/explosion risks the effects diminish with distance. Therefore, it was considered that the HFSP could allow greater quantities of hazardous substances to be stored if there is the ability to have adequate separation distances within the site. The value of 30 metres and the increase in quantity have been based on work carried out by the New South Wales Department of Planning, using computer-based risk modelling methods. It is possible to have 'sliding' changes of allowable threshold quantities versus separation distance, but this would complicate the HFSP procedure unnecessarily. Not all effects from accidental releases of hazardous substances behave in the same way, and having 'sliding changes' for the whole range of hazardous substances would detract from the HFSP model as a 'simple' screening tool.

g) FF2: Separation distance from site boundary – < 30 metres = 1

No increase in quantities is allowed for if the site boundary distance is up to 30 metres, which is considered to be the base point.

h) FF2: Separation distance from site boundary – > 30 metres = 3

If the 30 metre requirement is satisfied, allowable hazardous substances quantities are increased by a factor of 3. This 30 metre value links in with the 1:3:10 scale based on the professional experience and judgement of the peer review experts and has been calibrated against the SEPP 33 Guidelines. The results are somewhat more conservative in some cases for different hazardous substances, but in general it allows an increase in hazardous substances without affecting the consequences of any unplanned release of such hazardous substances.

A factor of 3 is also provided in the case of sub-facilities if the separation distance is more than 60 metres, which reflects the assumption of an 'invisible' boundary at 30 metres between the neighbouring sub-facilities (2 x 30 metres = 60 metres).

i) FF3: Type of activity – use = 0.3

The HFSP defines use as:

> *the manufacturing, processing or handling of a substance or mixture of substances for a particular activity without necessarily changing the physical state or chemical structure of the substance involved. This includes mixing, blending and packaging operations, but does not include the filling or drawing of substances from bulk storage tanks unless the processing is permanently connected to the bulk storage, and does not include loading out and dispensing of petroleum products.*

The HFSP has penalised the use of a hazardous substance because this type of activity normally involves a high frequency of handling operations. Generally, the more frequently a substance is handled, the greater the chance of an incident because of human error or malfunction of handling equipment. In the majority of industrial accidents, it is normally during the use or handling of the hazardous substance that the event occurs. In the Dow Index, the general process hazards factor also includes penalties for materials handling and transfer. The factor of 0.3 has been assigned in accordance with previous considerations of determining low, medium and high effects for the Adjustment Factors based on the logarithmic scale used throughout the HFSP.

j) FF3: Type of activity -- above ground storage = 1

The Base Thresholds for fire/explosion have been based for above ground storage, hence the value of 1.

k) FF3: Type of activity – underground storage = 10

This Adjustment Factor applies to flammable liquids only. For these substances, if stored underground, there are well developed Codes of Practice and regulations that prevent or mitigate their accidental release to the environment; in other words, the primary reason for storing these substances underground is to reduce their exposure to fire risks. Underground storage of liquid substances that are not flammable would be assessed on a case-by-case basis.

Given these restrictions, an Adjustment Factor of 10 has been assigned to underground storage tanks for flammable liquids.

4.2.3.2 Derivation of adjustment factors for the human health effect type

a) FH1: Substance form – solid = 3

The exposure pathways for solid hazardous substances to affect human health are limited unless a person is directly exposed. A value of 3 has been chosen to be consistent with the FF1 Adjustment Factor for the Fire/Explosion Effect Type, and to recognise that solids present less of a hazard than liquids or toxic gases.

b) FH1: Substance form – liquids, powder = 1

The base quantity has been based on the liquid form of a hazardous substance, hence the value of 1.

c) FH1: Substance form – gas (at 101.3 kPa and 20°C) = 0.1

Toxic gases have the ability to mobilise very quickly, and are a major concern because of their ability to cause widespread health effects or even death. The appropriate measures required for minimisation of toxic gas risks are very similar to those required for fire and explosion safety. For this reason, a factor of 0.1 has been assigned. Toxic gas is treated as a high hazard.

d) FH2: Separation distance to site boundary (gases only) – < 30 metres = 1

No increase in toxic gas quantities is allowed if the distance to the site boundary is less than 30 metres.

e) FH2: Separation distance to site boundary (gases only) – > 30 metres = 3

Toxic gases in the HFSP model are already well controlled with the setting of the base quantity and the FH1 Adjustment Factor of 0.1, hence the relaxation of the allowable quantities if the facility can provide a separation distance of more than 30 metres. If the 30 metre requirement is satisfied, toxic gas quantities may be increased by a factor of 3. Dispersion gas modelling has shown that toxic gas quantities can be increased without affecting the expected concentration levels compared to that modelled for 10 metres separation. Modelling for toxic gas has used a Gaussian plume dispersion model, using worst case atmospheric conditions.

f) FH3: Type of activity – use = 0.3

The justification for assigning an Adjustment Factor of 0.3 is similar to that provided for the Fire/Explosion Effect Type, Adjustment Factor FF3.

g) FH3: Type of activity – above-ground storage = 1

The base quantities for human health have been based on above ground storage, therefore no further adjustment is necessary.

h) FH3: Type of activity – underground storage = 10

This Adjustment Factor applies to Class 3 flammable liquids only. The rationale for assigning this Factor is the same as for the FF3 Adjustment Factor for the Fire/Explosion Effect Type and has been discussed above.

4.2.3.3 Derivation of adjustment factors for the environmental effect type

a) FE1: Substance form – solids = 3

For reasons already discussed, solids generally present lower hazards than liquids, powders or gases. For this Adjustment Factor, liquids and powders have been set as the benchmark. Therefore, in keeping with the scale of low, medium, and high risks discussed for the preceding Adjustment Factors, solids are given a ‘credit’ by assigning a value of 3.

b) FE1: Substance form – liquids and powders = 1

This factor has been set at 1 because liquids and powders have been taken as the base in determining hazards to the environment.

c) FE1: Substance form – gas (at 101.3 kPa and 20°C) = 0.1

The same factor as for gases with toxic properties has been adopted for gases with ecotoxic properties. It is noted that most gases with ecotoxic properties are also toxic.

d) FE2: Environmental sensitivity – normal = 1

This adjustment factor has been included to provide for protection of the aquatic environment, which is the most susceptible to contamination. In many instances, industrial areas are located next or near to major water resources such as harbours, streams, lakes, estuaries, wetlands and the sea. Aquifers and water supplies have been included in the definition of a water resource.

e) FE2: Environmental sensitivity – adjacent to a water resource = 0.3

Based on the above considerations, the potential risk of contaminating a water resource is increased if a development is sited in close proximity to it. A value of 0.3 has been assigned based on the low, medium and high hazard scale discussed in the FF2 Adjustment Factor for the Fire/Explosion Effect Type.

