# APPENDIX 6
# HAZARDOUS SUBSTANCES

## 6.1 Introduction

The 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.

The possible adverse effects of a HAZARDOUS SUBSTANCE on people, property and the environment can be predicted by the degree of hazard associated with that substance and the anticipated consequences of its release.

In order to assess the hazard posed by various substances and the risk they present, the COUNCIL has adopted the HAZARDOUS FACILITY Screening Procedure (HFSP)[1] for use in assessing HAZARDOUS FACILITIES.

The HFSP will be applied to any proposed new HAZARDOUS FACILITY. A step by step guide for APPLICANTS in the use of the HFSP is set out below.

Existing HAZARDOUS 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 is defined by sections 10, 10A and 20 of the ACT. In general, a significant change can be defined as a 20-30% or higher increase in the storage or use of HAZARDOUS SUBSTANCES, or a change in the type of process carried out on the SITE. It is unlikely that the replacement of tanks or other equipment would attract screening by the HFSP unless this enables a considerable increase in the storage or use of HAZARDOUS SUBSTANCES.

The HFSP will be used as a screening tool to assist in making decisions on the consent status of a HAZARDOUS FACILITY. This will determine whether a HAZARDOUS FACILITY is either:

1) Permitted, subject to specified conditions; or
2) Requires a resource consent which will be subject to an assessment of risks.

[1] Hazardous Facility Screening Procedure Review Group in conjunction with the Ministry for the Environment. 1995. Land Use Planning for Hazardous Facilities

The consent status for a HAZARDOUS FACILITY will be determined by comparing the value of its EFFECTS RATIO with the values for EFFECTS RATIOS specified in the rules section of the plan relating to the SITE on which the facility exists or is to be located. The EFFECTS RATIOS specified in the rules are derived from the Consent Status Matrix in Table 6.5 of this appendix.

## 6.2 Using the HAZARDOUS FACILITIES Screening Procedure - a step by step guide

### 6.2.1 Introduction

This section works through a step-by-step guide on how to use the HFSP, following the steps shown in Figure 6.2.1 and using a series of worksheets. These illustrate the HFSP's individual steps and longhand calculations. The COUNCIL also has a computer programme to carry out the required calculations.

### 6.2.2 Exceptions

The HFSP has limitations to applicability and shall not be applied to the following situations:

- Trade waste sewer and waste treatment or disposal facilities, due to the difficulty of identifying the quantity and nature of the substances involved.
- Storage or use of hazardous consumer products for private domestic purposes, because the degree of hazard is generally below the scale of potential effects considered by the HFSP.
- Retail outlets for the domestic usage sale of HAZARDOUS SUBSTANCES (e.g. SUPERMARKETS, hardware shops, pharmacies), because storage of HAZARDOUS SUBSTANCES is generally in small packages.
- Facilities using genetically modified or new organisms.
- Developments that are or may be hazardous but do not involve HAZARDOUS SUBSTANCES (e.g. mineral extraction, high voltage transmission LINES, radio masts, electrical substations). These should be controlled by other District Plan provisions.
- Dust explosions.

- Gas and oil pipelines and necessary incidental equipment including, but not limited to, main line valves, block-valve stations, pumping stations, regulator stations, metering equipment and compressor stations.
- Fuel in motor VEHICLES, boats and small engines such as weedeaters, lawnmowers, chainsaws etc.
- The transportation, use and/or storage of any HAZARDOUS SUBSTANCE in association with any TEMPORARY MILITARY TRAINING ACTIVITY subject to compliance with the New Zealand Defence Force Code of Practice for the Management of HAZARDOUS SUBSTANCES in association with military training activities.

### 6.2.3 Exemptions

The following activities are exempted from the HFSP:

- The storage and use of diesel (being a Class 3 Dangerous Good) in above-ground tanks up to a maximum quantity of 55,000 litres on any SITE provided the installation complies with the relevant provisions of the Dangerous Goods (Class 3 - Flammable Liquids) Regulations 1985 or any subsequent amending statute.
- The retail sale of liquid fuel, up to a storage capacity 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 six tonnes (single vessel storage) of LPG, provided that AS/NZS 1596:2008 The storage and handling of LP Gas is adhered to.
- Any use of HAZARDOUS SUBSTANCES exempted from licensing by regulation 5 of the Dangerous Goods (Licensing Fees) Regulations 1976.
- The storage and use of HAZARDOUS SUBSTANCES by EDUCATIONAL FACILITIES provided that the following guidelines and standards are adhered to:
  - Safety and Science: A guidance manual for New Zealand Schools 1997.
  - AS/NZS 2982:2010 Laboratory design and construction.
  - AS/NZS 2243.1:2005 Safety in laboratories – Part 1: Planning and operational aspects.
  - AS/NZS 2243.2:2006 Safety in laboratories – Part 2: Chemical aspects.
  - AS/NZS 2243.3:2002 Safety in laboratories – Part 3: Microbiological aspects and containment facilities, and AS/NZS 2243.3:2002A1 (Amendment 1).
  - AS/NZS 2243.5:2004 Safety in laboratories – Part 5: Non-ionizing radiations – Electromagnetic, sound and ultrasound.
  - AS 2243.6:1990 - Safety in Laboratories- Part 6: Mechanical Aspects.
  - AS/NZS 2243.8:2006 Safety in laboratories – Part 8: Fume cupboards.
  - AS/NZS 2243.9:2009 Safety in laboratories – Part 9: Recirculating fume cabinets.
  - AS/NZS 2243.10:2004 Safety in laboratories – Part 10: Storage of chemicals.
- Hazardous substances IN TRANSIT at a TRANSPORT INTERCHANGE AREA.

### 6.2.4 Step-by-step Guide

**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 shown in part 6.9 - Worksheet 1 of this appendix.

**Step 2: Compile a HAZARDOUS SUBSTANCES inventory**

Create an inventory of HAZARDOUS SUBSTANCES held on the SITE, or where the HAZARDOUS FACILITY is deemed to be a HAZARDOUS SUB-FACILITY, an inventory of HAZARDOUS SUBSTANCES for the HAZARDOUS SUB-FACILITY only which is to be subject to the HFSP. The inventory should include substances that are only stored or used temporarily such as waste HAZARDOUS SUBSTANCES and should list:

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

b) quantities;

c) UN classifications of all the HAZARDOUS SUBSTANCES on the SITE; and

d) whether the substance is used or stored.

