APPENDIX G

Hazardous Facility Screening Procedure

5.0 THE HAZARDOUS FACILITY SCREENING PROCEDURE

This section works through a step-by-step guide on how to use the *Hazardous Facility Screening Procedure*, following the steps shown in Figure 2 and using a series of worksheets. These illustrate the HFSP's individual steps and longhand calculations. A computer package is being developed to speed up the calculations.

5.1 Step 1: Assemble Site-specific Information

Site specific information is an essential component of the HFSP. Because it deals with effects, any sensitive land uses or environmental features on or near the site need to be noted. An example of a *Site Information Sheet* is Worksheet 1.

5.2 Step 2: Compile Hazardous Substances Inventory

To use the *Hazardous Facility Screening Procedure*, it is necessary to create a full inventory of hazardous substances held on a site, including substances that are only stored or used temporarily such as waste hazardous substances. The inventory should list:

(i) the names (including proprietary names and suppliers where necessary);

(ii) quantities;

(iii) UN classifications of all the hazardous substances on the site; and

(iv) whether the substance is used or stored.

A form to assist with this task is Worksheet 2.

It is noted that the HFSP uses the standards units of tonnes (for solids, liquids and liquefied gases) and m^3 (for compressed gases). It is therefore sometimes necessary to convert substance quantities to these units. In the case of liquids, it is necessary to apply the specific gravity (or density) to convert litres to kilograms, or m^3 to tonnes.

The specific gravity is the specific weight of a liquid in relation to that of water. Therefore, a liquid with a specific gravity of greater than 1.0 sinks, while a liquid with a specific gravity of less than 1.0 will float on water. For example, 1000 litres of petrol weigh approximately 800kg or 0.8 tonnes.

Conversions of quantities are also necessary where a substance is diluted, or mixed with another substance. In this instance, only the percentage of the pure substance in the dilution or mixture is accounted for. For example, if it is proposed to store 10 tonnes of a substance that has a concentration of 30%, the proposed quantity on Worksheet 2 should be 3 tonnes.

Exceptions to this are corrosives (UN Class 8) and oxidising substances (UN Class 5), where the UN Class is sometimes directly applied to specific commercially available concentrations. In these instances, conversions are only applied when these commercially supplied concentrations are further diluted for specific purposes. Pesticides are also substances which are commonly available as diluted commercial products. The UNRTDG (1993) lists a range of pesticides and their dilutions, and their related Packaging Groups in Class 6.1 in terms of a human poison rating.

If a substance is in a mixed form, proposed quantities for the percentage of pure substance in the mixture should be listed. In cases where synergistic effects result in a mixture that is more hazardous than its components, the mixture may need to be subjected to appropriate testing procedures to obtain the necessary information, unless relevant information is readily available.

It is also important to note that small packages are generally treated the same as bulk quantities. While small packages or containers reduce the risk of a major spill, they may still react like bulk quantities in some emergencies. For this reason, a conservative approach has been taken, especially as the HFSP generally does not apply to retail outlets.

In some cases, it may be difficult to decide whether a substance is in use or storage. Generally, the HFSP considers a substance in use when the full amount of the substance is used at any one time, for example as an acid bath. A substance that is taken from a container and used in small amounts while its bulk continues to be stored would be rated as being storage.

5.3 Step 3: Select “Priority Status” Substances

Often, numerous hazardous substances are held on a site, and it is time-consuming to prepare a full classification of all of them. It is neither practical nor necessary to submit every substance to the HFSP; therefore the following “common sense” guide-lines apply for sites where multiple hazardous substances are held, to assist in defining those which have “priority status”:

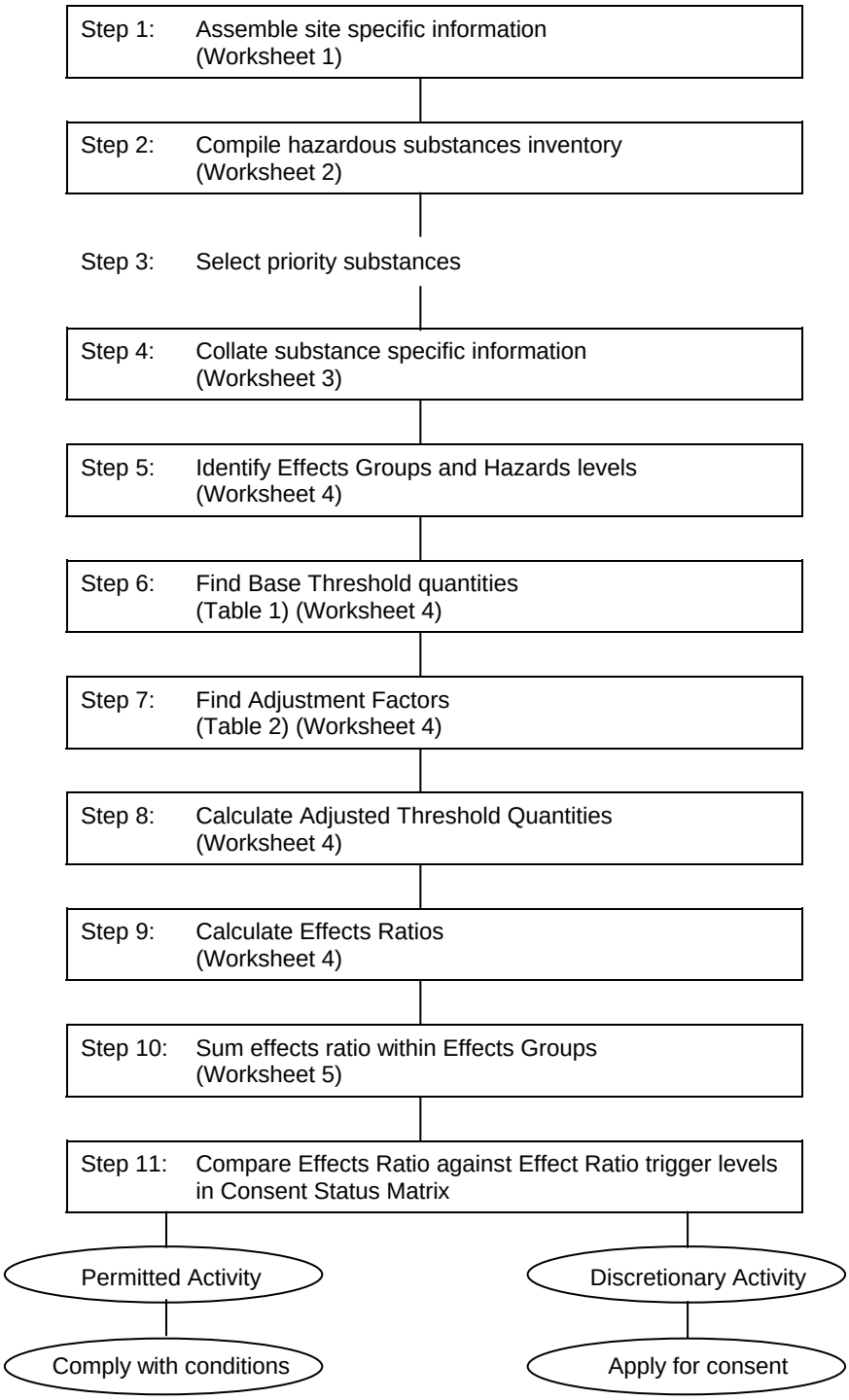
(i) if there are ten or fewer substances on site, the HFSP is carried out on all substances unless it is evident that one single substance is likely to exceed the relevant trigger levels in the Consent Status Matrix (in which case the proposal would require a consent application);

(ii) if there are more than ten substances on site, the HFSP is carried out on those substances which

a. are highly or extremely dangerous; and/or

b. are held in quantities 10% of the total stock of hazardous substances listed in the inventory (Worksheet 2).