The term ‘adjacent’ needs to be defined on a case-by-case basis depending on the geological and hydrological circumstances, type of aquatic environments and uses.

f) FE3: Type of activity – use = 0.3

The justification for assigning an Adjustment Factor of 0.3 is similar to that provided for the Fire/Explosion Effects Type Adjustment Factor FF3.

g) FE3: Type of activity – above-ground storage = 1

The base quantity for environmental effects have been based on above ground storage, therefore no further adjustment is necessary.

h) FE3: Type of activity – underground storage = 3

This adjustment factor applies to flammable and combustible liquids only. For these substances, if stored underground, there are well developed Codes of Practice and regulations that prevent or mitigate their accidental release to the environment; in other words, the primary reason for storing these substances underground is to reduce their exposure to fire risks. Underground storage of liquid substances that are not flammable would be assessed on a case-by-case basis.

The value for this factor has been set at 3. This limits permitted underground storage of flammable liquids to 90 tonnes, which corresponds to approximately 100,000 litres for many of these substances, the quantity currently stored underground at some of the larger service stations in the Auckland region.

It is acknowledged that allowing higher quantities of flammable liquids to be stored underground can increase the environmental risk. To account for this potential increase, the facility must comply with the performance standards described in the *Code of Practice for the Design, Installation and Operation of Underground Petroleum Storage Systems* (Department of Labour – OSH), or other codes that achieve the same performance standards.

4.2.4 Development of quantity ratios

In the HFSP, the Quantity Ratio is calculated by dividing the Proposed Quantity (Q) of a substance to be used or stored by the Adjusted Quantity (A). The result is a dimensionless numerical value for each substance to be held on the site. The Quantity Ratios for each substance can then be added together to generate a total Quantity Ratio which may be compared with the indices set in the Consent Status Matrix tables.

The concept of a dimensionless number representing each substance was introduced to account for the cumulative effect of more than one substance being held on the same site, following discussion of this issue with the risk experts involved in the review process.

5 Consent status matrix

5.1 Purpose

The Consent Status Matrix is a management tool to determine the quantity of hazardous substances that may be used or stored in different land use zones. This is reflected in the actual values assigned to the Consent Status Indices for the different land use zones.

The HFSP has been calibrated for maximum hazardous substance quantities in a heavy industrial zone, on the basis that no significant off-site effects would be expected to occur in the event of an accident involving hazardous substances. Based on this supposition, the Consent Status Index in the Consent Status Matrix has been set at a value of 1 for a typical heavy industrial zone.

5.2 Consent status matrix

Having set the Consent Status Index in a heavy industrial zone at 1, corresponding indices for less hazardous land use zones – such as residential or commercial – should be set at less than 1. To define appropriate indices for other land use zones, reference was made to land use risk criteria used in other countries. These land use risk criteria are similar to those developed by the New South Wales Department of Planning in Australia, on which the HFSP trigger levels have been based.

The New South Wales Department of Planning has set the following risk criteria for the death of an individual person in specific land use zones as follows:

Land use	Suggested criteria (risk per million per year)
Hospitals, schools, child care facilities, old age housing	0.5
Residential, hotels, motels, tourist resorts	1
Commercial developments including retail centres, offices and entertainment centres	5
Sporting complexes and active open space	10
Industrial	50

The above risk criteria have been based on the premise that the risk of accidental death due to industrial developments should not significantly increase the risk of death from other accidental causes for people located in sensitive land uses. Sensitive land uses include residential type developments, hospitals, childcare facilities, rest homes and schools. However, in risk management it is thought acceptable that risk levels be higher in industrial zones because:

- people voluntarily accept higher risks by taking employment in industry
- people normally spend only a third of their day in an industrial area, while they may spend up to 24 hours a day in residential areas.

Using the above quantitative land use risk criteria used by the New South Wales Department of Planning it is possible to set trigger levels for zones other than a heavy industrial zone. In a conservative approach, residential zones should have threshold quantities that are 50 times lower than those set for heavy industrial zones. The Consent Status Indices for other zones may be derived correspondingly according to the risk criteria shown above.

It should be noted that the New South Wales risk criteria have been developed for risk that is quantitatively assessed. In the HFSP, risk is not assessed in this way, as the procedure merely screens out activities that may have adverse off-site effects, based on threshold quantities for hazardous substances. Activities that are deemed, by the HFSP, to be in this category are then required to undergo a risk assessment.

In developing the Consent Status Indices for other zones, the Consent Status Matrix should take account of generally accepted risk management theory, in that commercial use may be subjected to more risk than that afforded to residential developments.

The Consent Status Indices in the Consent Status Matrix have been developed on a generalised basis in consultation with risk experts from Australia and New Zealand. The indices are not intended to be used for:

- deciding where to site a hazardous facility that is screened out as being a discretionary activity, or
- making an absolute judgement as to the risk posed by a facility that is screened out as being a discretionary activity.

6 References

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Appendix G: Schedule to District Plan Section on Hazardous Facilities

1 Background

The HFSP is applied to hazardous facilities in all land use zones and in addition to other zone-specific land use controls. The procedure is applied to all new hazardous facilities, irrelevant of their type and size. The HFSP should also be applied to existing hazardous facilities if a significant change occurs in the character, nature and scale of effects.[22]

Fundamentally, the HFSP is used to screen hazardous facilities **and** their sites. However, where hazardous facilities on the same site are separated by more than 30 metres from each other, they may be dealt with as separate facilities and the HFSP is applied to each of them separately.

2 Terminology

The HFSP uses a number of terms. These are listed and explained below.

