

appendix 21

hazardous

substances

AP21 Introduction

AP21.i This chapter deals with all issues relating to hazardous substances.

AP21.1 Meaning of words

AP21.1.i In this Appendix, unless the context otherwise requires:

Adjusted threshold

Means the amount (mass in tonnes or m³, at 101.3 kPa and 20°C, for compressed gases) of a substance that has been assessed as generating no significant off-site effects in a heavy industrial area after considering site and substance-specific conditions.

Adjustment factor

Means the product of the individual factors for each effects group (ie. fire/explosion, human health and environment) that increase or decrease the likelihood and consequences of the release of a hazardous or environmentally damaging substance.

Base threshold

Means the amount (mass in tonnes or m³, at 101.3 kPa and 20°C, for compressed gases) of a substance that has been assessed as generating no significant off-site effects in a heavy industrial area before considering site and substance-specific conditions.

Bioaccumulation

Means the accumulation of a substance within the tissues of living organisms.

Carcinogen

Means a carcinogenic substance that causes a statistically significant increase in the incident of tumours.

Effects group

Means one of 3 groups of effects generated when a hazardous or environmentally damaging substance is released:

- a) fire/explosion effects group
- b) human health effects group
- c) environmental effects group

Effects ratio

A dimensionless number representing the intrinsic hazard of a substance (Base Threshold) adjusted for the proposed quantity of a substance or to be used or stored, and the site specific factors (adjustment factors) that contribute to the overall effects of using or storing a hazardous substance. The Total Effects Ratio is the sum of all effects ratios for substances in each effects group.

Environmentally damaging substance

Means any substance which, by effects other than toxicity, is able to damage an aquatic ecosystem (for example, milk or oil).

Ecotoxicity

Means the adverse toxic effects on ecosystems or ecological communities, ecosystem, and living organisms.

Hazard

Means any intrinsic property of a substance which makes it capable of causing adverse effects to people, the environment or property.

Hazardous substance

Means any substance with:

- a) one or more of the following intrinsic properties:
 - i) explosiveness
 - ii) flammability
 - iii) a capacity to oxidise
 - iv) corrosiveness
 - v) toxicity (both acute and chronic)
 - vi) ecotoxicity, with or without bioaccumulation, or
- b) which on contact with air or water (other than air or water where the temperature or pressure has been artificially increased or decreased) generates a substance with any one or more of the properties specified in paragraph a) of this definition, and
- c) includes environmentally damaging substances.

Pesticide

Means any substance used for the prevention or control of any pest including herbicides, fungicides, defoliants and desiccants, but not including any fertiliser or animal remedies.

Risk

Means the likelihood of occurrence of an adverse effect from a substance combined with the magnitude of the consequences of that adverse effect.

Separation distance

Means the distance from the edge of the area where hazardous substances are used, stored or handled to the edge of the area exposed to adverse effects.

Storage

Means the containment of a substance or mixture of substances, either above ground or underground, and includes the filling and emptying of the container. Storage does not include substances in use, or those used as a cooling or heating medium.

Use

Means the manufacturing, processing or handling of a substance or mixture of substances for a particular activity without necessarily changing the physical state or chemical structure of the substance. Use includes mixing, blending and packaging operations, but does not include the filling or drawing of substances from bulk storage tanks unless the processing is permanently connected to the bulk storage, and does not include loading out and dispensing of petroleum products (including diesel, CNG, and LPG).

AP21.2 use or storage of hazardous substances

AP21.2.1 permitted activities

AP21.2.1.i The use or storage of hazardous substances is a permitted activity if either:

- a) the activity is listed as an exception or exemption in rule AP21.3 below, or
- b) the activity:
 - i) complies with the design standards in AP21.4 below, and
 - ii) the total effects ratio for any effects group, calculated in accord with this Appendix, does not exceed the level stated in the permitted activity column of Table AP21.2.4, or any lesser level applicable in terms of rule AP21.2.5 (zone boundaries).

AP21.2.2 controlled activities

AP21.2.2.i The use or storage of hazardous substances is a controlled activity if the activity:

- a) complies with the design standards in AP21.4 below, and
- b) the total effects ratio for any effects group, calculated in accord with this Appendix, is within the range stated in the controlled activity column of Table AP21.2.4, or any lesser level applicable in terms of rule AP21.2.5 (zone boundaries).

AP21.2.2.ii Control is reserved over:

- a) on-site hazards and potential exposure pathways, and
- b) effects and risks to neighbouring land uses and activities, and
- c) effects and risks on the natural environment, and
- d) effects on the local transport network, and
- e) cumulative risks arising together with neighbouring activities, and
- f) evaluation of development alternatives, and
- g) assessment of possible development alternatives, and
- h) fire safety and fire water management, and
- i) emergency procedures and plans, and
- j) site management system.

AP21.2.3 discretionary activities

AP21.2.3.i The use or storage of hazardous substances is a discretionary activity if the activity:

- a) complies with the design standards in AP21.4 below, and
- b) the total effects ratios for any effects group, calculated in accord with this Appendix, exceed the figure stated in the discretionary activity column of Table AP21.2.4, or any lesser level applicable in terms of rule AP21.5.

AP21.2.3.ii Assessment criteria:

- a) on-site hazards and potential exposure pathways
- b) effects and risks to neighbouring land uses and activities
- c) effects and risks on the natural environment
- d) effects on the local transport network
- e) cumulative risks arising together with neighbouring activities
- f) evaluation of development alternatives
- g) assessment of possible development alternatives
- h) fire safety and fire water management
- i) emergency procedures and plans
- j) site management system

AP21.2.4 total effects ratios in zones and areas

AP21.2.4.i The total effects ratio levels for permitted, controlled and discretionary activities in the various Zones and Areas are stated in Table 21.2.4. The levels are the same for all three effects groups.