FIGURE 2: A STEP-BY-STEP GUIDE TO THE HAZARDOUS FACILITY SCREENING



5.4 Step 4: Collate Substance Specific Information

It is an essential component of the HFSP to assign a hazard level for each *Effects Group* to the hazardous substances held on the site. To do so, it is necessary to collect a range of information about the substances, including UN classifications.

The Hazardous Substance Worksheet in Worksheet 3 has been designed to help with the task of recording the information required to classify substances into *Effects Groups* and hazard levels.

This information can be extracted from the UN Recommendations on the Transport of Dangerous Goods (UNRTDG) 8th edition, Material Safety Data Sheets, national and international databases, and text/reference books such as those listed in the table labelled *"Information Sources for Hazardous Substances".*

Occasionally, data on hazardous substances can only be found in units other than those required on Worksheet 3. Some frequently used conversion factors are provided .

Where the necessary information to carry out this step is not readily available from public information sources, a precautionary approach should be taken, and the substance should be assigned at least a medium hazard level for the Fire/Explosion and Human Health *Effects Groups*, and a high hazard level for the Environmental *Effects Group*.

These hazard levels are deemed appropriate because:

(i) in general, assessment of hazardous substances focuses on health effects and explosive or flammable properties. If a substances rates highly in these categories, this information is usually readily available. Therefore, it is considered reasonable to assign a medium hazard level in the Fire/Explosion and Human Health *Effects Groups* for those substances where this information is not readily available;

(ii) in contrast, information on environmental effects is often lacking. The precautionary approach therefore dictates that a high hazard level should be chosen where no information is available.

As the collation of this information is one of the more time-consuming parts of the HFSP, relevant information for some commonly used hazardous substances is provided in the table labelled *"Hazardous Substance Profiles".*

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5.5 Step 5: Identify Effects Groups and Hazard Levels

For the purposes of the HFSP, the effects of substances are categorised into three groups:

(i) Fire/Explosion Effects: concerned with damage to property, the built environment and safety of people;

(ii) Human Health Effects: concerned with the well-being, health and safety of people;

(iii) Environmental Effects: concerned with damage to ecosystems and natural resources.

Each Effects Group is divided into four hazard levels:

♦ extreme; ♦ high; ♦ medium; ♦ low.

The division into low, medium, high and extreme hazard levels in each of the *Effects Groups* (Fire/Explosion, Human Health and Environmental) is predominantly based on the UN (United Nations) classification system for hazardous substances as outlined in the UN Recommendations on the Transport of Dangerous Goods (UNRTDG), 8th edition, and the classification proposed by the Organisation for Economic Cooperation and Development (OECD) for health and environmental effects[1].

It is important to note that the above classification systems are inadequate for assigning *Effects Group* hazard levels to certain hazardous substances, particularly toxic substances (Class 6.1), toxic gases (Class 2.3) and environmentally toxic substances (Ecotoxic Class).

The following points should be noted:

(i) For the purposes of the HFSP, the classification of these substances (Classes 6.1, 2.3, and Ecotoxic) has been refined to account for extremely hazardous substances.

(ii) Environmentally damaging substances have been placed into the "Ecotoxic" class. Foodstuffs such as milk are an example of an environmentally damaging substance.

(iii) Hazardous substances lists based on the UN Classification System often only list the primary hazard of a substance and sometimes one subsidiary hazard, although a substance may have different effects in each of the *Effects Groups*. For example, a single substance may present:

a. a medium explosion effect;

b. an extreme human health effect; and

c. a high environmental effect.

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1 United Nations, 1993. Recommendations on the Transport of Dangerous Goods, Eighth Revised Edition. New York, United Nations. European Community, 1993. Official Journal of the European Community, No. L 110A/68.

Hence, the HFSP allows for the fact that many substances may fit into more than one *Effects Group*, which is similar to the approach taken in the proposed HSNO legislation.

Hazardous substances (including raw materials, product and wastes) can be classified into *Effects Groups* and assigned a hazard level for each *Effects Group* with the help of the table labelled *Classification of Hazardous Substances*, which lists UN Classes, Packaging Groups and other relevant information.

It should be noted that the HFSP also accounts for combustible liquids such as cooking oils that are not usually assigned a UN Class rating.

The classification of substances or assignment of hazard levels is, in the first instance, carried out according to their UN classification. For example, a UN Class 8, Packaging Group II substance is always assigned a medium Human Health *Effects Group* hazard level and a high Environmental *Effects Group* hazard level. Only when the UN classification does not account for an *Effects Group*, or the substance does not have a UN rating, should other information be used to classify the substance.

The *Effects Groups* and corresponding hazard levels are then recorded in the column marked "Step 4" on the "Summary Sheet for Manual HFSP Calculations" in Worksheet 4.

5.6 Step 6: Find Base Threshold Quantities

The *Base Threshold* (B) is a pre-calibrated quantity. 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. These aspects are addressed through the application of Adjustment Factors. *Base Thresholds* corresponding to the hazard levels in each *Effects Group* are listed in Table 1.

For example, in the Fire/Explosion *Effects Group* [Sub-category Flammables], non-significant off-site effects in a heavy industrial area would be represented by *Base Thresholds* of:

(i) 100 tonnes of a combustible liquid, which has a low hazard level in the Fire/Explosion *Effects Group*.

(ii) 30 tonnes of a Class 3, Packaging Group III substance, which are flammable liquids with a medium hazard level in the Fire/Explosion *Effects Group*.

The *Base Thresholds* for each substance used or stored on the site are found in Table 1 and recorded in the column marked "Step 6" on the "Summary Sheet for Manual HFSP Calculations" in Worksheet 4.

5.7 Step 7: Find Adjustment Factors

Pre-calibrated *Adjustment Factors* (FF, FH and FE) are used to multiply the *Base Threshold* quantities in order to take account of the substance properties and specific circumstances on each site which will influence the severity of any potential effect. This multiplication yields the *Adjusted Threshold* (T)(see Step 8).

Adjustment Factors differ for each of the *Effects Groups*, and take into account the following considerations:

(i) the physical state of the substance;

(ii) the pressure and temperature required for storage and usage;

(iii) the type of storage;

(iv) the type of activity or use;

(v) separation distances to the site boundary;

(vi) the environmental sensitivity of the site location.

For each *Effects Group*, different types of *Adjustment Factors* are relevant. For example, for the Fire/Explosion *Effects Group*, the temperature is relevant, while for the Human Health *Effects Group*, proximity to a potable water resource is important.

Table 2 lists the pre-calibrated *Adjustment Factors* to be used for each *Effects Group*.

In some instances, more than one *Adjustment Factor* within each *Effects Group* will need to be applied to a substance. Where this is the case, the *Adjustment Factors* are multiplied to generate one combined Adjustment Factor (FF, FH or FE) for each *Effects Group*, and the *Base Threshold* is then multiplied by that one Factor.

The *Adjustment Factors* for each substance are recorded in the column marked "Step 7" on the "Summary Sheet for Manual HFSP Calculations" in Worksheet 4.