A form to assist with this task is provided in part 6.10 - Worksheet 2 of this appendix.

The HFSP uses the standard units of tonnes (for solids, liquids and liquefied gases) and cubic metres (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. Formulae for some common conversions are set out in part 6.16 of this appendix.

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 weighs 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 three 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 that 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.

**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" guidelines apply for sites where multiple HAZARDOUS SUBSTANCES are held, to assist in defining those which have "priority status":

- If there are 10 or fewer substances on a 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);

- If there are more than 10 substances on a SITE, the HFSP is carried out on those substances which:
  - Are highly or extremely dangerous; and/or
  - Are held in quantities exceeding 10% of the total stock of HAZARDOUS SUBSTANCES listed in the inventory (part 6.10 - Worksheet 2 of this appendix).

**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 a SITE. To do so, it is necessary to collect a range of information about the substances, including UN classifications.

The HAZARDOUS SUBSTANCE Worksheet in part 6.11 - Worksheet 3 of this appendix 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.

Where the necessary information to carry out this step is not readily available from public information sources a precautionary approach should be taken. 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:

- In general, assessment of HAZARDOUS SUBSTANCES focuses on health effects and explosive or flammable properties. If a substance 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;
- 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.

**Step 5: Identify Effects Groups and hazard levels**

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

- Fire/Explosion Effects: concerned with damage to property, the built environment and the 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 Effects Group is divided into four hazard levels:

- Low;
- Medium;
- High; and
- Extreme.

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[2].

[2] 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.

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:

- 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;
- Environmentally damaging substances have been placed into the "Ecotoxic" class. Foodstuffs such as milk are an example of an environmentally damaging substance;
- 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 medium explosion effect;
    - An extreme human health effect; and
    - A high environmental effect.

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 HAZARDOUS SUBSTANCES and New Organisms Act 1996.

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 Table 6.6, 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 part 6.12 - Worksheet 4.

**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 6.6.

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:

- 100 tonnes of a combustible liquid, which has a low hazard level in the Fire/Explosion Effects Group.
- 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 6.6 and recorded in the column marked "Step 6" on the "Summary Sheet for Manual HFSP Calculations" in part 6.12 - Worksheet 4 of this Appendix.

**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:

- The physical state of the substance;

- The pressure and temperature required for storage and usage;
- The type of storage;
- The type of activity or use;
- Separation distances to the SITE boundary; and
- 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 6.7 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 part 6.12 - Worksheet 4 of this Appendix.

**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:

- T = B x FF provides the Adjusted Threshold for a substance in the Fire/ Explosion Effects Group.
- T = B x FH provides the Adjusted Threshold for a substance in the Human Health Effects Group.
- 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 part 6.12 - Worksheet 4 of this Appendix.

**Step 9: Calculate EFFECTS RATIOS**

The EFFECTS RATIO (ER) 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):

$$\text{EFFECTS RATIO (ER)} = \frac{\text{Proposed quantity of substance (Q)}}{\text{Adjusted Threshold (T)}}$$

The EFFECTS RATIO for each substance needs to be recorded in the column marked "Step 9" on the "Summary Sheet for Manual HFSP Calculations" in part 6.12 - Worksheet 4 of this Appendix.

The EFFECTS RATIO fulfils two important purposes:

- 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;
- 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.

**Step 10: Sum the EFFECTS RATIOS to find the total EFFECTS RATIO (ER)**

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 in this Appendix.

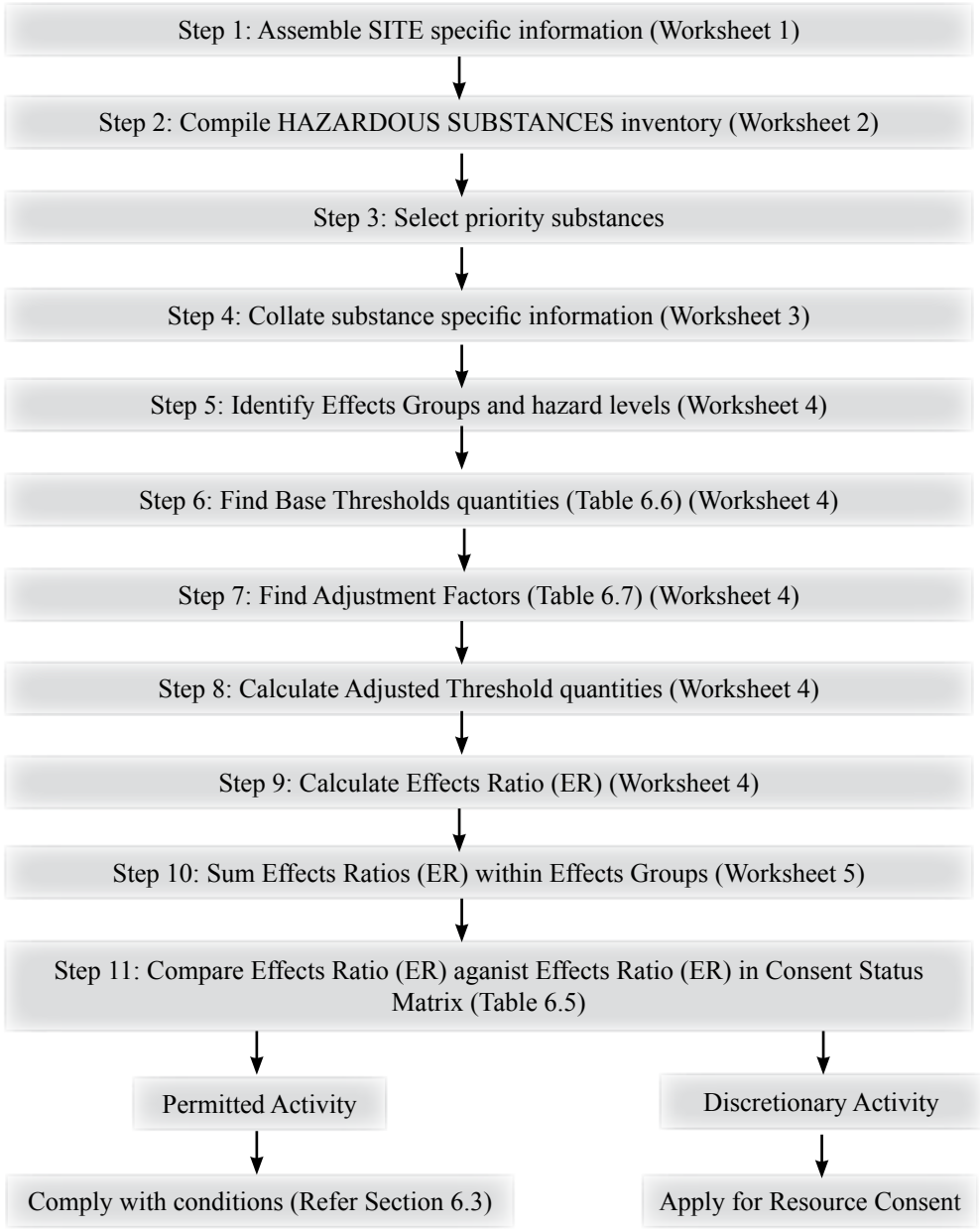
**Step 11: Determine consent status against the Consent Status Matrix (Table 6.5)**