Table AP21.2.4 total effects ratios

Zone or area of site	Total effects ratios - each effects group		
	Permitted activity	Controlled Activity	Discretionary activity
Industrial Zone: Port, Tahunanui, Airport, Nayland Road South Area, Saxtons Areas Rural Zone (excluding the Small Holdings Area)	<0.75	0.75 - 1.5	>1.5
Industrial Zone: Vanguard Street Area Rural Zone: Small Holdings Area	<0.2	0.2 - 0.4	>0.4
Inner City Zone: Inner Fringe Area Open Space and Recreation Zone Coastal Marine Area	<0.1	0.1 - 0.2	>0.2
Inner City Zone City Centre Area Suburban Commercial Zone	<0.075	0.075 - 0.15	>0.15
Conservation Zone	<0.05	0.05 - 0.1	>0.1
Residential Zone	≤0.02	-	>0.02

AP21.2.5 zone boundaries

AP21.2.5.i This rule applies where:

- a) hazardous substances are used or stored in the Industrial Zone or Rural Zone adjacent to the zone boundary, and
- b) the effects ratio levels given in Table AP21.2.4 of the neighbouring zone are lower than for the zone or area in which the activity takes place.

AP21.2.5.ii Where this rule applies, the effects ratio levels given in Table AP21.2.4 for the neighbouring zone apply to the activity for the distances stated in Table AP21.2.5.

Table AP21.2.5 buffer spaces

Site - zone or area	Distance adjoining effects ratio levels apply from zone boundary into industrial or rural zone.
Industrial Zone: Port Area, Tahunanui Area, Airport Area Rural Zone	30m
Industrial Zone: Nayland Rd South Area	20m

AP21.3 exceptions and exemptions

AP21.3.i These are the exceptions and exemptions referred to in rule AP21.2.

AP21.3.1 exceptions

AP21.3.1.i Trade waste sewers.

AP21.3.1.ii Storage and use of hazardous consumer products for private domestic purposes.

AP21.3.1.iii Retail outlets for the domestic-scale usage of hazardous substances (retail outlets include supermarkets, hardware shops, and pharmacies, but not wholesale outlets or outlets for the supply of trade).

AP21.3.1.iv Facilities using genetically modified organisms.

AP21.3.1.v Substances that give rise only to a dust explosion risk.

AP21.3.1.vi Gas or oil pipelines.

AP21.3.1.vii Fuel in motor vehicles, boats and small engines such as lawnmowers, chainsaws and the like, and storage in individual containers relating to the domestic equipment not exceeding 20 litres.

AP21.3.1.viii The use and/or storage of any hazardous substances 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 Facilities".

AP21.3.1.ix Storage of substances in use and used as a cooling or heating medium.

AP21.3.1.x The use and storage of hazardous substances in classroom situations within Schools and Tertiary Educational Institutions subject to compliance with "Safety and Science: A Guidance Manual for New Zealand Schools" published by the Ministry of Education 1997, or a means of compliance approved by the Council.

AP21.3.2 exemptions



AP21.3.2.i Storage of up to 100,000 litres of petrol and up to 50,000 litres of diesel in underground storage tanks, provided it can be demonstrated that the "Code of Practice for the Design, Installation and Operation of Underground Petroleum Systems" published by the Department of Labour (Occupational Safety and Health) is adhered to.

AP21.3.2.ii Storage of LPG in cylinders, provided it can be demonstrated that "AS/NZS 1596:1997 Storage and Handling of LP Gas" is adhered to.

AP21.3.2.iii Storage of up to 6 tonnes (single vessel storage) of LPG in a receptacle of a liquid capacity greater than 250l, provided it can be demonstrated that "AS/NZS 1596:1997 Storage and Handling of LP Gas" is adhered to.

Note - The Nelson Marlborough Health Services Ltd facilities in Waimea Road are covered by Schedule C to the Residential Zone.

AP21.4 design standards

AP21.4.i These are the design standards referred to in rule AP21.2.

AP21.4.1 storage

AP21.4.1.i Hazardous substances (or waste containing hazardous substances) shall be stored in a manner that prevents:

- a) exposure to ignition sources, and
- b) corrosion, embrittlement, or other alteration of the containers used for the storage of the hazardous substances, and
- c) unintentional release of the hazardous substances, and
- d) pressure changes likely to materially increase the risks associated with the storage of the substance.

AP21.4.2 site design

AP21.4.2.i Any part of a site where hazardous substances are used shall be designed, constructed and managed in a manner that prevents:

- a) any effects of the intended use from occurring outside of the intended area, and
- b) the entry or discharge of the hazardous substance into the stormwater drainage or a municipal sewerage system unless accepted by the network utility operator.

AP21.4.2.ii A site where hazardous substances are used or stored shall be designed, constructed and managed in a manner that prevents:

- a) the contamination of any land or water (including groundwater and potable water supplies) in the event of a spill or other unintentional release of hazardous substances, and
- b) the entry or discharge of the hazardous substance into the stormwater drainage or a municipal sewerage system in the event of a spill or other unintentional release.

AP21.4.2.iii A site where hazardous substances are used or stored shall be designed, constructed and managed in a manner that any stormwater originating on or collected on the site:

- a) does not transport any hazardous substances that have the potential to contaminate any land or water unless permitted by a resource consent or Plan provision, and
- b) does not enter or discharge into the stormwater drainage or a municipal sewerage system unless accepted by the network utility operator.

AP21.4.2.iv Hazardous substances shall not be stored on any land within a Flood Path Overlay or Flood Overlay.

AP21.4.2.v In the Residential Zone, where the effects ratios of hazardous substances used or stored on a site are within permitted levels, and substances are stored in the manufacturer's packaging, no special site design or construction is required.

AP21.4.2.vi The storage and use of hazardous substances within the Inundation Overlay shall be designed to ensure:

- a) any buildings or structures are above the minimum floor level determined for the site, and
- b) the substances are stored in an elevated tank or structure, or
- c) underground storage of hazardous substances shall be designed to take into account the possibility of inundation, and in accordance with "Code of Practice for the Design, Installation and Operation of Underground Petroleum Systems" published by the Department of Labour (Occupational Safety and Health).