TABLE 1: BASE THRESHOLDS FOR ALL EFFECTS GROUPS AND HAZARD LEVELS

FIRE/EXPLOSION EFFECTS GROUP					
		Hazard Levels			
UN Class	Hazard	Low	Medium	High	Extreme
Sub-Category: Flammables					
	LPG		LPG		
2	Gases			2.1 (exclude LPG)	
3	Flammable Liquids	Combustible Liquids	3 PGIII	3 PGI 3 PGII	
4	Flammable Solids			4.1	4.2 4.3
5	Oxidisers			5.1	5.2
B(tonnes)		100	30	10	1
B(m^3)*				10,000	
Sub-Category: Explosives					
1	Explosives		1.3	1.2	1.1
B(tonnes)			3	1	0.1

HUMAN HEALTH EFFECTS GROUP					
		Hazard Levels			
UN Class	Hazard	Low	Medium	High	Extreme
2.3	Toxic Gases			2.3 (b)-(d)	2.3 (a)
6	Poisons	6.1 PGIII	6.1 PGII	6.1 PGI (b)	6.1 PGI (a)
	Carcinogen			Carcinogen	
8	Corrosives		8 PGI 8 PGII		
B(tonnes)		30	10	1	0.1
B(m^3)*				500	50

ENVIRONMENTAL EFFECTS GROUP					
		Hazard Levels			
UN Class	Hazard	Low	Medium	High	Extreme
3	Flammable Liquids		3 C		
8	Corrosives			8 PGI 8 PGII 8 PGIII	
	Ecotoxic	Group 1(d) Group 2(d)	Group 1(c) Group 2(c)	Group 1(b)	Group 1(a)
	Pesticides				Pesticides
B(tonnes)		100	30	3	0.3

Note: * Base Threshold in m^3 at 101.3 kPA and 20 ^oC for permanent or compressed gases.

TABLE 2: ADJUSTMENT FACTORS FOR EACH EFFECTS GROUP

ADJUSTMENT FACTORS FOR FIRE/EXPLOSION EFFECTS GROUP		ADJUSTMENT FACTORS FOR HUMAN HEALTH EFFECTS GROUP		ADJUSTMENT FACTORS FOR ENVIRONMENTAL EFFECTS GROUP	
F1: SUBSTANCE FORM		F1: SUBSTANCE FORM		F1: SUBSTANCE FORM	
Solid	= 1	Solid	= 3	Solid	= 3
Liquid, Powder	= 1	Liquid, Powder	= 1	Liquid, Powder	= 1
Gas (at 101.3 kPA and 20^{o}C)	= 0.1	Gas (at 101.3 kPA and 20^{o}C)	= 0.1		
F2: HANDLING/STORAGE CONDITIONS[3]		F2: SEPARATION DISTANCE FROM SITE BOUNDARY (Gases only)		F2: ENVIRONMENTAL SENSITIVITY	
Temperature < flash point	= 1	< 30 metres	= 1	Normal	= 1
Temperature > flash point < boiling point	= 0.3	> 30 metres	= 3	Adjacent to a waterbody[1]	= 0.3
Temperature > boiling point	= 0.1				
F3: SEPARATION DISTANCE FROM SITE BOUNDARY		F3: PROXIMITY TO POTABLE WATER RESOURCE		F3: TYPE OF ACTIVITY	
< 30 metres	= 1	Normal	= 1	Use	= 0.3
> 30 metres	= 3	Proximity to potable water resource[2]	= 0.3	Above ground storage	= 1
F4: TYPE OF ACTIVITY		F4: TYPE OF ACTIVITY		Underground storage[3]	= 3
Use	= 0.3 Above	Use	= 0.3		
ground storage	= 1	Above ground storage	= 1		
Underground storage[3]	= 10	Underground storage[3]	= 10		
F1 x F2 x F3 x F4 = FF		F1 x F2 x F3 x F4 = FH		F1 x F2 x F3 = FE	

1 Waterbody includes streams, springs, lakes, wetlands, sea and estuaries, but does not include aquifers and entry points to the stormwater drainage network.
2 Potable water resource as defined by the Regional Council.
3 Applicable to UN Class 3 substances [Flammable Liquids] and Combustible Liquids only.

5.8 Step 8: Calculate Adjusted Threshold Quantities

The *Adjusted Threshold* (T) is calculated for each *Effects Group* by multiplying the *Base Threshold* (B) by the relevant *Adjustment Factor* (FF, FH, FE), as follows:

(i) T = B x FF provides the *Adjusted Threshold* for a substance in the Fire/Explosion *Effects Group.*

(ii) T = B x FH provides the *Adjusted Threshold* for a substance in the Human Health *Effects Group.*

(iii) T = B x FE provides the *Adjusted Threshold* for a substance in the Environmental *Effects Group.*

The *Adjusted Thresholds* (T) for each substance should be recorded in the column marked "Step 8" on the "Summary sheet for manual HFSP calculations" in Worksheet 4.

5.9 Step 9: Calculate Effects Ratios

The *Effects Ratio* (R) is a dimensionless number. It is obtained by dividing the quantity of a substance (Q) that is proposed to be used or stored on a site by the *Adjusted Threshold* (T):

$$\textit{Effects Ratio}\ (R) = \frac{\text{Proposed quantity of substance (Q)}}{\textit{Adjusted Threshold}\ (T)}$$

The *Effects Ratio* (R) for each substance needs to be recorded in the column marked "Step 9" on the "Summary Sheet for Manual HFSP Calculations" in Worksheet 4.

The *Effects Ratio* fulfils two important purposes:

(i) by using a dimensionless ratio of the proposed quantity of a hazardous substance over the *Adjusted Threshold* instead of *Adjusted Threshold* itself, 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 and which have similar hazardous properties;

(ii) it forms the basis of defining the trigger levels in the Consent Status Matrix which are used to determine the consent status of a particular facility. Whether or not a proposed facility requires a resource consent is determined by assessing whether the calculated *Effects Ratios* exceed the trigger levels in the Consent Status Matrix.

5.10 Step 10: Sum the Effects Ratios to Find the Total Effects Ratio

When assessing several hazardous substances on a site, it is necessary to add the *Effects Ratios* within each Effects Group together. When carrying out a manual calculation, this is done with the use of Worksheet 5.

5.11 Step 11: Determine Consent Status Against Consent Status Matrix

The sum of all *Effects Ratios* within each *Effects Group* determines the consent status of a particular site when compared against the *Effects Ratio* trigger levels in the Consent Status Matrix for that *Effects Group.* In most cases the same trigger value would cover all *Effects Groups*; in these situations, only the highest *Effects Ratio* in any of the three *Effects Groups* needs to be considered to identify the consent status, for example, whether a hazardous facility or activity is permitted, controlled or discretionary. However, there may be situations where a council chooses to differentiate between *Effects Groups*, in which case the *Effects Ratios* for the identified *Effects Groups* are relevant.

WORKSHEET 1: SITE INFORMATION SHEET

Facility name	
Address	
Map reference	
Description of activity	
Nature of adjoining land use	
Proximity to potable water resource[1]	
Within 20 metres of a waterbody[2]	

Map of site (show adjoining land uses and location of waterbodies)

1 Groundwater reservoir/aquifer as identified by the regional council.

2 "Waterbody" includes streams, springs, lakes, wetlands, sea and estuaries, but does not include aquifers and entry points to the stormwater drainage network.