The sum of the EFFECTS RATIOS within each Effects Group determines the consent status of the HAZARDOUS FACILITY being screened using the HFSP.

Only the highest EFFECTS RATIO of any of the three Effects Groups in considered.

Compare the highest EFFECTS RATIO value for the HAZARDOUS FACILITY being screened with the EFFECTS RATIO of the SITE on which the facility is to be located. Refer to Table 6.5 Consent Status Matrix for the EFFECTS RATIO relating to the SITE.

**Figure 6.2.1: A Step-by-Step Guide to the HAZARDOUS FACILITIES Screening Procedure**



## 6.3 Conditions that a HAZARDOUS FACILITY must comply with to be deemed a permitted activity

The following conditions apply to all HAZARDOUS FACILITIES:

1) Any SITE or part of a SITE where HAZARDOUS SUBSTANCES are used for their intended function shall be designed, constructed and managed in a manner that prevents:

   a) Any effects of the intended use from occurring beyond the boundaries of the SITE.

   b) The entry or discharge of HAZARDOUS SUBSTANCES into the stormwater drainage system.

   c) The entry or discharge of HAZARDOUS SUBSTANCES into the sewerage system unless permitted by the COUNCIL.

2) Any part of a SITE where HAZARDOUS SUBSTANCES are used, stored, manufactured, mixed, packaged, loaded, unloaded or otherwise handled shall be designed, constructed and managed in a manner that prevents:

   a) The contamination of any land and/or water (including groundwater and POTABLE WATER supplies) in the event of a spill or other unintentional release of a HAZARDOUS SUBSTANCE.

   b) The entry or discharge of a HAZARDOUS SUBSTANCE into a stormwater drainage system in the event of a spill or other unintentional release.

   c) The entry or discharge of a HAZARDOUS SUBSTANCE into a sewerage system in the event of a spill or other unintentional release.

3) Any SITE within which a HAZARDOUS FACILITY is located shall be designed, constructed and managed in a manner so that any stormwater originating on or collected on the SITE that has become contaminated:

   a) Shall not contaminate any land and/or water (including groundwater and POTABLE WATER supplies) by acting as a transport medium for HAZARDOUS SUBSTANCES unless permitted by a resource consent.

   b) Does not enter or discharge into the stormwater drainage system.

   c) Does not enter or discharge into a sewerage system unless permitted by the COUNCIL.

4) No HAZARDOUS FACILITY shall be established on land likely to be inundated with floodwaters in a 1% AEP or greater storm event.

Adherence to the following design guidelines will be deemed to comply with the above conditions:

5) Spill containment system

   Any SITE or part of a SITE within which a HAZARDOUS FACILITY is located shall be serviced by a spill containment system that is:

   a) Constructed from impervious materials resistant to the HAZARDOUS SUBSTANCES used, stored, manufactured, mixed, packaged, loaded, unloaded or otherwise handled on the SITE.

   b) Able to contain the maximum volume of the largest tank used, or where drums or other containers are used, able to contain half of the maximum volume of the HAZARDOUS SUBSTANCES stored.

   c) 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 any stormwater drainage system.

   d) 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 groundwater and POTABLE WATER supplies) unless permitted by a resource consent.

6) Stormwater drainage

   All stormwater sumps on the SITE shall be clearly labelled “Stormwater Only” with such signage to be shown on stormwater grates or in immediate proximity.

7) Washdown areas

Any SITE or part of a SITE within which a HAZARDOUS FACILITY is located where VEHICLES, equipment or containers that are, or may have become contaminated with HAZARDOUS SUBSTANCES are washed shall be designed, constructed and managed to prevent the effluent from the washdown area from:

a) Entry or discharge into any stormwater drainage system.

b) Entry or discharge into a sewerage system unless permitted by the COUNCIL.

c) Discharge into or onto land and/or water (including groundwater and POTABLE WATER supplies) unless permitted by a resource consent.

8) Underground storage tanks

Underground tanks for the storage of petroleum products shall be designed, constructed, maintained and managed to prevent leakage and spills.

Adherence to the Code of Practice for Design, Installation and Operation of Underground Petroleum Systems (Department of Labour - Occupational Safety and Health) is deemed to be one method of complying with this condition.

9) Signage

Any HAZARDOUS FACILITY shall be adequately signposted to indicate the nature of the substances stored, used or otherwise handled.

Adherence to the Code of Practice for Warning Signs for Premises Storing HAZARDOUS SUBSTANCES of the New Zealand Chemical Industry Council, or any other Code of Practice approved by the New Zealand Fire Service is deemed to be one method of complying with this condition.

10) Waste management

Any process waste or waste containing HAZARDOUS SUBSTANCES shall be managed to prevent:

a) That waste entering or discharging into any stormwater drainage system.

b) That waste entering or discharging into a sewerage system unless permitted by the COUNCIL.

c) That waste discharging into or onto land and/or water (including groundwater and POTABLE WATER supplies) unless permitted by a resource consent.