Term	Explanation
Proposed Quantity (P)	The quantity of a hazardous substance proposed to be used or stored on a site.
Base Quantity (B)	Pre-calibrated quantity of a hazardous substance that is deemed to be acceptable on a heavy industrial site without causing any significant off-site effects.
Adjustment Factor	Pre-calibrated factors that take into account substance, storage and site-specific circumstances.
Adjusted Quantity (A)	Equivalent to the Base Quantity that has been adjusted using Adjustment Factors.
Effect Type	Three Effect Types are used by the HFSP: Fire/Explosion Effects on Human Health Effects on the Environment.
Quantity Ratio (Q)	The ratio of the proposed quantity of a substance over the applicable Base Quantity.
Consent Status Index	Numerical values in the district plan that are used to determine the consent status of a facility.

3 Overview

The HFSP is designed to assess the environmental effects of hazardous substances proposed to be stored or used on a site, taking into account their quantities, characteristics, location, type of activity and local environmental conditions. This assessment is carried out for three defined Effect Types:

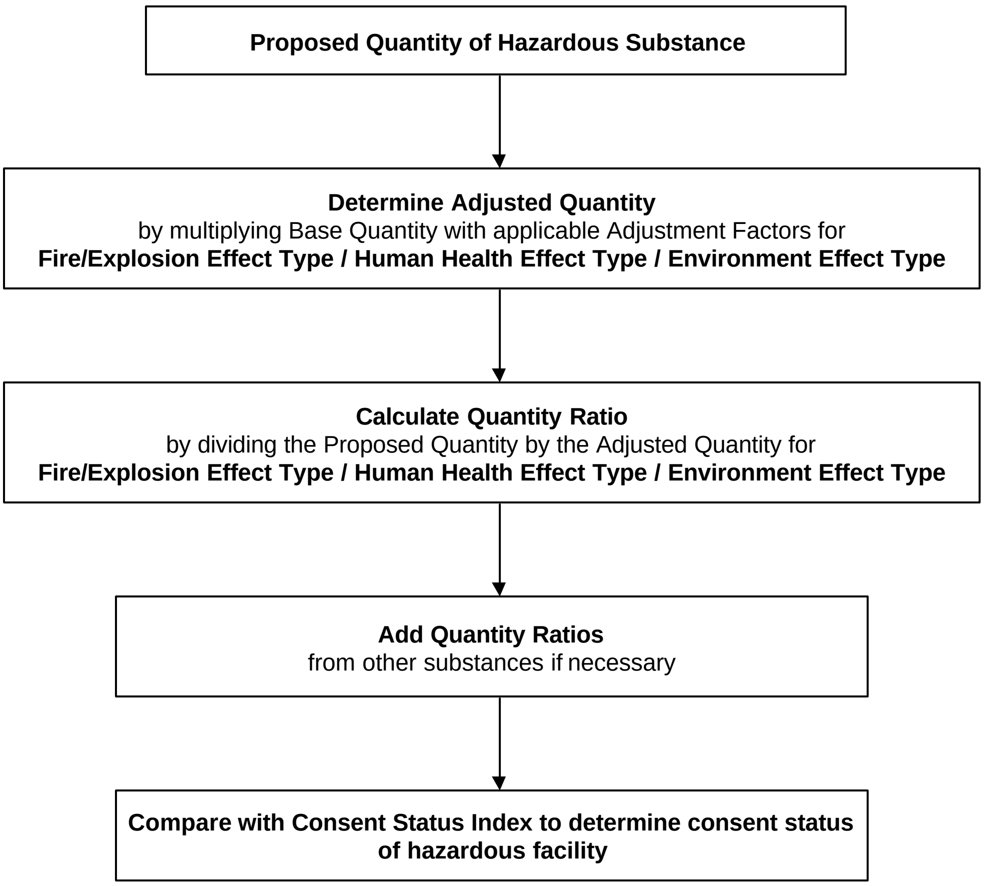
[22] It is recommended that councils define what constitutes a significant change.

- Fire/Explosion
- Human Health
- Environment.

Basically, the HFSP compares proposed quantities of hazardous substances with maximum allowable quantities (Adjusted Quantities) which depend on the type of substances, how they are used and stored, and the location of the facility. A Quantity Ratio is calculated by dividing the proposed quantity of each hazardous substance with the Adjusted Quantity. The Quantity Ratios of individual substances are added up for each of the Effect Types. Cumulative Quantity Ratios are then compared with defined limits called Consent Status Indices which are listed in the rules of the district plan. If any of the Quantity Ratios exceed specified Consent Status Indices, the hazardous facility in question requires a resource consent.

Some information needs to be assembled at the outset about the hazards of the substances concerned. This includes site layout and location, types of activities as well as the sensitivity of the surrounding environment. In most cases, only a limited number of substances need to be assessed to determine the resource consent status of an activity. This applies in particular if one, two or three substances are either very hazardous or stored/used in large quantities. An overview of the HFSP is presented in Figure F1.

Figure F1: Overview of HFSP (process for single substance)



4 Rating hazardous substances for the HFSP

To be able to assess hazardous substances under the HFSP, they must be rated first. These rating criteria are based on the classification system specified by regulations under the Hazardous Substances and New Organisms Act 1996 (HSNO) and are provided in Attachment A.

For the purposes of the HFSP, each substance is rated based on three Effect Types:

- Fire/Explosion Effects: concerned with damage to property, the built environment and safety of people
- Human Health Effects: concerned with the well-being, health and safety of people
- Environmental Effects: concerned with damage to ecosystems and natural resources.

Each Effect Type is divided into a maximum of three hazard levels:

♦ high ♦ medium ♦ low

The rating of a hazardous substance for the HFSP requires each substance to be assessed in terms of every hazard category listed in Attachment A. Hazard ratings may be obtained as follows:

1 Some commonly used hazardous substances in New Zealand have already been assessed and pre-rated for the HFSP. This information is available from the council desk or from the MfE website.

2 Under HSNO, all substances previously controlled by repealed legislation (such as the Dangerous Goods and Toxic Substances Acts) will be classified using HSNO classification criteria. Once a substance is classified under HSNO, it can be easily rated for the HFSP based on Attachment A. Information on the classification of hazardous substances under HSNO will be available from ERMA New Zealand (the Environmental Risk Management Authority) and be accessible through the ERMA website.