WORKSHEET 2: HAZARDOUS SUBSTANCES INVENTORY SHEET

FACILITY NAME: _____

ADDRESS: _____

DATE:

Substance Name	Substance Form	Conc.[1] (%)	Specific Gravity	Proposed Quantity (in known units)	Proposed Quantity (converted to tonnes or m^3)[2]	UN No.	UN Class	Storage or Use[3]	Type and Number of Storage Containers	Location of Storage Containers	Distance from Site Boundary (m)

1 Concentration

2 Convert to tonnes for solids, liquids and powders, and to m^3 for gases.

3 Identify type of container (eg drums, bulk storage), typical size (eg 209 litre drum) and number of containers.

WORKSHEET 3: HAZARDOUS SUBSTANCE WORKSHEET

1 SUBSTANCE DESCRIPTION	
Substance Name	
Proprietary Name and Supplier	
Substance Form [Gas, liquid, solid, powder]	

2 AVAILABLE INFORMATION [Extract from packaging material, MSDS, UN Recommendation for the Transport of Dangerous Goods (8th edition)]	
UN Number	
UN Primary Class	
UN Subsidiary Class	
Packaging Group(s)	

3 ADDITIONAL INFORMATION REQUIREMENTS [Extract from data sources listed in Appendix C and Material Safety Data Sheets]			DATA SOURCE
Physical Parameters	Initial boiling point (°C)		
	Flash point (°C)		
	Specific gravity @ 20°C		
	Molecular weight		
	Vapour pressure (mm Hg at 20°C)		
Toxicity Data[4]	Oral toxicity LD_{50} (mg/kg)		
	Dermal Toxicity LD_{50} (mg/kg)		
	Inhalation Toxicity LC_{50} (ppm)		
	Carcinogen[5] [yes/no]		
Ecotoxicity Data[6]	LC_{50} (Salmonid fish) (mg/l)		
	EC_{50} (Daphnia (mg/l)		
	EC_{50} (Algae) (mg/l)		
	BOD_5 (mg/kg)		
	Pesticide [yes/no]		
Other			

4 ASSESSMENT
[Extract from information in categories 2 and 3 above and Appendix A]

Hazard	UN Class	Division/ Packaging Group	Does hazardous property apply? [yes/no]	Effects Groups and Hazard Level[7]		
				Fire/Explosion	Human Health	Environmental
Explosive	1.1-1.3					
Flammable Gas	2.1					
Flammable Liquid	3					
Flammable Solid	4.1-4.3					
Oxidiser	5.1-5.2					
Toxic Gas	2.3					
Toxic Gas	2.3					
Toxic Material	6.1					
Corrosive	8					
Ecotoxic						

4 List lowest level available for human or mammalian species, type of species, test duration and data source.
5 See Appendix B.
6 For LC_{50} and EC_{50} list lowest levels for indicated or other aquatic species, type of species and data source.
7 Use E for extreme hazard level, H for high, M for medium, L for low and OSL if hazard is outside specified levels.

WORKSHEET 4: SUMMARY SHEET FOR MANUAL HFSP CALCULATIONS

	Step 4/5		Step 6	Step 7					Step 8		Step 9
SUBSTANCE	EFFECTS GROUP	HAZARD LEVEL	BASE THRESHOLD B (t/m^3)	ADJUSTMENT FACTORS F1	F2	F3	F4	PRODUCT OF ADJUSTMENT FACTORS FF, FH, FE	ADJUSTED THRESHOLD T (t/m^3)	PROPOSED QUANTITY Q (t/m^3)	EFFECTS RATIO R = Q/T
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										
10	Fire/Explosion										
	Human Health										
	Environment										

WORKSHEET 5: TOTAL EFFECTS RATIOS MANUAL CALCULATION SHEET

SUBSTANCE	Fire/Explosion Effects Ratio	Human Health Effects Ratio	Environmental Effects Ratio
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Total Effects Ratios			

Note: Only fill out those sections applicable to the substance being assessed: for example, non-flammables need not be assessed in the Fire/Explosion *Effects Group*

INFORMATION SOURCES FOR HAZARDOUS SUBSTANCES

Legend:
1 Describes substance properties
2 Contains information on human health effects
3 Contains information on ecotoxicity
4 Number of substances covered
5 Approximate cost (at time of writing, June 1995)

Textbooks/Hard Copies							
Author/Agency	Title	1	2	3	4	5	Comments
Sax, N I	Dangerous Properties of Industrial Materials (Van Nostrand Reinhold, London)	Yes	Yes	No		$2,300	Comprehensive resource on substance properties and human health effects.
Weiss, G	Hazardous Chemicals Data Book (Noyes Data Corp., New Jersey, USA)	Yes	?	?			
Environment Canada	Manual for Spills of Hazardous Materials	Yes	Yes	Yes	220		Good reference for a small number of common substances
Environment Canada	Canadian Water Quality Guidelines	No	No	Yes	~100		Good background information on the most common aquatic toxicants
US Environmental Protection Agency (USEPA)	Quality Criteria for Water	No	No	Yes	~100		Good background information on the most common aquatic toxicants
International Technical Information Institute (Tokyo, Japan)	Toxic and Hazardous Industrial Safety Manual	Yes	No	No			
Federal Office for Road Safety (Australia)	Australian Code for the Transport of Dangerous Goods by Road and Rail	Yes	No	No		$50	Information about UN hazardous substances classification and numbers
International Air Transport Association	Dangerous Goods Regulations	Yes	No	No		$150	Information about UN hazardous substances classification and numbers
Agro-Research Enterprises Ltd	Agrichemical Directory and Hazard Response Book (Havelock North)	Yes	?	?	22,500	$60	Identification of agrichemicals and spill response requirements
United States Coast Guard	Chemical Hazards Response Information System (CHRIS)						Focus on emergency procedures and spill response
Royal Society of Chemistry	Dictionary of Substances and their Effects (DOSE)	Yes	Yes	Yes			3 out of 7 volumes completed

Floppy Disk							
Author/Agency	Title	1	2	3	4	5	Comments
Brethericks	Reactive Chemical Hazards Database (Butterworth Heinemann)	Yes	No	No	4600		

CD-ROM							
Author/Agency	Title	1	2	3	4	5	Comments
Canadian Centre for Occupational Safety and Health	MSDS	Yes	Yes	?	87,000	$350*	Information on Material Safty Data Sheets (product hazards, emergency and first aid response, safe working procedures)
Canadian Centre for Occupational Safety and Health	CHEM Source	Yes	Yes	Yes	106,000	$300*	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)	No	Yes	No	120,000	$300*	Extensive database on human health effects of hazardous substances, including toxicity, skin/eye irritation, carcinogenicity, mutagenicity, and teratogenicity.
NZ National Poisons Centre	CD-Substance	Yes	Yes	No	16,000		Focus on medical emergencies and clean-up procedures.
SilverPlatter	CHEM-BANK	Yes	Yes	Yes	120,000	$3432	Combination of existing hazardous substances databases; includes HSDB, CHRIS, RTECS and OHMTADS (Oil and Hazardous Materials Technical Assistance Data System).
Committee of the EC Environmental Institute of the Joint Research Centre	ECDIN	Yes	Yes	Yes	1,700		Environmental and risk information, including ecological and economic implications
Micromedex Inc.	TOMES PLUS	Yes	Yes	Yes			Wide range of existing hazardou 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)

* Annual subscription rate

Other							
Author/Agency	Title	1	2	3	4	5	Comments
NZ Safety Ltd	Safeline Service						Toll-free 0800 service to assist those involved in the identification of chemical hazards. Focuses on Material Safety Data Sheets and personal protection requirements.

On Line Databases							
Author/Agency	Title	1	2	3	4	5	Comments
Canadian Centre for Occupational Health and Safety	CCINFO Line	Yes	Yes	Yes		$400*	Comprehensive collection of 50 health and safety databases from worldwide sources (core series comprises MSDS, CHEM Source, and RTECS).
New Zealand Poisons and Hazardous Chemicals Database	New Zealand Poison Centre / Cardinal Network	Yes	Yes	No	16,000		Focus on medical emergencies and clean-up procedures
US National Library of Medicine (NML). Access via the National Library of Australia (NLA)	TOXNET	Yes	Yes	Yes		$ 25**	On-line access to HSDB, Chemical Carcinogenesis Research Infromation System (CCRIS), RTECS, ETICBACK/EMICBACK (mutagen and teratogen databases) and IRIS
USEPA	AQUIRE (Aquatic Toxicity Information Retrieval Database	No	No	Yes	525		Comprehensive information on the toxicity of chemicals on aquatic organisms
USEPA	STARA (Studies on Toxicity Applicable to Risk Assessment)	No	No	Yes	200		Contains quantitative toxicological data on environmental chemicals.