AP21.4.3 underground storage areas

AP21.4.3.i Underground tanks for the storage of petroleum products shall be designed, constructed 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) will be accepted as one method of complying with this condition.

AP21.4.4 signs

AP21.4.4.i Any hazardous facility shall be adequately signposted to indicate the nature of the substances stored, used or otherwise handled. Signs are not required for substances used or stored as a permitted activity in the Residential Zone. 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 will be accepted as one method of complying with this condition.

AP21.4.5 waste management

AP21.4.5.i Any hazardous facility generating waste containing hazardous substances shall dispose of these wastes to appropriately permitted facilities, or be serviced by a reputable waste disposal contractor.

AP21.4.6 records

AP21.4.6.i All sites which use or store hazardous substances shall at all times maintain a record of all types and quantities of hazardous substances and hazardous wastes on the site. These records shall be maintained so that it is possible to track all consignments or products until they leave the site and their intended destination when leaving. These records shall include the name of the supplier, Material Safety Data Sheets, and names of the persons or organisations who remove any hazardous substances or wastes from the site. The records shall be kept up to date and be available for inspection at any time by an officer of the Council. Records are not required for substances used or stored as a permitted activity in the Residential Zone.

AP21.4.7 emergency and contingency plans

AP21.4.7.i All sites which produce, use, store or dispose of hazardous substances shall prepare an emergency and contingency plan which sets out how any spillages or leaks will be contained, cleaned up and disposed of. The plan must identify the elements required to respond to an emergency and define responsibilities and specific tasks in an emergency. A list of people to be contacted in the event of an emergency, the name of the person with primary management responsibility for any substances used or stored on site and any other relevant emergency procedures shall be provided to the Council and emergency services. Plans are not required for substances used or stored as a permitted activity in the Residential Zone.

AP21.4.8 information to be supplied with applications

AP21.4.8.i The following information is to be supplied with applications for resource consent in relation to use or storage of hazardous substances, in addition to any other information required under this Plan or the Act:

- a) the proposed operation and site lay-out
- b) the surrounding natural, human, and physical environment
- c) drainage for stormwater and sewage (layout and capacity)
- d) separation distances to boundaries and activities on the site and adjoining sites
- e) method and route of transportation of hazardous substances to site

AP21.4.9 reasons for rules

AP21.4.9.i Reasons and explanations are given throughout this Appendix. The rules regulate the use or storage of hazardous substances according to the risks posed, having regard to the tolerances acceptable in different zones. The technical and scientific basis for the risk analysis and procedures adopted is provided in the document "Land Use Planning for Hazardous Facilities" by the Hazardous Facility Screening Procedure Review Group (Auckland Regional Council, 1995). A copy may be viewed at the Nelson City Council. This document describes the Hazardous Facilities Screening Procedure (HFSP) adopted in many districts.

AP21.4.9.ii The site standards ensure protective measures are implemented to avoid the possibility of substances escaping into the environment. The Residential Zone permitted levels do not require these site standards because the quantities of substances allowed are very small, where substances are kept in the manufacturer's packaging, which provides adequate safeguards.

AP21.4.9.iii The exceptions and exemptions relate to use or storage of hazardous substances that are regulated by other legislation (eg. the Hazardous Substances and New Organisms Act 1996) or by the general zoning effect of separating incompatible activities, or (in the case of motor fuels) the existence of industry standards that mitigate the risks.

AP21.4.10 residential zone effects ratio

AP21.4.10.i The effects ratio for the Residential Zone is 0.02. This effects ratio is very low and reflects the need to provide maximum protection for local residents and facilities such as retirement homes, kindergartens, schools and halls, where people spend a major part of the day and night. It will permit the use of small hazardous substance quantities in residential areas, as is the case with home occupations.

AP21.4.11 rural zone

AP21.4.11.i The effects ratio is 0.75 in the Rural Zone. This reflects the fact that farming operations can be major users of hazardous substances - particularly very hazardous substances such as pesticides. The need for such an effects ratio in New Zealand farming areas has been verified by two farm surveys undertaken by the Environment and Business Group Ltd in different parts of New Zealand. The proposed effects ratio will enable most farm related activities to proceed as a permitted activity, unless higher than normal quantities of hazardous substances are used or stored. Reductions in rural risk might be achieved with a co-operative education programme for farming businesses, together with reliable services to remove and dispose safely of unused or waste agricultural chemicals.

AP21.4.11.ii In the Small Holdings Area the effects ratio is lower, recognising the greater living density and community activities, and the need to use minor to moderate quantities of hazardous substances for farming/horticultural purposes.

AP21.4.12 conservation zone

AP21.4.12.i Conservation Zone effects ratio is 0.05. This will allow only small quantities of hazardous substances to be used or stored for occasional maintenance and pest control purposes. The proposed level equates to approximately 1,500 litres of diesel, 500 litres of petrol, and 6 litres of concentrated biocide.

AP21.4.13 inner city zone

AP21.4.13.i Effects ratios for the City Centre and the Inner Fringe Areas are 0.075 and 0.1, respectively. These areas encompass the major commercial areas in the District, and reflect the need for the minor to moderate use of hazardous substances by these activities. This effects ratio accounts for the fact that people in commercial areas accept a somewhat higher risk compared to residential areas, as they usually only spend between 2 - 8 hours there. It is appropriate to set the level for the City Centre somewhat lower due to the increased focus on community and tourism related activities.

AP21.4.14 suburban commercial

AP21.4.14.i This zone covers the suburban commercial areas of the District and has the same rating (0.075) as the City Centre, given the community focus, the somewhat smaller desirable scale of commercial businesses in these areas, and also the vicinity of residential activities.