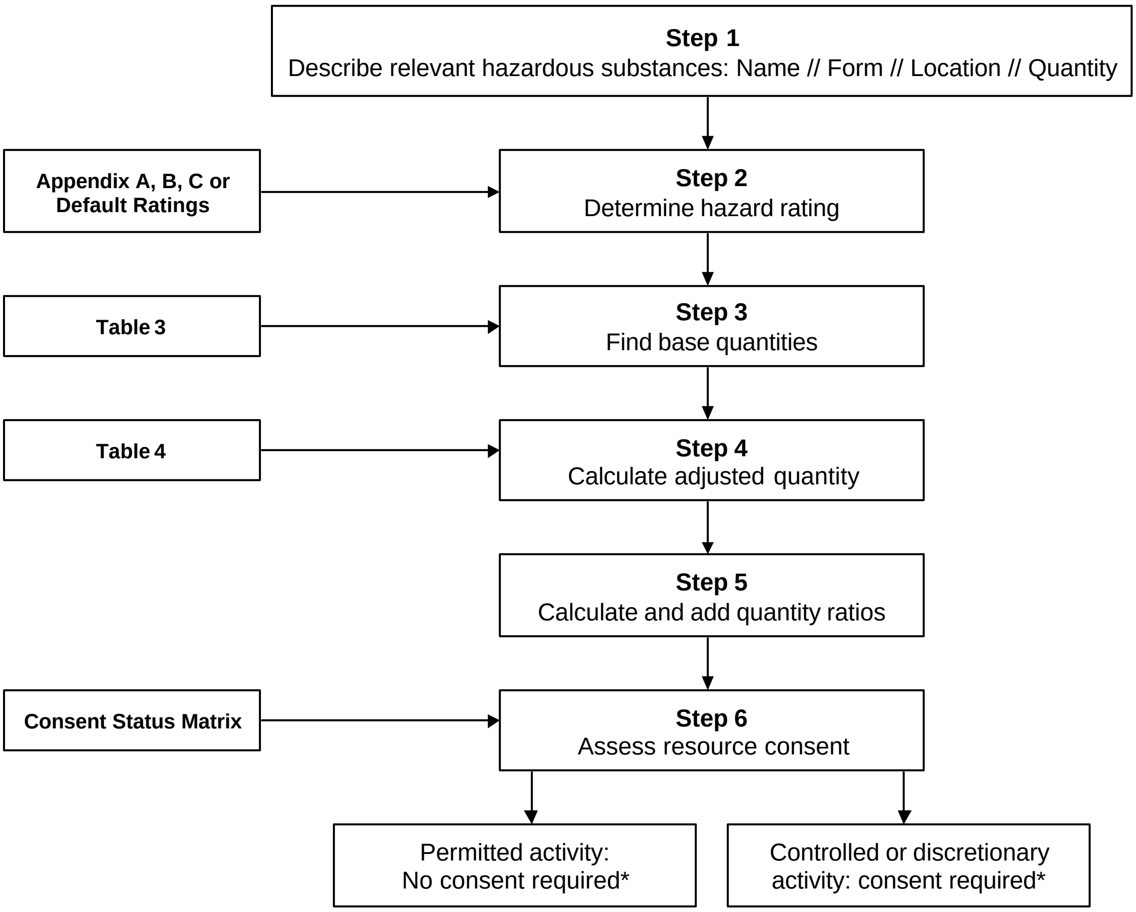
3 Where information for the rating of a hazardous substance for the HFSP is not or only partially available from the above discussed sources, a **precautionary default rating** of Medium for the Fire/Explosion and Human Health Effect Types, and High for the Environmental Effect Type should be applied to the hazardous substance in question.

4. Where no HFSP rating is available through Options 1 or 2 above and the default ratings given in Option 3 are not considered suitable, the rating Guide in Appendix C may be used to research and assign HFSP ratings to hazardous substances.

5 Step-by-step guide to the HFSP

This section works through a step-by-step guide on how to use the Hazardous Facility Screening Procedure, following the steps shown in Figure F2 and Table F1.

Figure F2: Step-by-step guide to the HFSP



* **Note:** Compliance with minimum performance standards is always required.

Table F1: HFSP – Step-by-Step Guide

Steps	HFSP calculations				Explanation
1 Describe the hazardous facility Prior to using the HFSP, it is necessary to compile a full description of the hazardous facility in question. This includes the creation of an inventory of hazardous substances held on the site, including: • names of the hazardous substances • quantities of the hazardous substances • the physical form of the substances at 20°C and 101.3 kPa • the location of use or storage on the site, including separation distances from the site boundary and neighbouring hazardous facilities (on-site and off-site). The description should also include site-specific details, including neighbouring land uses and the surrounding environment, with a focus on sensitive land uses and receptors (e.g. retirement accommodation, aquifers or wetlands).	**Substance name** Substance 1 Substance 2 … Substance 10	**Substance form** (liquid, solid, gas)	**Location of substances on site**	**Proposed quantity (P)** (tonnes or m^3)	The HFSP uses standard units of tonnes (t) (for solids, liquids and liquefied gases) and cubic metres (m^3) (for compressed gases). In some cases, it may therefore be necessary to convert substance quantities to these units. In the case of liquids, specific gravity (or density) must be taken into consideration when converting litres or m^3 to tonnes (i.e. $\frac{\text{volume of liquid (litres) x specific gravity}}{1000}$ = tonnes). Adjustments to quantities are also necessary where a substance is diluted with water or mixed with another substance. In this instance, only the percentage quantity of the hazardous substance or product in the dilution or mixture is assessed for the purposes of HFSP calculations (unless a mixture is more hazardous than its components, in which case data on the mixture need to be used). An exception to this are products or brands that already constitute dilutions or mixtures of hazardous substances and which have been classified in terms of their hazardous properties as the 'whole' dilution or mixture for life cycle management purposes. Examples of this are corrosives, oxidising substances and pesticides, which are often sold commercially as standard solutions or strengths. In these cases, quantity adjustments are only applied when these commercially supplied concentrations are further diluted or mixed.
	Example				
	Petrol	**Liquid**	**< 30 metres**	**50 +**	
2 Determine hazard rating For the purposes of the HFSP, the effects of substances are categorised into three Effect Types: • Fire/Explosion Effect Type: addressing damage to the built environment and safety of people • Human Health Effect Type: addressing adverse effects on the well-being, health and safety of people • Environmental Effect Type: addressing adverse effects on ecosystems and natural resources. Each Effect Type is divided into three Hazard Rating Levels: ♦ High ♦ Medium ♦ Low The rating levels are based predominantly on the HSNO classification system.	**Substance name** **Substance 1** **Substance 2** **…** **Substance 10**	**Hazard rating** Fire/ Explosion High (H) or Medium (M) or Low (L)	Human Health High (H) or Medium (M) or Low (L)	Environ-ment High (H) or Medium (M) or Low (L)	The HFSP rates hazardous substances in terms of each of the three Effect Types as having a high, medium or low hazard. The Hazard Rating of a substance is derived from: 1 The list of HFSP-rated hazardous substances in Appendix B. 2 The HSNO classification (refer Appendix A). Once a substance has been classified under HSNO, Hazard Ratings can be assigned for each Effect Type as shown in Appendix A. 3 Where a substance is neither found in Appendix B nor the HSNO database on the ERMA website, the following default ratings should be used: • Fire/Explosion Effect Type: Medium • Human Health Effect Type: Medium • Environment Effect Type: High 4 The substance may be rated using Appendix C as a guide.
	Example				
	Petrol	High	Low	Medium	