* Annual subscription rate
** Hourly user charge

1 Conversion of temperature

To convert degrees Fahrenheit to degrees Celsius, use the following formula:

$$^{o}C = \frac{5}{9} \times (F - 32)$$

2 Conversion of measurements for solids

1 ppm = 1 mg/kg

3 Conversion of measurements for liquids

1 ppm = 1 mg/l
1 ppb = 1 μg/l

1 ppm = 1 g/m^3
1 ppb = 1 mg/m^3

4 Conversion of measurements for gases and vapours

$$mg/m^3 = ppm \times \frac{\text{molecular weight}}{24.04}$$

HAZARDOUS SUBSTANCE PROFILES

Legend:
E: Extreme
H: High
M: Medium
L: Low
*: ClassifiedB according to precautionary approach due to unavailability of relevant data.
-: Not applicable to this Effects Group

Substance Name	UN No.	Substance Form	Specific Gravity	Primary Classification	Packaging Group	Subsidiary Classification	Effects Groups and Hazard Levels		
							Fire/ Explosion	Human Health	Environment
Acetaldehyde	1089	Liquid	0.780	UN 3	I	-	H	H	L
Acetone	1090	Liquid	0.791	UN 3	II	-	H	OSL	OSL
Acetone Cyanohydrin	1541	Liquid	0.925	UN 6.1	I	-	-	H	H*
Acetonitrile [Synonym: Methyl Cyanide]	1648	Liquid	0.787	UN 3	II	UN 6.1	H	M	H*
Acetylene	1001	Gas	-	UN 2.1	-	-	H	-	-
Acrolein [Synonym: Acrylic Aldehyde]	1092	Liquid	0.843	UN 3	I	UN 6.1	H	M	E
Aluminium Chloride (anhydrous)	1726	Solid	-	UN 8	II	-	-	M	H
Ammonia (anhydrous, liquefied)	1005	Gas	-	UN 2.3	-	-	-	H	-
Ammonium Hydroxide (>10%, ≤35% ammonia in solution)	2672	Liquid	0.880 - 0.957	UN 8	III	-	-	-	H
Ammonium Nitrate (≤0.2% combustible material, free from other added matter)	1942	Solid	-	UN 5.1	III	-	H	-	OSL
Argon	1006	Gas	-	UN 2.2	-	-	-	-	-

Substance Name	UN No.	Substance Form	Specific Gravity	Primary Classification	Packaging Group	Subsidiary Classification	Effects Groups and Hazard Levels		
							Fire/ Explosion	Human Health	Environment
Arsenic Trioxide	1561	Solid	-	UN 6.1	II	-	-	H	M
Benzene	1114	Liquid	0.879	UN 3	II	UN 6.1	H	H	M
Boric Acid	-	Solid	-	-	-	-	-	OSL	H*
Bromine	1744	Liquid	3.120	UN 8	I	UN 6.1	-	M	H
Butane	1011	Gas	-	UN 2.1	-	-	H	L	-
Cadmium Chloride	2570	Solid	-	UN 6.1	I/II/III	-	-	H	E
Calcium Hypochlorite (> 39% available chlorine)	1748	Solid	-	UN 5.1	II	-	H	L	H
Carbofuran	2757	Solid	-	UN 6.1	-	-	-	H	H
Carbon Dioxide	1013	Gas	-	UN 2.2	-	-	-	OSL	-
Carbon Disulphide	1131	Liquid	!.260	UN 3	I	UN 6.1	H	OSL	L
Carbon Tetrachloride	1846	Liquid	1.597	UN 6.1	II	-	-	H	H*
Chlordane	2762	Liquid	1.600	UN 6.1	-	UN 3	M	H	E
Chlorine	1017	Gas	-	UN 2.3	-	UN 6.1`	-	E	-
Chloroform	1888	Liquid	1.500	UN 6.1	II	-	-	H	H*
Cresol [Synonym: Cresylic Acid]	2022	Liquid	1.050	UN 6.1	II	UN 8	-	M	H
Cypermethrin	2783	Liquid	1.240	UN 6.1	-	-	-	H	E
Diazinon	2783	Liquid	1.116	UN 6.1	II	-	-	M	L
Dicamba	2769	Solid	-	UN 6.1	III	-	-	OSL	M
Dichlorobenzene (m, o)	1591	Liquid	1.307	UN 6.1	III	-	-	L	M
Dichlorvos	2783	Liquid	1.415	UN 6.1	II	-	-	M	H*
Diesel (Fuel, Flashpoint > 62^{o}C)	1202	Liquid	0.850	UN 3	-	-	L	OSL	M
Diethylene Glycol	-	Liquid	1.118	-	-	-	-	OSL	OSL
Epichlorohydrin	2023	Liquid	1.180	UN 6.1	II	UN 3	M	H	H*
Ethane	1035	Gas	-	UN 2.1	-	UN 3	H	-	-

Substance Name	UN No.	Substance Form	Specific Gravity	Primary Classification	Packaging Group	Subsidiary Classification	Effects Groups and Hazard Levels		
							Fire/ Explosion	Human Health	Environment
Ethanol [Synonym: Ethyl Alcohol]	1170	Liquid	0.790	UN 3	II	-	H	OSL	H*
Ethyl Acrylate	1917	Liquid	0.923	UN 3	II	UN 6.1	H	H	H*
Ethylene	1962	Gas	-	UN 2.1	-	-	H	-	-
Ethylene Glycol	-	Liquid	1.113	-	-	-	-	OSL	OSL
Ethyleneimine	1185	Liquid	0.832	UN 3	II	UN 6.1	H	H	H*
Fluorine	1045	Gas	-	UN 2.3	-	UN 5.1	H	E	-
Formaldehyde (37% - 50%)	1198	Liquid	1.100	UN 3	III	UN 6.1	M	H	L
Glyphosate	-	Liquid	1.170	-	-	-	-	OSL	M
Hexane	1208	Liquid	0.659	UN 3	II	-	H	OSL	H*
Hydrazine (anhydrous)	2029	Liquid	1.008	UN 3	I	UN 6.1	H	H	H
Hydrochloric Acid	1789	Liquid	1.190	UN 8	II	-	-	M	H
Hydrogen	1049	Gas	-	UN 2.1	-	-	H	-	-
Hydrogen Chloride	1050	Gas	-	UN 2.3	-	UN 8	-	H	-
Hydrogen Cyanide [Synonym: Hydrocyanic Acid]	1051	Liquid	0.689	UN 6.1	I	UN 3	H	H	H*
Hydrogen Fluoride (anhydrous)	1790	Liquid	0.950	UN 8	I	UN 6.1	-	M	H
Hydrogen Peroxide (>60%)	2015	Liquid	1.290	UN 5.1	I	UN 8	H	M	H
Hydrogen Sulfide	1053	Gas	-	UN 2.1	-	UN 2.3	H	H	-
Iodine	1759	Solid	-	UN 8	I	-	-	M	H
Lauryl Mercaptan	1228	Liquid	0.850	UN 3	II	UN 6.1	H	L	H*
LPG	1075	Gas	-	UN 2.1	-	-	H	-	-
Methanol [Synonym: Methyl Alcohol]	1230	Liquid	0.792	UN 3	II	UN 6.1	H	OSL	H*
Methyl Bromide	1062	Liquid	1.680	UN 2.3	-	UN 6.1	-	H	-
Methyl Chloride	1063	Gas	-	UN 2.1	-	UN 2.3	H	H	-