AP21.4.15 open space and recreation zone

AP21.4.15.i The Open Space and Recreation Zone has an effects ratio of 0.1. This is higher than residential areas because people spend proportionately less time there, i.e. in the order of 2 - 4 hours in open space areas. Open space is often used as a buffer between residential and industrial areas, or for activities involving hazardous substances such as swimming pools.

AP21.4.16 industrial zone



AP21.4.16.i None of the existing industrial areas in the Nelson District fulfils the requirements of a heavy industrial area, or is suitable for the location of major noxious industry. Ideally, a heavy industrial zone is well removed from residential and environmentally sensitive areas. However, a significant portion of the Industrial Zone is adjacent or close to sensitive marine resources or residential areas. It is therefore considered appropriate that hazardous facilities will be called in at an earlier stage for an assessment of environmental effects and risks. This is consistent with the HFSP, which assigns an effects ratio of 1 to a heavy industrial area.

AP21.4.16.ii The Industrial Zone at the Port, Tahunanui and the Airport have an effects ratio 0.75. This permits storage of 22,500 litres of diesel, 7,500 litres of petrol, or 750 litres of an environmentally highly toxic substance. The Vanguard St and Nayland Rd South Industrial areas receive a rating of 0.25 and 0.5, respectively. The Vanguard St area is in the vicinity of Residential and Inner City Zones, and it is desirable to minimise hazardous substances use in this area as much as possible. The Nayland South Industrial area comprises mainly food processing industries, which generally are not compatible with industry manufacturing or using large quantities of hazardous substances. However, food processing industries have hazardous substances requirements for transportation and refrigeration.

AP21.4.17 major institutions

AP21.4.17.i Technical institutes, hospitals, and scientific laboratories are regulated in the same way as the rest of the zone they are in. Generally, an effects ratio between 0.1 and 0.2 would be expected at such institutions. If the zones within which these institutions are located in have lower effects ratio, then they will have to rely on their existing use rights or apply for a resource consent to use or store hazardous substances above the permitted levels. The quarries and the landfill are located in the Rural Zone, which, at a proposed effects ratio of 0.75, caters appropriately for these facilities

AP21.4.18 utility services

AP21.4.18.i Utility services - such as electricity or telephone lines - are generally provided by a network utility operator under designations which have been identified through Requiring Authorities (approved network operators). Where the use or storage of hazardous substances is not covered by a designation, the effects ratio of the zone applies.

AP21.5 hazardous facility screening procedure - overview

AP21.5.1 overview

AP21.5.1.i The system of regulation of hazardous substance use and storage in this Appendix follows the Hazardous Facility Screening Procedure (HFSP) developed by a working group from the Auckland Regional Council, Environment Waikato, Accident Compensation Corporation and consultants. The technical background to the HFSP is provided in the Document "Land Use Planning for Hazardous Facilities" by the Hazardous Facility Screening Procedure Review Group (Auckland Regional Council, 1995). A copy may be viewed at Nelson City Council.

AP21.5.1.ii To plan for facilities using or storing hazardous substances, the Hazardous Facility Screening Procedure focuses on assessing three groups of potential adverse effects:

- a) effects caused by fire or explosion
- b) effects on human health
- c) environmental effects

AP21.5.1.iii Possible adverse effects of hazardous substances can be predicted by the hazard of the substance and the anticipated consequences of its release to the environment. Adverse effects include:

- a) contamination of water, soil and air
- b) short and long term damage to ecosystems
- c) accumulation of persistent substances in the bodies of humans and animals, resulting in chronic and/or long term damage to their health
- d) acute damage to human health through exposure to substances affecting skin, mucous membranes, respiratory and digestive systems
- e) damage to the environment, human health and property through fire and explosion events

AP21.5.1.iv It is important to distinguish between the hazard of a substance and the risk it poses:

- a) hazard is principally defined by the intrinsic properties of the substance, such as its flammability or toxicity
- b) the risk presented by a substance is defined by the probability of its release, combined with the potential effects of that release

AP21.5.1.v The Hazardous Facility Screening Procedure focuses on the potential effects of a hazardous substances release, and thus brings the essential dimension of risk into council evaluations of hazardous substance proposals. It works by assessing the quantities and hazard posed by substances on a proposed site in relation to the levels of acceptable risk in different localities, as stated in an "effects ratio."

AP21.5.1.vi Generally, each substance to be used or stored on the site should be assessed for its effects in each of the three groups. For each substance and in each Effects Group, the HFSP has assigned the following:

- a) a Base Threshold (B) which is mainly dependent on the substance's intrinsic hazardous properties. The Base Threshold 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. It is expressed as the weight, or volume for compressed gases, of classes of substances.
- b) Adjustment Factors (FF, FH, FE) which have been developed specifically for use with the HFSP. These adjust the Base Thresholds of substances on the site to reflect the risk posed by factors which increase or decrease the likelihood and consequences of release, such as the physical state of the substance, the type of storage and activity, site separation distances and the environmental sensitivity of the location.

AP21.5.1.vii Users of the HFSP then calculate the following:

- a) an Adjusted Threshold, by multiplying the Base Thresholds by the Adjustment Factors. This generates an Adjusted Threshold for each substance in each of the Effects Groups, so as to more realistically reflect the potential effects of the substances on the site.
- b) the Effects Ratio for each substance in each effects group, by dividing the proposed quantity of the substance to be used or stored with the Adjusted Threshold quantity. Where multiple substances are used or stored, the Effects Ratios for each Effects Group are added up, to indicate the cumulative potential effects of the proposed facility.

AP21.5.1.viii The Total Effects Ratio (i.e. the sum of all effects ratios of individual substances within an effects group) is used to determine whether or not the activity needs a resource consent. Table AP21.2.4 indicates the Total Effects Ratio values at which an activity or facility is permitted, controlled or discretionary in different zones and areas. The effects ratio figure is the same for each effects group in Table AP21.2.4.