The storage of any process waste or waste containing HAZARDOUS SUBSTANCE shall at all times comply with the conditions for a permitted activity as described in Sections 6.3 1) - 4).

Any waste containing HAZARDOUS SUBSTANCE shall be stored in such a manner that prevents:

a) Exposure to ignition sources;

b) Corrosion or other alteration of the containers used for the storage of the waste;

c) Unintentional release of the waste.

Any HAZARDOUS FACILITY generating waste containing HAZARDOUS SUBSTANCES shall operate and maintain a register of the types and quantities of hazardous wastes generated, and the methods of disposal.

Any HAZARDOUS FACILITY generating waste containing HAZARDOUS SUBSTANCES shall dispose of such wastes to appropriately permitted facilities, or be serviced by a reputable waste disposal contractor.

## 6.4 Other aspects of HAZARDOUS FACILITY management

The following comments are included for the guidance of the operators of HAZARDOUS FACILITIES and APPLICANTS.

1 Cross-boundary effects

Where a HAZARDOUS FACILITY is to be located in proximity to the boundary of any other territorial authority the COUNCIL may need to liaise with the adjoining district or regional council. The COUNCIL will have regard to any material matters raised by other councils where cross-boundary consultation takes place. APPLICANTS should also be aware that adjoining district or regional councils may formally lodge submissions in respect of notified resource consent applications.

2 Disposal of HAZARDOUS SUBSTANCES

The disposal of wastes containing HAZARDOUS SUBSTANCES should occur at facilities designed for such purposes. Such facilities may require resource consents from the COUNCIL and Taranaki Regional Council.

The COUNCIL does not accept hazardous wastes, solid or liquid, at any of its landfills. However the COUNCIL has a policy of providing advice on the treatment of hazardous waste to render it non-hazardous.

Liquid hazardous wastes may be disposed of to the COUNCIL'S waste water system subject to the waste meeting the requirements of the COUNCIL'S Trade Waste Bylaw 1997.

3 Monitoring

The procedures to be used by the COUNCIL to monitor the state of the environment and the exercise of resource consents are detailed in the implementation section of the plan.

In the monitoring of HAZARDOUS FACILITIES the COUNCIL may undertake this in conjunction with Taranaki Regional Council and/or may contract technical expertise.

Matters that the COUNCIL will take into account in the monitoring of HAZARDOUS FACILITIES will include the following:

- 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.
- The extent to which an operator undertakes self-monitoring of their HAZARDOUS FACILITY

## 6.5 Consent Status Matrix

| | EFFECTS RATIOS | |
|---|---|---|
| | permitted activity | discretionary activity |
| **OVERLAYS FOR ALL ENVIRONMENT AREAS** | | |
| COASTAL HAZARD AREA* | ≤0.2 | >0.2 |
| FAULT LINES* | | |
| • Within 20m of a FAULT LINE | Non-complying activity | |
| • Where located between 20m and 30m from a FAULT LINE | ≤0.2 | >0.2 |
| FLOOD HAZARD AREA* | ≤0.2 | >0.2 |
| VOLCANIC HAZARD AREA* | ≤0.2 | >0.2 |
| Note*: Where the EFFECTS RATIO for an OVERLAY is equal to or exceeds the EFFECTS RATIO for the underlying ENVIRONMENT AREA, the lesser EFFECTS RATIO value shall apply. | | |
| **ENVIRONMENT AREAS** | | |
| RESIDENTIAL | ≤0.02 | >0.02 |
| RURAL | | |
| • Within 30m of a RESIDENTIAL ENVIRONMENT AREA | ≤0.02 | >0.02 |
| • Within 20m of an INDUSTRIAL A ENVIRONMENT AREA | ≤0.3 | >0.3 |
| • Within 10m of an INDUSTRIAL B ENVIRONMENT AREA | ≤0.5 | >0.5 |
| • Within 10m of an OPEN SPACE ENVIRONMENT AREA | ≤0.2 | >0.2 |
| • Anywhere else | ≤0.75 | >0.75 |
| BUSINESS | | |
| • Within 10m of a RESIDENTIAL ENVIRONMENT AREA | ≤0.02 | >0.02 |
| • Anywhere else | ≤0.2 | >0.2 |
| INDUSTRIAL | | |
| • In the INDUSTRIAL A ENVIRONMENT AREA and within 20m of any RESIDENTIAL ENVIRONMENT AREA | ≤0.02 | >0.02 |
| • In the INDUSTRIAL B ENVIRONMENT AREA and within 25m of any RESIDENTIAL ENVIRONMENT AREA | ≤0.02 | >0.02 |
| • In the INDUSTRIAL A , B or C ENVIRONMENT AREA and within 20m of any BUSINESS ENVIRONMENT AREA | ≤0.2 | >0.2 |
| • In the INDUSTRIAL C or D ENVIRONMENT AREA and within 30m of any RESIDENTIAL ENVIRONMENT AREA | ≤0.02 | >0.02 |
| • In the INDUSTRIAL D or E ENVIRONMENT AREA and within 30m of any OPEN SPACE ENVIRONMENT AREA | ≤0.2 | >0.2 |
| • In the INDUSTRIAL E ENVIRONMENT AREA and within 30m of a RURAL or INDUSTRIAL C ENVIRONMENT AREA | ≤0.75 | >0.75 |
| • In the INDUSTRIAL F ENVIRONMENT AREA and within 50m of the RURAL ENVIRONMENT AREA | ≤0.75 | >0.75 |

| | EFFECTS RATIOS | |
|---|---|---|
| | permitted activity | discretionary activity |
| **ENVIRONMENT AREAS cont...** | | |
| INDUSTRIAL cont... | | |
| • Anywhere else in the INDUSTRIAL A ENVIRONMENT AREA | ≤0.3 | >0.3 |
| • Anywhere else in the INDUSTRIAL B ENVIRONMENT AREA | ≤0.5 | >0.5 |
| • Anywhere else in the INDUSTRIAL C or D ENVIRONMENT AREA | ≤0.75 | >0.75 |
| • Anywhere else in the INDUSTRIAL E ENVIRONMENT AREA | ≤1.0 | >1.0 |
| • Anywhere else in the INDUSTRIAL F ENVIRONMENT AREA | ≤1.5 | >1.5 |
| OPEN SPACE | | |
| • Within 10m of a RESIDENTIAL ENVIRONMENT AREA | ≤0.02 | >0.02 |
| • Anywhere else | ≤0.2 | >0.2 |