Steps	HFSP calculations				Explanation
3 Find base quantities The Base Quantity (B) is pre-calibrated. It is the amount of a substance that has been assessed as generating no significant off-site effects in a heavy industrial area before site- and substance-specific considerations have been taken into account (refer Step 4). Base Quantities for different hazardous properties and hazard ratings in each Effect Type are listed in Table 3.	**Substance name**	**Base quantities (B)**			For example, in the Fire/Explosion Effect Type (Sub-category Flammables), non-significant off-site effects in a heavy industrial area are represented by a Base Quantity of: • 100 tonnes of a HSNO Category D flammable liquid which has a low hazard level for the Fire/Explosion Effect Type. • 30 tonnes of a HSNO Category C flammable liquid which has a medium hazard level for the Fire/Explosion Effect Type.
		Fire/ Explosion	Human Health	Environ-ment	
	Substance 1	B_1	B_1	B_1	
	Substance 2	B_2	B_2	B_2	
	…	…	…	…	
	Substance 10	B_{10}	B_{10}	B_{10}	
	Example				
	Petrol	10 t	30 t	30 t	
4 Calculate Adjusted Quantity (A) The precalibrated Adjustment Factors (FF, HF, EF) are multiplied with the Base Quantities (B) to account for substance properties and site-specific environmental circumstances. This multiplication yields the Adjusted Quantity (A). Adjustment Factors differ for each of the Effect Types, and take into account the following considerations: • the physical state of the substance • the type of storage • the type of activity or use • separation distances to the site boundary • the environmental sensitivity of the site location. The Adjustment Factors are listed in Table 4.	**Substance name**	**Adjusted quantities (A)**			Different Adjustment Factors are applied for each Effect Type. For example, for the Fire/Explosion Effect Type, the temperature is relevant, while for the Human Health Effect Type, proximity to a potable water resource is important. In some instances, more than one Adjustment Factor within each Effect Type must be applied, which then need to be multiplied with each other to yield the total Adjustment Factor for the Effect Type. When the Adjustment Factors for each Effect Type have been calculated, they in turn are multiplied with the Base Quantity to yield the Adjusted Quantity). In the example given, the following parameters have been assumed: • <30m to site boundary • not adjacent to water body • underground storage.
		Fire/ Explosion	Human Health	Environ-ment	
	Substance 1	A_1	A_1	A_1	
	Substance 2	A_2	A_2	A_2	
	…	…	…	…	
	Substance 10	A_{10}	A_{10}	A_{10}	
	Example				
	Petrol	100 t (10 tonnes x 10)	300 t (30 tonnes x 30)	90 t (30 tonnes x 3)	
5 Calculate and add Quantity Ratios (FQ, HQ, EQ) This step requires the calculation of the Quantity Ratio for each hazardous substance in question. The Quantity Ratio is a dimensionless number. It is obtained by dividing the quantity of a substance that is proposed to be used or stored on a site, i.e. the Proposed Quantity (P) by the Adjusted Quantity (A). If several hazardous substances are used or stored on a site, the Quantity Ratios calculated for each of these substances are added up for each Effect Type. Note that $FQ/HQ/EQ_{Total}$ stands for the total sum of Quantity Ratio values from all assessed hazardous substances, within each Effect Type.	**Substance name**	**Quantity ratios (FQ, HQ, EQ)**			By using the dimensionless ratio of the Proposed Quantity of a hazardous substance over the Adjusted Quantity, it is possible to aggregate the effects presented by multiple substances held on the same site. Hence, it becomes possible to assess the cumulative potential effects which may be created by several substances present on the same site.
		Fire/ Explosion	Human Health	Environ-ment	
	Substance 1	FQ_1	FQ_1	FQ_1	
	Substance 2	FQ_2	FQ_2	FQ_2	
	…	…	…	…	
	Substance 10	FQ_{10}	FQ_{10}	FQ_{10}	
		$\mathbf{FQ_{Total}}$	$\mathbf{HQ_{Total}}$	$\mathbf{EQ_{Tpta;}}$	
	Example				
	Petrol	0.50 **(50 tonnes / 100 tonnes)**	0.1667 **(50 tonnes / 300 tonnes)**	0.5556 **(50 tonnes / 90 tonnes)**	
6 Assess resource consent status of hazardous facility When assessing the resource consent status of a particular hazardous facility, the added Quantity Ratios for each Effect Type are compared with relevant Consent Status Indices in the Resource Consent Matrix in the district plan. If they are exceeded, a resource consent is required.	**Substance name**	**Does quantity ratio exceed consent status index?**			When examining total Quantity Ratios against applicable Consent Status Indices, one or several substances may trigger a resource consent. This highlights the fact that when assessing hazardous facilities, it is often sufficient to assess just a few hazardous substances to start off with, mainly those that are either highly hazardous or are used/stored in high quantities.
		Fire/ Explosion	Human Health	Environ-ment	
	Substance 1 **Substance 2** **…** **Substance 10**	**Yes / No**	**Yes / No**	**Yes / No**	
	Example In a typical industrial zone:				
	Petrol	No	No	No	