AP21.5.1.ix If the HFSP indicates that a proposed facility is controlled or discretionary, a more detailed, merit-based assessment of risks will be needed. This risk assessment should take account of:

- a) the probability and effects of potential hazardous substances accidents
- b) the proposed measures to mitigate and manage that risk, and
- c) location and characteristics of the proposed site

AP21.5.1.x The granting of a resource consent would then be considered in terms of whether the off-site risks presented by a hazardous facility are adequately contained and managed. The HFSP does not determine the outcome of the resource consent application.

AP21.5.1.xi A conceptual overview of the HFSP is shown in Figure AP21E.1

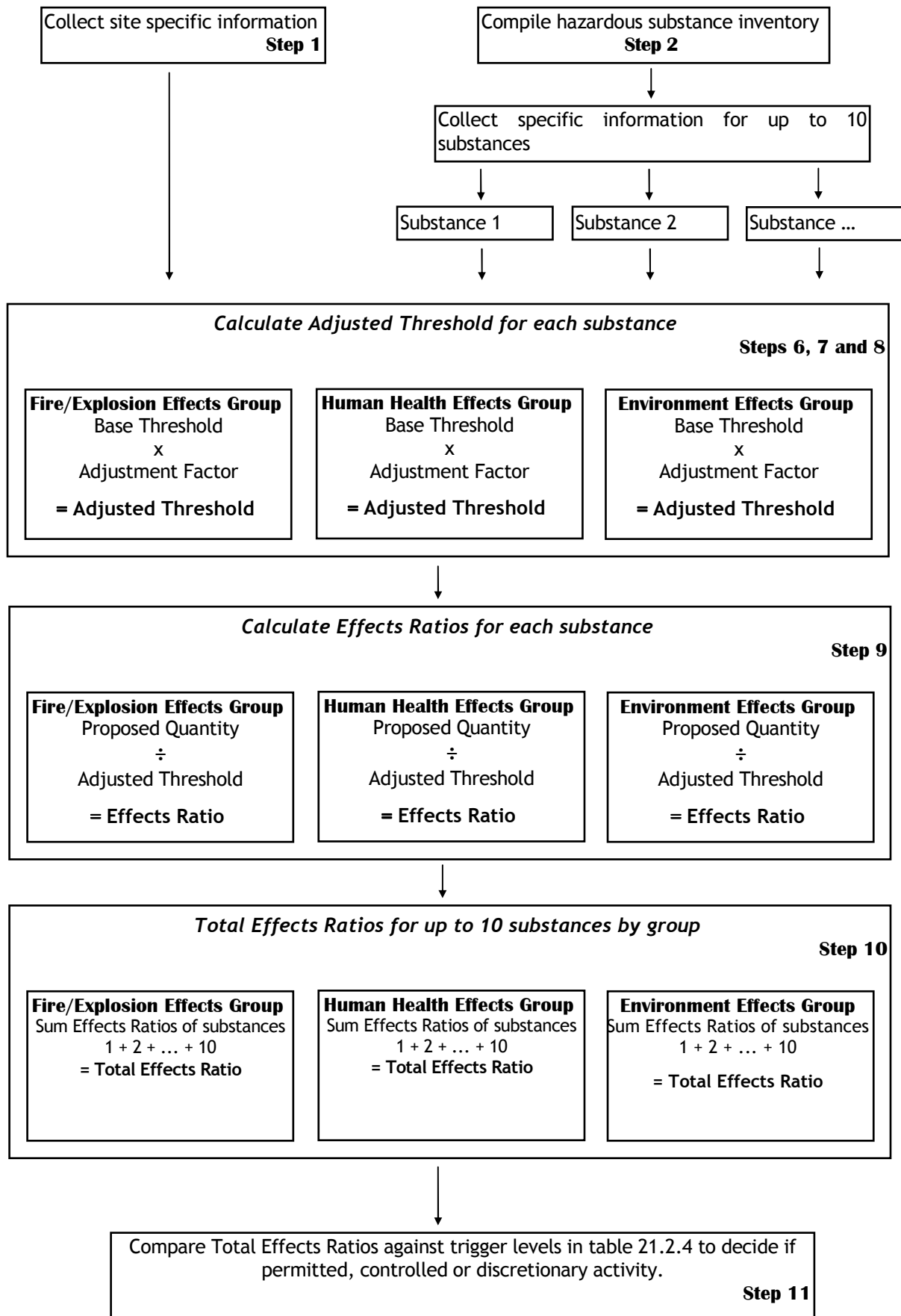
AP21.5.2 where the HFSP fits into the range of controls on hazardous facilities

AP21.5.2.i Because the Hazardous Facility Screening Procedure is simply a tool for determining whether or not an activity needs a resource consent, it forms only one component of a management strategy containing other essential and complementary elements.

AP21.5.2.ii The tools available to regulatory bodies for controlling hazardous facilities are as follows:

- a) location controls such as zoning determine generally where they may locate
- b) management and design controls such as performance standards or rules control how they go about their activities
- c) land use controls imposed by way of a land use resource consent may also be required when the Hazardous Facility Screening Procedure and Table AP21.2.4 screen out facilities which require more specific controls

Figure AP21E.1 Hazardous facility screening procedure overview



AP21.6 hazardous facility screening procedure - steps for calculating total effects ratios

AP21.6.i This section is a step-by-step guide on how to calculate the Total Effects Ratios, for comparison with the numbers in Table AP21.2.4. The worksheets referred at each step are in Attachment 21A to this Appendix. The Council will make available packages of Working Materials, and advise on the procedures, but people using or storing hazardous substances must make their own calculations.

AP21.6.1 step 1 - assemble site-specific information

AP21.6.1.i Site specific information is an essential component of the Adjustment Factors required at Step 7. Any sensitive land uses or environmental features on or near the site, that are relevant to the adjustment factors in Table AP21.6.2, need to be noted. Use Attachment 21A, Worksheet 1.