## 6.6 Base Thresholds for all Effects Groups and Hazard Levels

| FIRE / EXPLOSION EFFECTS GROUP | | | | | |
|---|---|---|---|---|---|
| **UN Class** | **Hazard** | **Hazard Levels** | | | |
| | | **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(m3)* | | | | 10,000 | |
| **Sub-Category: Explosives** | | | | | |
| 1 | Explosives | | 1.3 | 1.2 | 1.1 |
| B(tonnes) | | | 3 | 1 | 0.1 |

| HUMAN HEALTH EFFECTS GROUP | | | | | |
|---|---|---|---|---|---|
| **UN Class** | **Hazard** | **Hazard Levels** | | | |
| | | **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 |

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

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

## 6.7 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°C) | = | 0.1 | Gas (at 101.3 kPA and 20°C) | = | 0.1 | | | |
| F2: HANDLING/STORAGE CONDITIONS[3] | | | F2: SEPARATION DISTANCE FROM SITE BOUNDARY AND HAZARDOUS SUB-FACILITY (Gases only) | | | F2: ENVIRONMENTAL SENSITIVITY | | |
| Temperature < flash point | = | 1 | < 30m from the closest SITE boundary and any HAZARDOUS SUB-FACILITY | = | 1 | Normal | = | 1 |
| Temperature > flash point < boiling point | = | 0.3 | > 3m from the closest SITE boundary and any HAZARDOUS SUB-FACILITY | = | 3 | Adjacent to a waterbody[3] | = | 0.3 |
| Temperature > boiling point | = | 0.1 | | | | | | |
| F3: SEPARATION DISTANCE FROM SITE BOUNDARY and HAZARDOUS SUB-FACILITY | | | F3: PROXIMITY TO POTABLE WATER RESOURCE | | | F3: TYPE OF ACTIVITY | | |
| < 30m from the closest SITE boundary and any HAZARDOUS SUB-FACILITY | = 1 | | Normal | = | 1 | Use | = | 0.3 |
| > 30m from the closest SITE boundary and any HAZARDOUS SUB-FACILITY | = 3 | | Proximity to POTABLE WATER resource[4] | = | 0.3 | Above ground storage | = | 1 |
| F4: TYPE OF ACTIVITY | | | F4: TYPE OF ACTIVITY | | | Underground storage[3] | = | 3 |
| Use | = | 0.3 | Use | = | 0.3 | | | |
| Above ground storage | = | 1 | Above ground storage | = | 1 | | | |
| Underground storage[5] | = | 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 | | |

[3] Waterbody includes streams, springs, lakes, wetlands, sea and estuaries, but does not include aquifers and entry points to the stormwater drainage network.
[4] POTABLE WATER resource as defined by the regional council.
[5] Applicable to UN Class 3 substances [Flammable Liquids] and Combustible Liquids only.

## 6.8 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:<br>• give rise to considerable radiant heat, or<br>• burn one after another, producing minor blast and/or projection effects. | Fire/Explosion | Medium |
| | | 1.4, 1.5, 1.6 | Not applicable. | | |

| UN Class | Hazard | Division | Description | Effects Group | Hazard Level |
|---|---|---|---|---|---|
| 2 | Gases | LPG | LPG | Fire/Explosion | Medium |
| | | 2.1 | Flammable gases: gases which at 20°C and a standard pressure of 101.3 kPa:<br>• are ignitable when in a mixture of 13% or less by volume with air, or<br>• have a flammable range with air of at least 12% regardless of the lower flammability limit.<br>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:<br>a) Inhalation toxicity vapours LC50: < 200ppm (= ml/$m^3$) | Human Health | Extreme |
| | | | b) Inhalation toxicity vapours LC50: ≥200ppm - 5,000ppm (=ml/$m^3$) | Human Health | High |

| UN Class | Hazard | Division | Description | Effects Group | Hazard Level |
|---|---|---|---|---|---|
| 3 | Flammable Liquids | 3 PGI | 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).<br>Flash point: < 23°C<br>Initial boiling point: < 35°C | Fire Explosion | High |
| | | 3 PGII | Flash point: < 23°C<br>Initial boiling point: > 35°C | Fire Explosion | High |
| | | 3 PGIII | Flash point: < 23°C < 60.5°C<br>Initial boiling point: > 35°C | Fire Explosion | Medium |
| | | Combustible Liquids | Flash point: > 60.5°C | Fire Explosion | Low |
| | | | | Environment | Medium |

| UN Class | Hazard | Division | Description | Effects Group | Hazard Level |
|---|---|---|---|---|---|
| 4 | Flammable Solids | 4.1 | • Flammable solids that are readily combustible or may cause fire easily through an ignition source or friction.<br>• Self-reacting substances that are thermally unstable and are liable to undergo a strongly exothermic decomposition even without the participation of oxygen.<br>• 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:<br>• pyrophoric substances: liquid or solid substances which, even in small quantities, ignite within five minutes of coming in contact with air<br>• self-heating substances: solid substances which generate heat when in contact 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:<br>• be liable to explosive decomposition,<br>• burn rapidly,<br>• be sensitive to impact or friction,<br>• react dangerously with other substances and cause damage to the eyes. | Fire/Explosion | Extreme |

| UN Class | Hazard | Division | Description | | Effects Group | Hazard Level |
|---|---|---|---|---|---|---|
| 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):<br>Dermal toxicity $LD_{50}$ (mg/kg):<br>Inhalation toxicity dust/mist $LC_{50}$ (mg/l): | ≤ 1<br>≤ 10<br>≤ 0.5 | Human Health | Extreme |
| | | | b) Oral toxicity $LD_{50}$ (mg/kg):<br>Dermal toxicity $LD_{50}$ (mg/kg):<br>Inhalation toxicity dust/mist $LC_{50}$ (mg/l): | > 1 - 5<br>> 10 - 40<br>≤ 0.5 | Human Health | High |
| | | 6.1 PGII | Oral toxicity $LD_{50}$ (mg/kg):<br>Dermal toxicity $LD_{50}$ (mg/kg):<br>Inhalation toxicity dust/mist $LC_{50}$ (mg/l): | > 5 - 50<br>> 40 - 200<br>> 0.5 - 2 | Human Health | Medium |
| | | 6.1 PGIII | Oral toxicity $LD_{50}$ (mg/kg):<br>Dermal toxicity $LD_{50}$ (mg/kg)<br>Inhalation toxicity dust/mist $LC_{50}$ (mg/l): | > 50 - 500 (liquids), > 50 - 200 (solids)<br>> 200 - 1,000<br>> 2 - 10 | Human Health | Low |
| | | | Carcinogen | | Human Health | High |
| | | 6.2 | Not applicable | | | |