Substance Name	UN No.	Substance Form	Specific Gravity	Primary Classification	Packaging Group	Subsidiary Classification	Effects Groups and Hazard Levels		
							Fire/ Explosion	Human Health	Environment
Methyl Ethyl Ketone	1193	Liquid	0.806	UN 3	II	-	H	OSL	H*
Methyl Isobutyl Ketone	1245	Liquid	0.802	UN 3	II	-	H	M	H*
Methyl Isocyanate	2480	Liquid	0.960	UN 3	I	UN 6.1	H	M	H*
Methyl Mercaptan	1064	Gas	-	UN 2.1	-	UN 6.1	H	M*	-
Methylene Chloride [Synonym: Dichloromethane]	1593	Liquid	1.326	UN 6.1	III	-	-	H	L
Milk	-	Liquid	1.032	-	-	-	-	-	M
Nitric Acid	2031	Liquid	1.490	UN 8	I	-	-	M	H
Nitroglycerine	0143	Liquid	1.599	UN 1.1	-	UN 6.1	E	L	H*
Oxygen	1072	Gas	-	UN 2.2	-	UN 5.1	H	-	-
Pentachlorophenol	2020	Solid	-	UN 6.1	III	-	-	M	E
Petrol	1203	Liquid	0.703	UN 3	II	-	H	OSL	H*
Phenol	1671	Solid	-	UN 6.1	II	-	-	M	L
Phosgene	1076	Gas	-	UN 2.3	-	8	-	H	-
Phosphoric Acid	1807	Solid	-	UN 8	II	-	-	M	H
Phosphorus (white, yellow)	1381	Solid	-	UN 4.2	-	UN 6.1	E	H	H*
Potassium Hydroxide [Synonym: Caustic Potash]	1813	Solid	-	UN 8	II	-	-	M	H
Potassium Permanganate	1490	Solid	-	UN 5.1	II	-	H	L	H*
Propylene Oxide	1280	Liquid	0.830	UN 3	I	UN 6.1	H	H	H*
Sodium Hydroxide	1823	Solid	-	UN 8	II	-	-	M	H
Sodium Selenite	2630	Solid	-	UN 6.1	I	-	-	H	M
Styrene Monomer	2055	Liquid	0.910	UN 3	III	-	M	OSL	L
Sulphur Dioxide	1079	Gas	-	UN 2.3	-	-	-	H	-
Sulphuric Acid ($\geq$ 33%)	1830	Liquid	1.840	UN 8	II	-	-	M	H
1,1,2,2-Tetrachloroethane	1702	Liquid	1.590	UN 6.1	II	-	-	M	H*
Toluene	1294	Liquid	0.867	UN 3	II	-	H	OSL	H*

Substance Name	UN No.	Substance Form	Specific Gravity	Primary Classification	Packaging Group	Subsidiary Classification	Effects Groups and Hazard Levels		
							Fire/ Explosion	Human Health	Environment
Toluene 2,4 Diisocyanate	2078	Liquid	1.220	UN 6.1	II	-	-	H	H*
1,1,2-Trichloroethane	-	Liquid	1.442	UN 6.1	III	-	-	L	L
Trichloroethylene	1710	Liquid	1.460	UN 6.1	III	-	-	L	H
Turpentine	1299	Liquid	0.860	UN 3	III	-	M	OSL	H*
Xylene (m, o, p)	1307	Liquid	0.870	UN 3	II, III	-	M	OSL	H
Zinc (powder or dust)	1436	Powder	-	UN 4.3	II	UN 4.2	E	-	H*
Zinc Ammonium Chloride	-	Solid	-	-	-	-	-	OSL	H*

CLASSIFICATION OF HAZARDOUS SUBSTANCES

UN Class	Hazard	Division	Description	Effects Group	Hazard Level
1	Explosives	1.1	Articles and substances having a mass explosion hazard.	Fire/Explosion	Extreme
		1.2	Articles and substances having a projection hazard, but not a mass explosion hazard.	Fire/Explosion	High
		1.3	Articles and substances having a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard. This division comprises articles and substances that: • give rise to considerable radiant heat, or • burn one after another, producing minor blast and/or projection effects.	Fire/Explosion	Medium
		1.4, 1.5, 1.6	Not applicable.		
2	Gases	LPG	LPG	Fire/Explosion	Medium
		2.1	Flammable gases: gases which at 20^{o}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. This class includes aerosols containing flammable propellants.	Fire/Explosion	High
		2.2	Not applicable.		
		2.3	Toxic gases: gases which are known to be toxic or corrosive to humans and pose a hazard to health. This division is divided into the following categories: a) Inhalation toxicity vapours LC_{50}: < 200 ppm (= ml/m^3)	Human Health	Extreme
			b) Inhalation toxicity vapours LC_{50}: ≥ 200 ppm - 5,000 ppm (=ml/m^3)	Human Health	High

UN Class	Hazard	Division	Description	Effects Group	Hazard Level
3	Flammable Liquids		Flammable liquids comprising liquids, mixtures of liquids, or liquids containing solids in suspension which give off a flammable vapour at specific temperatures. This class is divided into three packaging groups (PG).		
		3 PGI	Flash point: $< 23^oC$ Initial boiling point: $< 35^oC$	Fire/Explosion	High
		3 PGII	Flash point: $< 23^oC$ Initial boiling point: $> 35^oC$	Fire/Explosion	High
		3 PGIII	Flash point: $\geq 23^oC; \leq 60.5^oC$ Initial boiling point: $> 35^oC$	Fire/Explosion	Medium
		Combustible Liquids	Flash point: $> 60.5^oC$	Fire/Explosion	Low
				Environment	Medium
4	Flammable Solids	4.1	• Flammable solids that are readily combustible or may cause fire easily through an ignition source or friction. • Self-reacting substances that are thermally unstable and are liable to undergo a strongly exothermic decomposition even without the participation of oxygen. • Desensitised explosives: substances which are wetted with water or alcohol or diluted with other substances to suppress their explosive properties.	Fire/Explosion	High
		4.2	Substances liable to spontaneous combustion: • pyrophoric substances: liquid or solid substances which, even in small quantities, ignite within 5 minutes of coming in contact with air • self-heating substances: solid substances which generate heat when in contact with with air without additional energy supply.	Fire/Explosion	Extreme
		4.3	Substances, which in contact with water, become spontaneously flammable, or emit flammable gases.	Fire/Explosion	Extreme

UN Class	Hazard	Division	Description	Effects Group	Hazard Level
5	Oxidising substances and organic peroxides	5.1	Oxidising substances: substances which, in themselves are not necessarily combustible, but may cause or contribute to the combustion of other materials by yielding oxygen.	Fire/Explosion	High
		5.2	Organic peroxides: organic substances that are thermally unstable and may undergo exothermic, self-accelerating decomposition. They may: • be liable to explosive decomposition, • burn rapidly, • be sensitive to impact or friction, • react dangerously with other substances cause damage to the eyes.	Fire/Explosion	Extreme
6	Poisonous (toxic) substances	6.1	Poisonous substances: substances which are liable to cause death or injury, or to harm human health if swallowed, inhaled, or contacted by the skin. This division is divided into three packaging groups (PG).		
		6.1 PGI	a) Oral toxicity LD_{50} (mg/kg): ≤ 1 Dermal toxicity LD_{50} (mg/kg): ≤ 10 Inhalation toxicity dust/mist LC_{50} (mg/l): ≤ 0.5	Human Health	Extreme
			b) Oral toxicity LD_{50} (mg/kg): > 1 - 5 Dermal toxicity LD_{50} (mg/kg): > 10 - 40 Inhalation toxicity dust/mist LC_{50} (mg/l): ≤ 0.5	Human Health	High
		6.1 PGII	Oral toxicity LD_{50} (mg/kg): > 5 - 50 Dermal toxicity LD_{50} (mg/kg): > 40 - 200 Inhalation toxicity dust/mist LC_{50} (mg/l): > 0.5 - 2	Human Health	Medium
		6.1 PGIII	Oral toxicity LD_{50} (mg/kg): > 50 - 500 (liquids), > 50 - 200 (solids) Dermal toxicity LD_{50} (mg/kg): > 200 - 1,000 Inhalation toxicity dust/mist LC_{50} (mg/l): > 2 - 10	Human Health	Low