AP21.6.2 step 2 - compile hazardous substances inventory

AP21.6.2.i 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. A form to assist with this task is provided in Attachment 21A, Worksheet 2. The inventory should list:

- a) the names (including proprietary names and suppliers where necessary)
- b) UN classifications of all the hazardous substances on the site
- c) quantities

AP21.6.2.ii The United Nations Recommendations on the Transport of Dangerous Goods (UNRTDG), 8th edition (1993) is the primary source of information on UN classifications. See further comment at Steps 4 and 5 about sources of information. The general characteristics of each class are stated in Attachment 21B to this Appendix.

AP21.6.2.iii Use the standard units of tonnes (for solids, liquids and liquefied gases) and m³ (for compressed gases). It is necessary to express all 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 m³ to tonnes.

AP21.6.2.iv Conversions of quantities are also necessary where a substance is diluted, or mixed with another substance. 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.

AP21.6.2.v An exception 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. UNRTDG lists a range of pesticides and their dilutions, and their related Packaging Groups in Class 6.1 in terms of a human poison rating.

AP21.6.2.vi 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.

AP21.6.2.vii Small packages are 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.

AP21.6.3 step 3 - select "priority status" substances

AP21.6.3.i If there are less than 10 hazardous substances used or stored on a site, all are included in the total effects ratio calculation. Where there are more than 10 substances on a site, the 10 substances with the highest individual effects ratios within each effects group make up the total effects ratio. In order to save calculating effects ratios for all substances to identify the 10 highest, a "common sense" approach is recommended, whereby the calculation is first carried out on those substances which:

- a) are highly or extremely dangerous, or
- b) are held in quantities exceeding 10% of the total stock of hazardous substances listed in the inventory (Attachment 21A, Worksheet 2).

AP21.6.3.ii It is suggested that all of the steps in this section should be completed in respect of just these substances, before considering any other substances. The effects ratios of these substances by themselves may dictate that a resource consent is required.

AP21.6.4 step 4 - collate substance specific information

AP21.6.4.i Assign a hazard level for each effects group to the hazardous substances held on the site. This requires the collection of a range of information about the substances, including UN classifications. 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, text and reference books. The Council has available a list of other reference sources, if required, and relevant information for some commonly used hazardous substances.

AP21.6.4.ii Attachment 21A, Worksheet 3 has been designed to help with the task of recording the information required to classify substances into effects groups and hazard levels. Where data on hazardous substances can only be found in units other than those required on Worksheet 3, appropriate conversions need to be carried out

AP21.6.4.iii 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 a medium hazard level for the fire/explosion and human health effects groups, and a high hazard level for the environmental effects group.

AP21.6.4.iv These default hazard levels are adopted because:

- a) 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
- b) 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

AP21.6.5 step 5 - identify effects groups and hazard levels

AP21.6.5.i The effects of substances are categorised into three groups:

- a) fire/explosion effects - concerned with damage to property, the built environment and safety of people
- b) human health effects - concerned with the well-being, health and safety of people
- c) environmental effects - concerned with damage to ecosystems and natural resources

AP21.6.5.ii Each effects group is divided into four hazard levels:

- a) extreme
- b) high
- c) medium
- d) low

AP21.6.5.iii 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 United Nations classification system for hazardous substances as outlined in the United Nations 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. (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.)

AP21.6.5.iv The following points should be noted:

- a) the above classification systems are inadequate for assigning effects group hazard levels to certain hazardous substances in the human health and environment effects groups, particularly toxic substances (Class 6.1), toxic gases (Class 2.3) and environmentally toxic substances (Ecotoxic Class)
- b) the classification of these substances in Classes 6.1, 2.3, and Ecotoxic has been refined to account for extremely hazardous substances. This has been done by creating an additional “extreme” hazard level, which is not part of the UN Classification system, see Attachment 21B and Table AP21.6.1
- c) environmentally damaging substances have been placed into the “Ecotoxic” class. (See Attachment 21B) Foodstuffs such as milk are an example of an environmentally damaging substance
- d) hazardous substances listed 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:
 - i) a medium explosion effect
 - ii) an extreme human health effect, and
 - iii) a high environmental effect

AP21.6.5.v 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 Attachment 21B, which lists UN Classes, Packaging Groups and other relevant information.

AP21.6.5.vi 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.

AP21.6.5.vii 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.

AP21.6.5.viii 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 Attachment 21A, Worksheet 4.

AP21.6.6 step 6 - find base threshold quantities

AP21.6.6.i 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 in Step 7 below). Base Thresholds (B) corresponding to the hazard levels in each effects group are listed in Table AP21.6.1. There are only 18 possible values of B, as given in Table AP21.6.1.

AP21.6.6.ii 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:

- a) 100 tonnes of a combustible liquid, which has a low hazard level in the fire/explosion effects group
- b) 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

AP21.6.6.iii The base thresholds for each substance used or stored on the site are found in Table AP21.6.1 and recorded in the column marked “Step 6” on the “Summary Sheet for Manual HFSP Calculations” in Attachment 21A, Worksheet 4.

AP21.6.7 step 7 - find adjustment factors

AP21.6.7.i Table AP21.6.2 lists the pre-calibrated adjustment factors to be used for each effects group. Pre-calibrated adjustment factors (FF, FH and FE) are used to adjust 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. Adjustment factors differ for each of the effects groups, and take into account the following considerations:

- a) the physical state of the substance
- b) the pressure and temperature required for storage and usage
- c) the type of storage
- d) the type of activity or use
- e) separation distances to the site boundary
- f) the environmental sensitivity of the site location

AP21.6.7.ii 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.

AP21.6.7.iii All adjustment factors within each effects group are applied to all substances. The adjustment factors are multiplied to generate one combined adjustment factor (FF, FH or FE) for each effects group, which is used in Step 8. The adjustment factors for each substance are recorded in the column marked “Step 7” on the “Summary Sheet for Manual HFSP Calculations” in Attachment 21A, Worksheet 4.