Table F2: Base quantities for all effect types and hazard levels

HSNO category	UN class equivalent	Hazard level	Unit tonnes or cubic metres	Base quantity (B)		
				Fire/ explosion	Human health	Environment
Explosive substances						
1.1	1.1	High	tonnes	0.1	–	–
1.2	1.2	Medium	tonnes	1	–	–
1.3	1.3	Low	tonnes	3	–	–
1.5	1.5	Low	tonnes	3	–	–
Flammable gases						
2.1.1A	2.1	High	m^3 tonnes	10,000* 10	–	–
2.1.2A	2.1	High	m^3 tonnes	10,000* 10	–	–
	LPG	Medium	tonnes	30	–	–
Flammable liquids						
3.1 A	3PGI	High	tonnes	10	–	–
3.1 B	3PGII	High	tonnes	10	–	–
3.1 C	3PGIII	Medium	tonnes	30	–	–
3.1 D	Combustible liquids	Low	tonnes	100	–	–
Liquid desensitised explosives						
3.2 A 3.2 B 3.2 C	3 PGI 3 PGII 3 PGIII	High	tonnes	1		
Flammable solids						
4.1.1.A	4.1 (a) PGII	Medium	tonnes	10	–	–
4.1.1 B	4.1 (a) PGIII	Low	tonnes	30	–	–
4.1.2 A 4.1.2 B	4.1 (b) PGII	High	tonnes	1	–	–
4.1.2 C 4.1.2 D	4.1 (b) PGII	Medium	tonnes	10	–	–
4.1.2 E 4.1.2 F 4.1.2 G	4.1 (b) PGII	Low	tonnes	30	–	–
4.1.3 A	4.1 (c) PGI	High	tonnes	1	–	–
4.1.3 B	4.1 (c) PGII	High	tonnes	1	–	–
4.1.3 C	4.1 (c) PGIII	High	tonnes	1	–	–
4.2 A	4.2 PGI	High	tonnes	1	–	–
4.2 B	4.2 PGII	High	tonnes	1	–	–
4.2 C	4.2 PGIII	Medium	tonnes	10	–	–
4.3 A	4.3 PGI	High	tonnes	1	–	–
4.3 B	4.3 PGII	High	tonnes	1	–	–
4.3 C	4.3 PGIII	Medium	tonnes	10	–	–

HSNO category	UN class equivalent	Hazard level	Unit tonnes or cubic metres	Base quantity (B)		
				Fire/ explosion	Human health	Environment
Oxidising substances						
5.1.1 A	5.1 PGI	High	tonnes	1		
5.1.1 B	5.1 PGII	High	tonnes	1		
5.1.1 C	5.1 PGIII	Medium	tonnes	10		
5.1.2 A	2.2	High	m^3 tonnes	10,000 10		
5.2 A 5.2 B	5.2 Types A and B	High	tonnes	1		
5.2 C 5.2 D	5.2 Types C and D	Medium	tonnes	10		
5.2 E 5.2 F 5.2 G	5.2 Types E, F and G	Low	tonnes	30		
Toxic substances						
6.1 A	6.1 PGI 2.3	High	tonnes m^3	–	1 50	–
6.1 B	6.1 PGII 2.3	High	tonnes m^3	–	1 50	–
6.1 C	6.1 PGIII 2.3	Medium	tonnes m^3	–	10 150	–
6.1 D	Standard poison	Low	tonnes m^3	–	30 500	–
Corrosive substances						
8.2 A	8 PGI	High	tonnes	–	1	–
8.2 B	8 PGII	Medium	tonnes	–	10	–
8.2 C	8 PGIII	Low	tonnes	–	30	–
Ecotoxic substances						
9.1 A	GHS	High	tonnes	–	–	3
9.1 B	GHS	Medium	tonnes	–	–	30
9.1 C	GHS	Low	tonnes	–	–	100
9.1 D	GHS	Low	tonnes			100

* Base quantity in m^3 at 101.3 kPA and 20^{o}C for permanent or compressed gases.

Table F3: Adjustment factors

Fire/explosion	Human health	Environment
FF1: Substance form Solid = 1 Liquid, powder = 1 Gas (101.3 kPa, 20°C) = 0.1	***FH1: Substance form*** Solid = 3 Liquid, powder = 1 Gas (101.3 kPa and 20°C) = 0.1	***FE1: Substance form*** Solid = 3 Liquid, powder = 1 Gas (101.3 kPa and 20°C) = 0.1
FF2: Separation distance from site boundary (sub-facility) < 30 m = 1 > 30 m (>60 m)[23] = 3	***FH2: Separation distance from site boundary (sub-facility)*** *(gases only)* < 30 m = 1 > 30 m (>60 m)[2] = 3	***FE2: Environmental sensitivity*** Normal = 1 Adjacent to water resource[24] = 0.3
FF3: Type of activity Use = 0.3 Above ground storage = 1 [Underground storage[25] = 10]	***FH3: Type of activity*** Use = 0.3 Above ground storage = 1 [Underground storage[6] = 10]	***FE3: Type of activity*** Use = 0.3 Above ground storage = 1 [Underground storage[6] = 3]
Final fire/explosion adjustment factor **FF = FF1 x FF2 x FF3**	Final human health adjustment factor **FH = FH1 x FH2 x FH3**	Final environment adjustment factor **FE = FE1 x FE2 x FE3**

Attachment A: HFSP Rating of Hazardous Substances

The full description of HSNO Classes, Sub-classes and Categories as well as explanations of terms used is contained in the HSNO Regulations. Further details on their use may also be found in the ERMA 'Users Guide to the HSNO Thresholds and Classifications of Hazardous Substances'.

It is important to note that:

- HSNO Classes and categories do not always correspond perfectly with the UN Classification. The list provided in this Appendix should therefore only be used for HFSP purposes.
- A number of HSNO classes or sub-classes do not have an HFSP hazard rating in the land use planning context as the potential for off-site effect of these substances is low.

[23] If the facility is assessed as a sub-facility, the distance to the neighbouring sub-facility must be more than 60 metres (i.e. 2 x 30 metres) to qualify for an Adjustment Factor of 3 (refer Section 5.5.4 of the main document).

[24] Water resources include aquifers and water supplies, streams, springs, lakes, wetlands, estuaries and the sea, but do not include entry points to the stormwater drainage network. 'Adjacent' must be defined in respective district plans and will depend on the type of water resource potentially affected (adjacent is variably defined as between 30 and 100 metres).