| UN Class | Hazard | Division | Description | Effects Group | Hazard Level |
|---|---|---|---|---|---|
| 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). | Human Health | Medium |
| | | 8 PGI | Very dangerous substances and preparations. | Environment | High |
| | | 8 PGII | Substances and preparations presenting medium hazard. | Human Health | Medium |
| | | | | Environment | High |
| | | PGIII | Substances and preparations presenting minor hazard. | Environment | High |

| UN Class | Hazard | Division | Description | Effects Group | Hazard Level |
|---|---|---|---|---|---|
| | 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. | Environment | Extreme |
| | | | a) 96 hr $LC_{50}$ salmonid fish (mg/l): <0.1<br>48 hr $EC_{50}$ daphnia (mg/l): <0.1<br>72 hr $EC_{50}$ algae (mg/l): <0.1 | | |
| | | | b) 96 hr $LC_{50}$ salmonid fish (mg/l): ≥0.1 - 1.0<br>48 hr $EC_{50}$ daphnia (mg/l): ≥0.1 - 1.0<br>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<br>48 hr $EC_{50}$ daphnia (mg/l): ≥1.0 - 10.0<br>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<br>48 hr $EC_{50}$ daphnia (mg/l): ≥10.0 - 100.0<br>72 hr $EC_{50}$ algae (mg/l): ≥10.0 - 100.0 | Environment | Low |
| | | 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. | | |
| | | | a) $BOD_5$ (mg/l): >10,000 | Environment | Medium |
| | | | b) $BOD_5$ (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 |

## 6.9 Worksheet 1 - SITE information

| | |
|---|---|
| Facility name | |
| Address | |
| Map reference | |
| Description of activity | |
| Nature of adjoining land use | |
| Proximity to POTABLE WATER resource[6] | |
| Within 20m of a waterbody[7] | |

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

[6] Groundwater reservoir/aquifer as identified by Taranaki Regional Council.

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

## 6.10 Worksheet 2 - HAZARDOUS SUBSTANCE inventory

FACILITY NAME: .....

ADDRESS: .....

DATE: .....

| Substance Name | Substance Form | Conc.[8] (%) | Specific Gravity | Proposed Quantity (in known units) | Proposed Quantity (converted to tonnes or $m^3$)[9] | UN No. | UN Class | Storage or Use | Type and Number of Storage Containers[10] | Location of Storage Containers | Distance from site Boundary (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
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| | | | | | | | | | | | |

[8] Concentration.
[9] Convert to tonnes for solids, liquids and powders, and to m3 for gases.
[10] Identify type of container (eg drums, bulk storage), typical size (e.g. 209 litre drum) and number of containers.

## 6.11 Worksheet 3 - HAZARDOUS SUBSTANCES assessment

| 1 | **SUBSTANCE DESCRIPTION** | |
|---|---|---|
| | Substance Name | |
| | Proprietary Name and supplier | |
| | Substance Form (Gas, liquid, solid, powder) | |

| 2. | **AVAILABLE INFORMATION**<br>**(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**<br>**(Extract from data sources listed in Appendix C and Material Safety Data Sheets)** | | **DATA SOURCE** |
|---|---|---|---|
| Physical Parameters | Intial boiling point ($^0$C) | | |
| | Flash point ($^0$C) | | |
| | Specific gravity @ 20$^0$C | | |
| | Molecular weight | | |
| | Vapour pressure<br>(mm Hg at 20$^0$C) | | |
| Toxicity Data[11] | Oral toxicity<br>$LD_{50}$ (mg/kg) | | |
| | Dermal Toxicity<br>$LD_{50}$ (mg/kg) | | |
| | Inhalation Toxicity<br>$LC_{50}$ (ppm) | | |
| | Carcinogen [12] (yes/no) | | |
| Ecotoxicity Data [13] | $LC_{50}$ (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 Table 6.8) | | | | | | |
|---|---|---|---|---|---|---|
| Hazard | UN Class | Division / Packaging Group | Does hazardous property apply? (yes/no) | Effects Groups and Hazard Level[14] | | |
| | | | | 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 Material | 6.1 | | | | | |
| Corrosive | 8 | | | | | |
| Ecotoxic | | | | | | |

[11] List lowest level available for human or mammalian species, type of species, test duration and data source.
[12] See section 6.14 of this Appendix.
[13] For LC50 and EC50 list lowest levels for indicated or other aquatic species, type of species and data source.
[14] Use E for extreme hazard level, H for high, M for medium, L for low and OSL if hazard is outside specified levels.

## 6.12 Worksheet 4 - Summary sheet for manual HFSP calculations

| | Step 4 | | Step 6 | Step 7 | | | | | Step 8 | | Step 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Substance | Effects Group | Hazard Level | Base Threshold B (t/m³) | Adjustment Factors | | | | Product of Adjustment Factors FF, FH, FE | Adjusted Threshold T (t/m³) | Proposed Quantity Q (t/m³) | Effects Ratio ER = Q/R |
| | | | | F1 | F2 | F3 | F4 | | | | |
| 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 | | | | | | | | | | |