UN Class	Hazard	Division	Description	Effects Group	Hazard Level
			Carcinogen	Human Health	High
		6.2	Not applicable		
8	Corrosives		Substances which, by chemical action, can cause severe damage when in contact with living tissue or, in the case of leakage, will materially damage or destroy other materials. Corrosives are divided into three packaging groups (PG).		
		8 PGI	Very dangerous substances and preparations.	Human Health	Medium
				Environment	High
		8 PGII	Substances and preparations presenting medium hazard.	Human Health	Medium
				Environment	High
		8 PGIII	Substances and preparations presenting minor hazard.	Environment	High
	Ecotoxic	Group 1	Ecotoxic substances: any substance exhibiting a toxic effect on the ecosystem, based on the toxicity to aquatic life. This division is divided into four categories. a) 96 hr LC_{50} salmonid fish (mg/l): <0.1 48 hr EC_{50} daphnia (mg/l): <0.1 72 hr EC_{50} algae (mg/l): <0.1	Environment	Extreme
			b) 96 hr LC_{50} salmonid fish (mg/l): ≥0.1 - 1.0 48 hr EC_{50} daphnia (mg/l): ≥0.1 - 1.0 72 hr EC_{50} algae (mg/l): ≥0.1 - 1.0	Environment	High
			c) 96 hr LC_{50} salmonid fish (mg/l): ≥1.0 - 10.0 48 hr EC_{50} daphnia (mg/l): ≥1.0 - 10.0 72 hr EC_{50} algae (mg/l): ≥1.0 - 10.0	Environment	Medium
			d) 96 hr LC_{50} salmonid fish (mg/l): ≥10.0 - 100.0 48 hr EC_{50} daphnia (mg/l): ≥10.0 - 100.0 72 hr EC_{50} algae (mg/l): ≥10.0 - 100.0	Environment	Low

UN Class	Hazard	Division	Description	Effects Group	Hazard Level
		Group 2	Environmentally damaging or persistent substances: any substance exhibiting a damaging (other than toxic) effect on the ecosystem. This division is divided into two categories. c) BOD_5 (mg/l): >10,000	Environment	Medium
			d) BOD_5 (mg/l): >1,000	Environment	Low
		Pesticides	Pesticides are deemed to have an extreme hazard level unless data can be provided to demonstrate lesser toxicity.	Environment	Extreme
		Corrosives	All corrosives (Class 8, PG I - III) have a high Environmental Effects hazard level.	Environment	High

LIST OF RECOGNISED CARCINOGENIC SUBSTANCES

The following list of carcinogenic substances and activities has been sourced from a Woodward Clyde Ltd document. It is based on the following publications:

International Agency for Research on Cancer (IARC), World Health Organisation: Monographs volumes 1-55, 1972-1992 and Supplement 7,1987.

US Department of Health and Human Services, National Toxicology Programme (NTP): Sixth Annual Report on Carcinogens, 1991.

IARC classify carcinogens and suspected carcinogens into three categories:

Category 1 is for substances for which there is sufficient evidence for a causal relationship with cancer in humans.

Category 2A is for substances for which there is a lesser degree of evidence in humans but sufficient evidence in animal tests, or degrees of evidence considered appropriate to this category (probable human carcinogen).

Category 2B is for substances for which there is sufficient evidence in animal tests, or degrees of evidence considered appropriate to this category (possible human carcinogen).

The IARC and NTP lists in Part I are combined as far as is possible, but some anomalies may exist. Excluded from the list are IARC Category 3 carcinogens for which assessment evidence is limited.

PART 1: IARC AND NTP CARCINOGEN LIST

Category 1

Aflatoxins
Alcoholic beverages
Aluminium production
4-aminobiphenyl
Arsenic and arsenic compounds
Asbestos
Manufacture of auramine
Azathioprine
Benzene
Benzidine
Betel quid with tobacco
Bis(chloromethyl)ether and chloromethyl methyl ether (technical grade)
Boot and shoe manufacture and repair (occupational exposure)
1,4 Butanediol dimethanesulphonate (Myleran)
Chlorambucil
Chlornaphazine
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1 nitrosourea
Chromium compounds (hexavalent)
Cyclosporin
Coal gasification
Coal tar pitches
Coal tars
Coke production
Cyclophosphamide
Erionite
Furniture and cabinet making
Underground haematite mining with exposure to radon
Iron and steel founding
Isopropyl alcohol manufacture (strong acid process)
Manufacture of magenta
Melphalan
8-Methoxypsoralen (Methoxsalen) plus ultraviolet radiation
Mineral oils - untreated and mildly treated oils
MOPP and other combined chemotherapy for cancer
Mustard gas (sulphur mustard)
2-Naphthylamine
Nickel and nickel compounds (essentially sulphate and sulphide)
Nonsteroidal oestrogens (not necessarily all in a group); includes diethylstilboestrol
Oestrogen replacement therapy
Combined oral contraceptives and sequential oral contraceptives
Steroidal oestrogens (not all in a group)
Phenacetin (analgesic mixtures containing)
Rubber industry
Solar radiation
Shale oils
Soots
Sulphuric acid (occupational exposures to strong-inorganic-acid mists of sulphuric acid)
Talc containing asbestiform fibres
Thiotepa
Tobacco products (smokeless)
Tobacco smoke
Treosulphan
Vinyl chloride

Category 2A

Acrylonitrile

Adriamycin

Anabolic steroids

Azacitidine

Benzanthracene

Benzidene-based dyes (technical grade):

- Direct Black 38
- Direct Blue 6
- Direct Brown 95

Benzopyrene

Beryllium and compounds

1,3-Butadiene (upgraded from 2B)

Cadmium and cadmium compounds

Captafol

Bischloroethyl nitrosourea (BCNU)

1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)

Chloramphenicol

para-Chloro-ortho-toluidine and its strong acid salts

Chlorozotocin

Cisplatin

Creosotes

Dibenzanthracene

Diesel engine exhaust

Diethyl sulphate

Dimethylcarbamoyl chloride

Dimethyl sulphate

Epichlorohydrin

Ethylene dibromide

Ethylene oxide

Formaldehyde

Insecticide use (occupational)

Mate drinking (hot)

5-Methoxypsoralen

4,4-Methylene bis (2-chloroaniline) (MOCA)

N-Methyl-N-nitro-N-nitrosoguanidine (MNNG)

N-Methyl-N-nitrosourea

Nitrogen mustard

N-Nitrosodiethylamine

N-Nitrosodimethylamine

Petroleum refining (occupational refining exposures)

Phenacetin

Polychlorinated biphenyls

Procarbazine hydrochloride

Propylene oxide

Silica (crystalline)

Styrene oxide

Tris(1-azaridinyl)phosphine sulphide (Thiotepa)