AP21.6.8 step 8 - calculate adjusted threshold quantities

AP21.6.8.i 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:

- a) $T = B \times FF$ provides the adjusted threshold for a substance in the fire/explosion effects group
- b) $T = B \times FH$ provides the adjusted threshold for a substance in the human health effects group
- c) $T = B \times FE$ provides the adjusted threshold for a substance in the environmental effects group

AP21.6.8.ii 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 Attachment 21A, Worksheet 4.

AP21.6.9 step 9 - calculate effects ratios for each substance

AP21.6.9.i The effects ratio (R) is a dimensionless number. It is calculated for each substance as follows:

$$R = \frac{Q}{T}$$

AP21.6.9.ii Where:

- a) R is the effects ratio for one substance in one effects group
- b) Q is the proposed quantity of the substance to be used or stored on the site
- c) T is the adjusted threshold for the relevant effects group calculated at Step 8.

AP21.6.9.iii The effects ratio (R) for each substance and effects group is recorded in the column marked “Step 9” on the “Summary Sheet for Manual HFSP Calculations” in Attachment 21A, Worksheet 4.

AP21.6.10 step 10 - sum the effects ratios to find the total effects ratio for each effects group

AP21.6.10.i Add the effects ratios (R) for each substance (up to 10 substances) within each Effects Group together, to produce the Total Effects Ratio for each effects group for all hazardous substances on a site. Use Attachment 21A, Worksheet 5.

AP21.6.10.ii The Total Effects Ratio represents the aggregate effects presented by multiple substances held on the same site. It makes it possible to assess the cumulative potential effects of several substances present on the same site within each effects group.

AP21.6.11 step 11 - determine consent status against Table AP21.2.4

AP21.6.11.i The total effects ratio within each effects group (from Step 10) determines whether or not resource consent is required for the proposed activity. The figure from Step 10 is compared with the total effects ratios in Table AP21.2.4.

AP21.6.11.ii The Effects ratio figures stated in Table AP21.2.4 apply to all effects groups; that is, the maximum level is the same for all effects groups. The highest total effects ratio in any of the three effects groups determines whether the activity is permitted, controlled or discretionary.

AP21.6.11.iii For example, in the Residential Zone, the level for a permitted activity is 0.02. Everything above that level is a discretionary activity, there being no controlled activity provided for in that zone. Assume a particular activity produced the following total effects ratio figures at Step 10:

- a) fire/explosion effects group - 0.01
- b) human health effects group - 0.01
- c) environmental effects group - 0.5

AP21.6.11.iv In this example, a resource consent application would be required for a discretionary activity, because the effects ratio for the environmental effects group is exceeded.

Table AP21.6.1 base thresholds (B) 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	3C / Combustible Liquids	3 PGIII	3 PGI 3 PGII	
4	Flammable Solids			4.1	4.2 4.3
5	Oxidizers			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 / Combustible Liquids		
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

* Base Threshold in m³ at 101.3 kPa and 20 °C for permanent or compressed gases.

** Ecotoxic “groups” are further described in **Attachment 21B.

Table AP21.6.2 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 ⁰ C) = 0.1	Gas (at 101.3 kPa and 20 ⁰ C) = 0.1	
F2: Handling/storage conditions	F2: Separation distance from site boundary (gases only)	F2: Environmental sensitivity
Temperature < flash point = 1	< 30m = 1	Normal = 1
Temperature > flash point < boiling point = 0.3	> 30m = 3	Adjacent to a waterbody or coastal water ¹ = 0.3
Temperature > boiling point = 0.1		
F3: Separation distance from site boundary	F3: Proximity to potable water resource	F3: Type of activity
< 30m = 1	Normal = 1	Use = 0.3
> 30m = 3	Proximity to potable water resource ² = 0.3	Above ground storage = 1
		Underground storage ³ = 3
F4: Type of activity	F4: Type of activity	
Use = 0.3	Use = 0.3	
Above 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 Within 50m of a waterbody. This includes streams, springs, lakes, wetlands, seas 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.

attachments

21A - Worksheets

**21B - Classification of
hazardous substances**

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 m of a waterbody ² or coastal water	

Sketch 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 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, UNRTDG]						
UN Number						
UN Primary Class						
UN Subsidiary Class						
Packaging Group(s)						
3 ADDITIONAL INFORMATION REQUIREMENTS					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 ¹	Oral toxicity LD ₅₀ (mg/kg)					
	Dermal Toxicity LD ₅₀ (mg/kg)					
	Inhalation Toxicity LC ₅₀ (ppm)					
	Carcinogen ² [yes/no]					
Ecotoxicity Data ³	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 Attachment 21B]						
Hazard	UN Class	Division/ Packaging Group	Does hazardous property apply? [yes/no]	Effects Groups and Hazard Level ⁴		
				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						

¹ List lowest level available for human or mammalian species, type of species, test duration and data source.

² See Appendix B.

³ For LC₅₀ and EC₅₀ list lowest levels for indicated or other aquatic species, type of species and data source.

⁴ 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 calculation

Substance	Step 4		Step 6	Step 7				Step 8	Proposed Quantity	Step 9
	Effects Group	Hazard Level	Base Threshold	Adjustment Factors				Product Adjustment Factors of Adjusted Threshold		Effects Ratio $R = \frac{Q}{T}$
			B (t/m ³)	F1	F2	F3	F4	FF, FH, FE	T (t/m ³)	Q (t/m ³)
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.

Attachment 21B: 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.		