## 6.13 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.

## 6.14 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 I: IARC and NTP carcinogen list

### Category 1

| | |
|---|---|
| Aflatoxins | Iron and steel founding |
| Alcoholic beverages | Isopropyl alcohol manufacture (strong acid process) |
| Aluminium production | Manufacture of magenta |
| 4-aminobiphenyl | Melphalan |
| Arsenic and arsenic compounds | 8-Methoxypsoralen (Methoxsalen) plus ultraviolet radiation |
| Asbestos | Mineral oils - untreated and mildly treated oils |
| Manufacture of auramine | MOPP and other combined chemotherapy for cancer |
| Azathioprine | Mustard gas (sulphur mustard) |
| Benzene | 2-Naphthylamine |
| Benzidine | Nickel and nickel compounds (essentially sulphate and sulphide) |
| Betel quid with tobacco | Nonsteroidal oestrogens (not necessarily all in a group); includes diethylstilboestrol |
| Bis(chloromethyl)ether and chloromethyl methyl ether (technical grade) | Oestrogen replacement therapy |
| Boot and shoe manufacture and repair (occupational exposure) | Combined oral contraceptives and sequential oral contraceptives |
| 1,4 Butanediol dimethanesulphonate (Myleran) | Steroidal oestrogens (not all in a group) |

| | |
|---|---|
| Chlorambucil | Phenacetin (analgesic mixtures containing) |
| Chlornaphazine | Rubber industry |
| 1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1 nitrosourea | Solar radiation |
| Chromium compounds (hexavalent) | Shale oils |
| Ciclosporin | Soots |
| Coal gasification | Sulphuric acid (occupational exposures to strong-inorganic-acid mists of sulphuric acid) |
| Coal tar pitches | Talc containing asbestiform fibres |
| Coal tars | Thiotepa |
| Coke production | Tobacco products (smokeless) |
| Cyclophosphamide | Tobacco smoke |
| Erionite | Treosulphan |
| Furniture and cabinet making | Vinyl chlorideCategory 2A |
| Underground haematite mining with exposure to radon | |

## Category 2A

| | |
|---|---|
| Acrylonitrile | Dimethyl sulphate |
| Adriamycin | Epichlorohydrin |
| Anabolic steroids | Ethylene dibromide |
| Azacitidine | Ethylene oxide |
| Benzanthracene | Formaldehyde |
| Benzidene-based dyes (technical grade): | Insecticide use (occupational) |
| • Direct Black 38 | Mate drinking (hot) |
| • Direct Blue 6 | 5-Methoxypsoralen |
| • Direct Brown 95 | 4,4-Methylene bis (2-chloroaniline) (MOCA) |
| Benzopyrene | N-Methyl-N-nitro-N-nitrosoguanidine (MNNG) |
| Beryllium and compounds | N-Methyl-N-nitrosourea |
| 1,3-Butadiene (upgraded from 2B) | Nitrogen mustard |
| Cadmium and cadmium compounds | N-Nitrosodiethylamine |
| Captafol | N-Nitrosodimethylamine |
| Bischloroethyl nitrosourea (BCNU) | Petroleum refining (occupational refining exposures) |
| 1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU) | Phenacetin |

| | |
|---|---|
| Chloramphenicol | Polychlorinated biphenyls |
| para-Chloro-ortho-toluidine and its strong acid salts | Procarbazine hydrochloride |
| Chlorozotocin | Propylene oxide |
| Cisplatin | Silica (crystalline) |
| Creosotes | Styrene oxide |
| Dibenzanthracene | Tris(1-azaridinyl)phosphine sulphide (Thiotepa) |
| Diesel engine exhaust | Trist (2,3-dibromopropyl) phosphate |
| Diethyl sulphate | Ultraviolet radiation: A, B and C including sunlamps and sunbeds |

## Category 2B

| | |
|---|---|
| A-C(2-Amino-9H-pyrido[2,3-b]indole) | Heptachlor |
| Acetaldehyde | Hexachlorobenzene |
| Acetamide | Hexachlorocyclohexanes: |
| Acrylamide | • Technical grades |
| AF-2[2-(2-Furyl)-3-(5-nitro-2-furyl)acrylamide | • alpha isomer |
| para-Aminoazobenzene | • gamma isomer (lindane) |
| ortho-Aminoazobenzene | Hexamethylphosphoramide |
| 2-Amino-5-(5-nitro-2-furyl) -1,3,4-thiadiazole | Hydrazine |
| Amitrole | Indeno (1,2,3-cd)pyrene |
| ortho-Anisidine | IQ (2-Amino-3-methylimidazo[4,5-f] quinoline) |
| Antimony trioxide | Iron-dextran complex |
| Aramite | Lasiocarpine |
| Atrazine | Lead and lead compounds (inorganic) |
| Attapulgite | MeA-a-C(2-Amino-3-meyhyl-9H-pyrido[2,3-b]indole) |
| Azaserine | Merphalan |
| Benzo(b)fluoranthene | 2-Methylaziridine |
| Benzo(j)fluoranthene | Methylazoxymethanol and its acetate |
| Benzo(k)fluoranthene | 5-Methylchrysene |
| Benzyl violet | 4,4-Methylene bis(2-methylaniline) |
| Bitumens (extracts of steam-refined and air-refined bitumens) | 4,4-Methylenedianiline |
| Bleomycins | Methylmethanesulphonate |

| | |
|---|---|
| Bracken ferns | 2-methyl-1-nitroanthraquinone(uncertain purity) |
| Bromodichloromethane | N-methyl-N-nitrosourethane |
| Butylated hydroxyanisole (BHA) | Methylthiouracil |
| ß-Butyrolactone | Metronidazole |
| Carbon black extract | Mirex |
| Carbon tetrachloride | Mitomycin |
| Carrageenan (degraded) | Monocrotaline |
| Chloramphenicol | 5-(Morpholinomethyl)-3-[(5-nitrofur-furylidene)amino]-2-oxazolidinone |
| Chlordane | Nafenopin |
| Chlordecone | Nickel (metallic) |
| Chlorendic acid | Niridazole |
| Chlorinated paraffins of average carbon-chain length (C12) and average degree of chlorinated (approx. 60%) | 5-Nitroacenaphthene |
| alpha-Chlorinated toluenes (not necessarily all in a group): | 6-Nitrochrysene |
| • Benzotrichloride | Nitrofen (technical grade) |
| Chloroform | 2-Nitrofluorene |
| Chlorophenols: | 1-[(5-Nitrofurfuryliden)amino]-2-imidazolidinone |
| • Pentachlorophenol | N-[4-(5-Nitro-2-furyl)-2-thiazolyl)acetamide |
| • 2,4,6-Trichlorophenol | Nitrogen mustard N-oxide |
| Chlorophenoxy herbicides (not necessarily all in group) | Nitrolotriacetic acid and its salts |
| 4-Chloro-ortho-phenylenediamine | 2-Nitropropane |
| Citrus Red No.2 | 1-Nitropyrene |
| Cobalt and cobalt compounds | 4-Nitropyrene |
| Coffee (bladder) | N-Nitrosodi-n-butylamine |
| para-Cresidine | N-Nitrosodiethanolamine |
| Cycasin | N-Nitrosodi-n-propylamine |
| Dacarbazine | 3-(N-Nitrosomethylamino)propionitrile |
| Dantron (1,8-dihydroxyanthraquinone) | 4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK) |
| Daunomycin | N-Nitrosomethylethylamine |
| DDT | N-Nitrosomethylvinylamine |
| N,N-Diacetylbenzidine | N-Nitrosomorpholine |