Trist (2,3-dibromopropyl) phosphate

Ultraviolet radiation: A, B and C including sunlamps and sunbeds

Category 2B

A-C(2-Amino-9H-pyrido[2,3-b]indole)
Acetaldehyde
Acetamide
Acrylamide
AF-2[2-(2-Furyl)-3-(5-nitro-2-furyl)acrylamide
para-Aminoazobenzene
ortho-Aminoazobenzene
2-Amino-5-(5-nitro-2-furyl) -1,3,4-thiadiazole
Amitrole
ortho-Anisidine
Antimony trioxide
Aramite
Atrazine
Attapulgite
Azaserine
Benzo(b)fluoranthene
Benzo(j)fluoranthene
Benzo(k)fluoranthene
Benzyl violet
Bitumens (extracts of steam-refined and air-refined bitumens)
Bleomycins
Bracken ferns
Bromodichloromethane
Butylated hydroxyanisole (BHA)
ß-Butyrolacetone
Carbon black extract
Carbon tetrachloride
Carrageenan (degraded)
Chloramphenicol
Chlordane
Chlordecone
Chlorendic acid
Chlorinated paraffins of average carbon-chain length (C12) and average degree of chlorinated (approx. 60%)
alpha-Chlorinated toluenes (not necessarily all in a group):
• Benzotrichloride
Chloroform
Chlorophenols:
• Pentachlorophenol
• 2,4,6-Trichlorophenol
Chlorophenoxy herbicides (not necessarily all in group)
4-Chloro-ortho-phenylenediamine
Citrus Red No.2
Cobalt and cobalt compounds
Coffee (bladder)
para-Cresidine
Cycasin
Dacarbazine
Dantron (1,8-dihydroxyanthraquinone)
Daunomycin
DDT
N,N-Diacetylbenzidine
4,4-Diaminodiphenyl ether
2,4-Diaminotoluene
Dibenz[a,h]acridine
Dibenz[a,j]acridine
7H-Dibenzo[c,g]carbazole
Dibenzo[a,e]pyrene
Dibenzo[a,h]pyrene
Dibenzo[a,i]pyrene
Dibenzo[a,l]pyrene
1,2-Dibromo-3-chloropropane
para-Dichlorobenzene
3,3-Dichlorobenzene
3,3-Dichloro-4,4-diaminodiphenyl ether
1,2-Dichloroethane
Dichloromethane
1,3-Dichchloropropene (technical grade)
Dichlorvos
Diepoxybutane
Diesel fuel (marine)
Di(2-ethylhexyl)phthalate

1,2-Diethylhydrazine
Diglycidyl resorcinol ether
Dihydrosafrole
Diisoprpyl sulfate
3,3-Dimethoxybenzidine
para-Dimethylaminoazobenzene
trans-2-[(Dimethylamino)methylimino]-5-[2-(5-nitro-2-furyl)vinyl]-1,3,4-oxidiazole
3,3-Dimethylbenzidine (ortho-tolidine)
Dimethylformamide
1,1-Dimethylhydrazine
1,2-Dimethylhydrazine
1,6-Dinitropyrene
1,8-Dinitropyrene
1,4-Dioxane
Disperse Blue 1
Ethyl acrylate
Ethylene thiourea
Ethyl methanesulphonate
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole
Fuel oils (residual, heavy)
Gasoline
Gasoline engine exhausts
Glu-P-1(2-Amino-6-methyldipyrido[1,2-a:3'2'-d]imidazole)
Glu-P-2(2-Aminodipyrido [1,2-a:3'2'-d] imidazole)
Glycidaldehyde
Griseofulvin
Heptachlor
Hexachlorobenzene
Hexachlorocyclohexanes:
• Technical grades
• alpha isomer
• gamma isomer (lindane)
Hexamethylphosphoramide
Hydrazine
Indeno (1,2,3-cd)pyrene
IQ (2-Amino-3-methylimidazo[4,5-f] quinoline)
Iron-dextran complex
Lasiocarpine
Lead and lead compounds (inorganic)
MeA-a-C(2-Amino-3-meyhyl-9H-pyrido[2,3-b]indole)
Merphalan
2-Methylaziridine
Methylazoxymethanol and its acetate
5-Methylchrysene
4,4-Methylene bis(2-methylaniline)
4,4-Methylenedianiline
Methylmethanesulphonate
2-methyl-1-nitroanthraquinone(uncertain purity)
N-methyl-N-nitrosourethane
Methylthiouracil
Metronidazole
Mirex
Mitomycin
Monocrotaline
5-(Morpholinomethyl)-3-[(5-nitrofur-furylidene)amino]-2-oxazolidinone
Nafenopin
Nickel (metallic)
Niridazole
5-Nitroacenaphthene
6-Nitrochrysene
Nitrofen (technical grade)
2-Nitrofluorene
1-[(5-Nitrofurfuryliden)amino]-2-imidazolidinone
N-[4-(5-Nitro-2-furyl)-2-thiazolyl)acetamide
Nitrogen mustard N-oxide
Nitrolotriacetic acid and its salts
2-Nitropropane
1-Nitropyrene
4-Nitropyrene
N-Nitrosodi-n-butylamine
N-Nitrosodiethanolamine
N-Nitrosodi-n-propylamine

3-(N-Nitrosomethylamino)propionitrile
4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)
N-Nitrosomethylethylamine
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosonornicotine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
N-Nitrososarcosine
Oil Orange
Panfuran S (containing dihydroxymethylfurazine)
Phenazopyridine hydrochloride
Phenobarbital
Phenoxybenzamine hydrochloride
Phenyl glycidyl ether
Phenytoin
Polybrominated biphenyls
Ponceau MX
Ponceau 3R
Potassium bromate
1,3-Propane sultone
Progestins:
• Medroxyprogesterone acetate
ß-Propiolactone
Propylthiouracil
Saccharin
Safrole
Sodium ortho-phenylphenate
Sterigmatocystin
Streptozolocin
Styrene
Sulfallate
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)
Tetrachlorethylene
Textil manufacturing (occupational exposures)
Thiocetamide
4,4-Thiodianiline
Thiourea
Toluene diisocyanates
ortho-Toluidine
Toxaphene (polychlorinated camphenes)
Trichlormethine (trimustine hydrochloride)
Trp-P-1(3-Amino-1,4-dimethyl-5-H-pyrido[4,3-b)indole
Trp-P-2(3-Amino-1-methyl-5H-pyrido [4,3-b]indole)
Trypan blue
Uracil mustard
Urethane
Welding fumes
Wood industries:
• Carpentry and joinery

PART II: USEPA LIST OF FOOD PESTICIDES

The USEPA also publish a peer reviewed carcinogen identification list with similar categories as above. This list is substantially different from the IARC/NTP list as many chemicals have not been reviewed by the IARC, and the NTP list has different selection criteria.

The following is a list of food pesticides listed by the USEPA as carcinogenic. Categories are:

A Human carcinogen

B Probable human carcinogen

- B1: limited evidence in humans
- B2: sufficient evidence in animals

C Possible human carcinogen

A Human Carcinogen

Arsenic acid

B1: Probable Human Carcinogen, Limited Evidence in Humans

Ethylene oxide

B2: Probable Human Carcinogen, Sufficient Evidence in Animals

1,3-dichloropropene
acifluorfen
alachlor
captan
chlorobenzilate
chlorothalonil
etridiazole
folpet
lactofen
lindane (also in C)
mancozeb
maneb
metiram
o-phenylphenol
PCNB (quintozene)
procymidone
propoxur
toxaphene
triphenyltin hydroxide
zineb

C Possible Human Carcinogen

acephate
fosetyl-al
Amdro
amitraz
clofentazine
asulam
atrazine
benomyl
bifenthrin
bromoxynil
cyanazine
cypermethrin
dichlobenil
dichlorvos
diclofop-methyl
dicofol
dimethipin
fomesafen
hexythiazox
linuron
methidathion
methomyl
metalochlor
norflurazon
oryzalin
oxadiazon
oxadixyl
oxyfluorfen
pronamide
propiconazole
simazine
terbutryn
tribenuron-methyl
paradichlorobenzene
parathion (ethyl)
permethrin
phosmet
phosphamidon
tetrachlorvinphos
thiodicarb
thiophanate methyl
triadimefon
triadimenol
tribufos
tridiphane
trifluralin

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