[25] Applicable to UN Class 3 substances (flammable liquids) only.

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
Explosive substances	1.1	1.1	Substances and articles that have a mass explosion hazard.	Fire/ explosion	High
	1.2	1.2	Substances and articles that have a projection hazard but not a mass explosion hazard.	Fire/ explosion	Medium
	1.3	1.3	Substances and articles that have a fire hazard and either a minor blast hazard or a minor projection hazard or both.	Fire/ explosion	Low
	1.5	1.5	Very insensitive substances that have a mass explosion hazard.	Fire/ explosion	Low
Flammable gases	2.1.1A High hazard	2.1	a) Ignitable when in a mixture of 13% or less by volume with air; or b) Has a flammable range with air of at least 12%, regardless of the lower flammability limit.	Fire/ explosion	High
	2.1.2A Flammable aerosols	2.1	An aerosol comprising 45% or more by mass of flammable ingredients.	Fire/ explosion	High
		LPG		Fire/ explosion	Medium
Flammable liquids	3.1.A Very high hazard	3 PGI	A flash point of less than 23^{o}C and an initial boiling point of less than or equal to 35^{o}C.	Fire/ explosion	High
	3.1B High hazard	3 PGII	A flash point of less than 23^{o}C and an initial boiling point of greater than 35^{o}C.	Fire/ explosion	High
	3.1C Medium hazard	3 PGIII	A flash point of greater than or equal to 23^{o}C but less than or equal to 60^{o}C.	Fire/ explosion	Medium
	3.1D Low hazard	Combustible liquids	A flash point of greater than 60^{o}C but less than or equal to 93^{o}C.	Fire/ explosion	Low
Liquid desensitised explosives	3.2A 3.2B 3.2C	3 PGI 3 PGII 3 PG III	a) A substance that: (i) is listed as a liquid desensitised explosive and is assigned Packing Group I, II or III in the UN Model Regulations; or b) A liquid desensitised explosive that: (i) is formed from an explosive of Class I by adding a desensitising agent to form a liquid that no longer meets the threshold for Class I; and (ii) is not listed in the UN Model Regulations and is not assigned a Packing Group.	Fire/ explosion	High
Flammable solids – readily combustible solids and solids that may cause fire through friction	4.1.1A Medium hazard	4.1(a) PG II	A substance that burns rapidly or the reaction spreads rapidly or may cause fire through low friction in the relevant tests of the UN Manual of Tests and Criteria.	Fire/ explosion	Medium
	4.1.1B Low hazard	4.1(a) PG III	A substance that has lower ratings than 4.1.1A in the relevant tests of the UN Manual of Tests and Criteria.	Fire/ explosion	Low
Self-reactive substances	4.1.2A 4.1.2B	4.1(b) Type A Type B	A thermally unstable substance that propagates a detonation or rapid deflagration or violent effect or thermal explosion in the relevant tests of the UN Manual of Tests and Criteria.	Fire/ explosion	High
	4.1.2C 4.1.2D	4.1(b) Type C Type D	A substance with lower ratings than the above two categories in the relevant tests.	Fire/ explosion	Medium

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
	4.1.2E 4.1.2F 4.1.2G	4.1(b) Type E Type F	A substance with even lower ratings than the above two categories in the relevant tests.	Fire/ explosion	Low
Solid desensitised explosives	4.1.3A 4.1.3B 4.1.3C	4.1(c) PG I PG II PG III	a) A substance with one of the specified UN serial numbers listed in the UN Model Regulations; or b) A solid desensitised explosive that is formed from an explosive of Class I by adding a desensitising agent to form a solid substance that no longer meets the threshold for Class I.	Fire/ explosion	High
Spontaneously combustible substances	4.2A Spontaneously combustible and pyrophoric substances High hazard	4.2 PG I	a) A solid substance that does not meet the criteria for subclass 4.1.2, but ignites within 5 minutes on contact with air under the relevant test conditions in the UN Manual of Tests and Criteria; or b) A substance that does not meet the criteria for subclass 4.1.2, but is a liquid which ignites or chars the filter paper under the relevant test conditions.	Fire/ explosion	High
	4.2B Spontaneously combustible and self-heating substances Medium hazard	4.2 PG II	A substance that does not meet the criteria for subclass 4.1.2 but meets specified criteria under the relevant test conditions.	Fire/ explosion	High
	4.2C Spontaneously combustible and self-heating substances Low hazard	4.2 PG III	A substance that does not meet the criteria for subclass 4.1.2, which, depending on quantity, meets specified criteria under the relevant test conditions.	Fire/ explosion	Medium
Solids that emit flammable gas when in contact with water	4.3A High hazard	4.3 PG I	a) A substance that emits a gas that ignites when a small quantity of the substance is brought into contact with water; or b) A substance that reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is > 10 litres/kg over any 1 minute.	Fire/ explosion	High
	4.3B Medium hazard	4.3 PG II	A substance that reacts readily with water at ambient temperatures such that the maximum rate of evolution is > 20 litres/ kg per hour.	Fire/ explosion	High
	4.3C Low hazard	4.3 PG III	A substance that reacts slowly with water at ambient temperatures so that the maximum rate of evolution of flammable gas is > 1 litre /kg per hour.	Fire/ explosion	Medium
Oxidising substances – liquids or solids	5.1.1A High hazard	5.1 PG I	a) A substance listed as 5.1 in the UN Model Regulations and assigned Packing Group I; or b) A solid that when mixed with dry cellulose either spontaneously ignites or exhibits a mean burning time less than that of a specified reference material; or c) A liquid that when mixed with dry cellulose forms a mixture that either spontaneously ignites or exhibits a mean pressure rise time less than that of a specified reference material.	Fire/ explosion	High