| | |
|---|---|
| 4,4-Diaminodiphenyl ether | N-Nitrosonornicotine |
| 2,4-Diaminotoluene | N-Nitrosopiperidine |
| Dibenz[a,h]acridine | N-Nitrosopyrrolidine |
| Dibenz[a,j]acridine | N-Nitrososarcosine |
| 7H-Dibenzo[c,g]carbazole | Oil Orange |
| Dibenzo[a,e]pyrene | Panfuran S (containing dihydroxymethylfuratzine) |
| Dibenzo[a,h]pyrene | Phenazopyridine hydrochloride |
| Dibenzo[a,i]pyrene | Phenobarbital |
| Dibenzo[a,l]pyrene | Phenoxybenzamine hydrochlorid |
| 1,2-Dibromo-3-chloropropane | Phenyl glycidyl ether |
| para-Dichlorobenzene | Phenytoin |
| 3,3-Dichlorobenzene | Polybrominated biphenyls |
| 3,3-Dichloro-4,4-diaminodiphenyl ether | Ponceau MX |
| 1,2-Dichloroethane | Ponceau 3R |
| Dichloromethane | Potassium bromate |
| 1,3-Dichchloropropene (technical grade) | 1,3-Propane sultone |
| Dichlorvos | Progestins: |
| Diepoxybutane | • Medroxyprogesterone acetate |
| Diesel fuel (marine) | ß-Propiolactone |
| Di(2-ethylhexyl)phthalate | Propylthiouracil |
| 1,2-Diethylhydrazine | Saccharin |
| Diglycidyl resorcinol ether | Safrole |
| Dihydrosafrole | Sodium ortho-phenylphenate |
| Diisoprpyl sulfate | Sterigmatocystin |
| 3,3-Dimethoxybenzidine | Streptozolocin |
| para-Dimethylaminoazobenzene | Styrene |
| trans-2-[(Dimethylamino)methylimino]-5 [2 (5 nitro-2-furyl)vinyl]-1,3,4-oxidiazole | Sulfallate |
| 3,3-Dimethylbenzidine (ortho-tolidine) | 2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD) |
| Dimethylformamide | Tetrachlorethylene |
| 1,1-Dimethylhydrazine | Textil manufacturing (occupational exposures) |
| 1,2-Dimethylhydrazine | Thiocetamide |

| | |
|---|---|
| 1,6-Dinitropyrene | 4,4-Thiodianiline |
| 1,8-Dinitropyrene | Thiourea |
| 1,4-Dioxane | Toluene diisocyanates |
| Disperse Blue 1 | ortho-Toluidine |
| Ethyl acrylate | Toxaphene (polychlorinated camphenes) |
| Ethylene thiourea | Trichlormethine (trimustine hydrochloride) |
| Ethyl methanesulphonate | Trp-P-1(3-Amino-1,4-dimethyl-5-H-pyrido[4,3-b)indole |
| 2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole | Trp-P-2(3-Amino-1-methyl-5H-pyrido [4,3-b]indole) |
| Fuel oils (residual, heavy) | Trypan blue |
| Gasoline | Uracil mustard |
| Gasoline engine exhausts | Urethane |
| Glu-P-1(2-Amino-6-methyldipyrido[1,2-a:3'2'-d]imidazole) | Welding fumes |
| Glu-P-2(2-Aminodipyrido [1,2-a:3'2'-d] imidazole) | Wood industries |
| Glycidaldehyde | Carpentry and joinery |
| Griseofulvin | |

## 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
norflurazon
oryzalin
oxadiazon
oxadixyl
oxyfluorfen
paradichlorobenzene
parathion (ethyl)
permethrin
phosmet
phosphamidon
pronamide
propiconazole
simazine
terbutryn
tribenuron-methyl
tetrachlorvinphos
thiodicarb

fomesafen
hexythiazox
linuron
methidathion
methomyl
metalochlor
thiophanate methyl
triadimefon
triadimenol
tribufos
tridiphane
trifluralin

## 6.15 HAZARDOUS SUBSTANCE profiles

Legend:
- E: Extreme
- H: High
- M: Medium
- L: Low
- OSL: Outside Specified Levels
- * : Classified 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 | Fire/ Explostion | 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 | - | - | - | - | - |
| 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* |

| Substance Name | UN No. | Substance Form | Specific Gravity | Primary Classification | Packaging Group | Subsidiary Classification | Fire/ Explostion | Human Health | Environment |
|---|---|---|---|---|---|---|---|---|---|
| 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 | 1.260 | 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°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 | - | - |
| 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 |

| Substance Name | UN No. | Substance Form | Specific Gravity | Primary Classification | Packaging Group | Subsidiary Classification | Fire/ Explostion | Human Health | Environment |
|---|---|---|---|---|---|---|---|---|---|
| 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 | - |
| 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 | - |

| Substance Name | UN No. | Substance Form | Specific Gravity | Primary Classification | Packaging Group | Subsidiary Classification | Fire/ Explostion | Human Health | Environment |
|---|---|---|---|---|---|---|---|---|---|
| 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 ( ≥ 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* |
| 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* |

## 6.16 Conversion of measurement units

### 1 Conversion of temperature

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

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

### 2 Conversion of measurements for solids

1ppm = 1mg/kg

### 3 Conversion of measurements for liquids

1ppm = 1mg/l

1ppb = 1µg/l

1ppm = $1g/m^3$

1ppb = $1mg/m^3$

### 4 Conversion of measurements for gases and vapours

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