UN Class	Hazard	Division	Description	Effects Group	Hazard Level
2	Flammable gas	LPG	LPG	Fire/Explosion	Medium
		2.1	Flammable gases: gases which at 20°C and a standard pressure of 101.3 kPa: are ignitable when in a mixture of 13% or less by volume with air, or have a flammable range with air of at least 12% regardless of the lower flammability limit. This class includes aerosols containing flammable propellants.	Fire/Explosion	High
	Non-flammable, non-toxic gas	2.2	Not applicable.		
	Toxic gas	2.3	<p>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:</p> <p>a) Inhalation toxicity vapours $LC_{50} < 200 \text{ ppm} (= \text{ml/m}^3)$</p>	Human Health	Extreme
			<p>b) Inhalation toxicity vapours $LC_{50} \geq 200 \text{ ppm} - 5,000 \text{ ppm} (= \text{ml/m}^3)$</p>	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°C Initial boiling point: ≤ 35°C	Fire/Explosion	High
		3 PGII	Flash point: < 23°C Initial boiling point: > 35°C	Fire/Explosion	High
		3 PGIII	Flash point: ≥ 23°C - ≤ 61°C Initial boiling point: > 35°C	Fire/Explosion	Medium
	Combustible Liquids	3C	Flash point: > 61°C - <200°C°	Fire/Explosion Environment	Low 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. 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 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 Agents	5.1	Oxidising agents: substances which, in themselves are not necessarily combustible may cause or contribute to the combustion of other materials by yielding oxygen.	Fire/Explosion	High
	Organic peroxides	5.2	Organic peroxides: organic substances that are thermally unstable and may undergo exothermic decomposition at normal or elevated temperatures. The decomposition can be initiated by heat, contact with impurities (e.g. acids, heavy metal compounds, amines), friction or impact. The rate of decomposition increases with temperature and varies with the organic peroxide formulation. Decomposition may result in the evolution of harmful or flammable gases or vapours, In addition, they may have one of the following properties: 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

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): Dermal toxicity LD ₅₀ (mg/kg): Inhalation toxicity dust/mist LC ₅₀ (mg/l): Inhalation toxicity vapours LC ₅₀ :	≤ 1 ≤ 10 ≤ 0.5 200 ppm (=ml/m ³) and V ⁽¹⁾ 10 x LC ₅₀	Human Health Extreme
			b) Oral toxicity LD ₅₀ (mg/kg): Dermal toxicity LD ₅₀ (mg/kg): Inhalation toxicity dust/mist LC ₅₀ (mg/l): Inhalation toxicity vapours LC ₅₀ :	> 1 - 5 > 10 - 40 ≤ 0.5 1000 ppm (=ml/m ³) and V ⁽¹⁾ 10 x LC ₅₀	Human Health High

UN Class	Hazard	Division	Description	Effects Group	Hazard Level	
		6.1 PGII	Oral toxicity LD ₅₀ (mg/kg): Dermal toxicity LD ₅₀ (mg/kg): Inhalation toxicity dust/mist LC ₅₀ (mg/l): Inhalation toxicity vapours LC ₅₀ :	> 5 - 50 > 40 - 200 > 0.5 - 2 3000 ppm (=ml/m ³) and V ⁽¹⁾ LC ₅₀	Human Health	Medium
		6.1 PGIII	Oral toxicity LD ₅₀ (mg/kg): Dermal toxicity LD ₅₀ (mg/kg): Inhalation toxicity dust/mist LC ₅₀ (mg/l): Inhalation toxicity vapours LC ₅₀ :	> 50 - 500 (liquids), > 50 - 200 (solids) > 200 - 1,000 > 2 - 10 5000 ppm (=ml/m ³) and V ⁽¹⁾ 1/5 LC ₅₀	Human Health	Low
			Carcinogen		Human Health	High
	Infectious substances	6.2	Not applicable			
	Radioactive substances	7	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).		

(1) $V = (p/P \times 10^6 \text{ ppm or ml/m}^3)$, where P = 760 mm Hg and p = Vapour Pressure at 20°C

KEY: EC₅₀ means the effective toxicant concentration resulting in a 50% response of a given parameter (for example, reproduction rate, mobility) in a given period.
LC₅₀ means the lethal concentration of a substance at which 50% of the test organisms die in a given period.
LD₅₀ means the lethal dose of a substance at which 50% of the test organisms die in a given period.

UN Class	Hazard	Division	Description	Effects Group	Hazard Level
		8 PGI	Very dangerous substances and preparations. Substances that cause full thickness destruction of intact skin tissue within an observation period up to 60 minutes starting after the exposure time of three minutes or less.	Human Health	Medium
				Environment	High
		8 PGII	Substances and preparations presenting medium hazard. Substances that cause full thickness destruction of intact skin tissue within an observation period up to 14 days starting after the exposure time of more than three minutes but not more than 60 minutes.	Human Health	Medium
				Environment	High
		8 PGIII	Substances and preparations presenting minor hazard. (a) Substances that cause full thickness destruction of intact skin tissue within an observation period up to 14 days starting after the exposure time of more than 60 minutes but not more than 4 hours; or (b) Substances which are judged not to cause full thickness destruction of intact skin tissue but which exhibit a corrosion rate on steel or aluminium surfaces exceeding 6.25mm a year at a test temperature of 55°C.	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.		
			a) 96 hr LC ₅₀ salmonid fish (mg/l): 48 hr EC ₅₀ daphnia (mg/l): 72 hr EC ₅₀ algae (mg/l):	<0.1 <0.1 <0.1	Environment Extreme
			b) 96 hr LC ₅₀ salmonid fish (mg/l): 48 hr EC ₅₀ daphnia (mg/l): 72 hr EC ₅₀ algae (mg/l):	≥0.1 - 1.0 ≥0.1 - 1.0 ≥0.1 - 1.0	Environment High
			c) 96 hr LC ₅₀ salmonid fish (mg/l): 48 hr EC ₅₀ daphnia (mg/l): 72 hr EC ₅₀ algae (mg/l):	≥1.0 - 10.0 ≥1.0 - 10.0 ≥1.0 - 10.0	Environment Medium
			d) 96 hr LC ₅₀ salmonid fish (mg/l): 48 hr EC ₅₀ daphnia (mg/l): 72 hr EC ₅₀ algae (mg/l):	≥10.0 - 100.0 ≥10.0 - 100.0 ≥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.		
			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