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
	5.1.1B Medium hazard	5.1 PG II	a) A substance listed as 5.1 in the UN Model Regulations and assigned Packing Group II; or b) A solid that does not meet the criteria of 5.1.1A and that when mixed with dry cellulose forms a mixture that exhibits a mean burning time equal to or less than a specified reference material; or c) A liquid that does not meet the criteria of 5.1.1A and that when mixed with dry cellulose forms a mixture that exhibits a mean pressure rise time less than or equal to that of a specified reference material.	Fire/ explosion	High
	5.1.1C Low hazard	5.1 PG III	a) A substance listed as 5.1 in the UN Model Regulations and assigned Packing Group III; or b) A solid that does not meet the criteria of 5.1.1A or B and that when mixed with dry cellulose forms a mixture that exhibits a mean burning time equal to or less than that of a specific reference material; or c) A liquid that does not meet the criteria of 5.1.1A or B and that when mixed with dry cellulose forms a mixture that exhibits a mean pressure rise time less than or equal to that of a specified reference material.	Fire/ explosion	Medium
Gases	5.1.2A	2.2	a) A gas that is listed as 5.1 in the UN model Regulations; or b) A gas that causes or contributes to combustion of other material at a faster rate than air.	Fire/ explosion	High
Organic peroxides	5.2A 5.2B	5.2 Type A Type B	A substance that propagates a detonation or rapid deflagration or violent effect or thermal explosion in the relevant tests of the UN Manual of Tests and Criteria.	Fire/ explosion	High
	5.2C 5.2D	5.2 Type C Type D	A substance with lower ratings than 5.2A or B in the relevant tests.	Fire/ explosion	Medium
	5.2E 5.2F 5.2G	5.2 Type E Type F Type G	A substance with even lower ratings than 5.2A or B in the relevant tests.	Fire/ explosion	Low
Toxic substances	6.1A	6.1 PGI 2.3 (gases)	Oral toxicity: LD_{50} of less than or equal to 5 mg/kg Dermal toxicity: LD_{50} of less than or equal to 50 mg/kg Inhalation toxicity (gas): LC_{50} of less than or equal to 100 ppm Inhalation toxicity (vapour): LC_{50} of less than or equal to 0.5 mg/l Inhalation toxicity (dust/mist): LC_{50} of less than or equal to 0.05 mg/l	Human health	High

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
	6.1B	6.1 PGII 2.3 (gases)	Oral toxicity: LD_{50} of greater than 5 mg/kg but less than or equal to 50 mg/kg Dermal toxicity: LD_{50} of greater than 50 mg/kg but less than or equal to 200 mg/kg Inhalation toxicity (gas): LC_{50} of greater than 100 ppm but less than or equal to 500 ppm Inhalation toxicity (vapour) LC_{50} of greater than 0.5 mg/l but less than or equal to 2.0 mg/l Inhalation toxicity (dust/mist) LC_{50} of greater than 0.05 mg/l but less than or equal to 0.5 mg/l	Human health	High
	6.1C	6.1 PGIII	Oral toxicity: LD_{50} of greater than 50 mg/kg but less than or equal to 300 mg/kg Dermal toxicity: LD_{50} of greater than 200 mg/kg but less than or equal to 1000 mg/kg Inhalation toxicity (gas): LC_{50} of greater than 500 ppm but less than or equal to 2500 ppm Inhalation toxicity (vapour) LC_{50} of greater than 2.0 mg/l but less than or equal to 10.0 mg/l Inhalation toxicity (dust/mist) LC_{50} of greater than 0.5 mg/l but less than or equal to 1.0 mg/l	Human health	Medium
	6.1D	Toxic Substances Regulations: Standard Poison	Oral toxicity: LD_{50} of greater than 300 mg/kg but less than or equal to 2000 mg/kg Dermal toxicity: LD_{50} of greater than 1000 mg/kg but less than or equal to 2000 mg/kg Inhalation toxicity (gas): LC_{50} of greater than 2500 ppm but less than or equal to 5000 ppm Inhalation toxicity (vapour) LC_{50} of greater than 10 mg/l but less than or equal to 20 mg/l Inhalation toxicity (dust/mist) LC_{50} of greater than 1.0 mg/l but less than or equal to 5.0 mg/l	Human health	Low
Corrosive substances	8.2A	8 PG I	Data indicate irreversible destruction of dermal tissue following brief exposure	Human health	High
	8.2B	8 PG II	Data indicate irreversible destruction at dermal tissue following moderate exposure	Human health	Medium
	8.2C	8 PG III	Data indicate irreversible destruction at dermal tissue following lengthy exposure (up to four hours)	Human health	Low

Hazard	HSNO Class and Category	(UN Division)	Description	Effect type	Hazard rating
Ecotoxic substances	9.1A Substances that are very ecotoxic in the aquatic environment	GHS	Acute aquatic toxicity value[26] of less than or equal to 1 mg/l	Environ-ment	High
	9.1B Substances that are ecotoxic in the aquatic environment	GHS	Chronic aquatic toxicity[27] of less than or equal to 1 mg/l and a) acute aquatic toxicity value of greater than 1 mg/l but less than 10 mg/l; and b not rapidly degradable or is bioaccumulative, or is not rapidly degradable and is bioaccumulative.	Environ-ment	Medium
	9.1C Substances that are harmful in the aquatic environment	GHS	Chronic aquatic toxicity of less than or equal to 1 mg/l and: a) acute aquatic toxicity value of greater than 10 mg/l but less than 100 mg/l; and b) not rapidly degradable or is bioaccumulative or, is not rapidly degradable and is bioaccumulative.	Environ-ment	Low
	9.1D Substances that are slightly harmful in the aquatic environment or are otherwise designed for biocidal action	GHS	a) Acute aquatic toxicity value of greater than 1 mg/l but less than 100 mg/l, but does not meet classification criteria for 9.1A, 9.1B or 9.1C; or b) Chronic aquatic toxicity value is less than or equal to 1 mg/l but does not meet classification criteria for 9.1B or 9.1C; or c) Not rapidly degradable and is bioaccumulative but does not meet classification criteria for 9.1A, 9.1B or 9.1C.	Environ-ment	Low

[26] ‘Acute aquatic toxicity value’ means the lowest value expressed in units of milligrams of a substance per litre of water from:
(a) fish LC_{50} data after a 96-hour exposure period; or
(b) crustacean EC_{50} data after a 48-hour exposure period; or
(c) algal, or other aquatic plant EC_{50} data after a 72-hour exposure period.

[27] ‘Chronic aquatic toxicity’ means the lowest value expressed in units of milligrams of a substances per litre of water from chronic fish, crustacean, algal, or other aquatic plant NOEC (no observed effect concentration) data.