Government of Western Australia
Department of Environment Regulation

Guidelines for the design and operation of facilities for the acceptance and storage of household hazardous waste

Department of Environment Regulation
168 St Georges Terrace
Perth WA 6000
Phone: +61-8-6467-5000
Fax: +61-8-6467-5562
www.der.wa.gov.au

Original document was prepared in 2009 by:
Millennium3.Org Pty Ltd ABN 68 096 077 486 trading as Asterisk One
PO Box 303 Castle Hill NSW 1765
Tel: +61-2- 9659-0233 Fax: +61-2-9659-0299
consult@asteriskone.com.au

With input from representatives of:
Department of Environment Regulation (formerly Department of Environment and Conservation)
Department of Mines and Petroleum, Dangerous Goods Safety Branch
Western Australian Local Government Association
Toxfree (formerly Chemsal)

Final revision January 2013 by staff at the Department of Mines and Petroleum, Dangerous Goods Safety Branch.

This document is available in alternative formats on request.

August 2013

Questions regarding this report should be directed to:

Waste Management Branch

Department of Environment Regulation

Locked Bag 33

Cloisters Square 6850

Phone: +61-8-6467-5315

Email: chantelle.cummins@DER.wa.gov.au

The recommended reference for this publication is:

Department of Environment Regulation, 2013, *Guidelines for the design and acceptance and storage of household hazardous waste,* Department of Environment Regulation, Perth Western Australia.

Contents

1 INTRODUCTION

Household hazardous waste is broadly defined as leftover household products that are corrosive, toxic, flammable or reactive. If improperly used or disposed of, HHW can be harmful to people and the environment. The safe disposal of leftover chemicals and other potentially hazardous products is a problem for householders, who may either accumulate unwanted materials in cupboards and garages or dispose of them inappropriately.

The Household Hazardous Waste (HHW) Program was established in 2008 to provide the Western Australia community with safe HHW disposal options. The Program is funded by the Waste Authority and administered by the Western Australian Local Government Association (WALGA). Local Governments and Regional Councils run the HHW acceptance and storage facilities, where community members can drop off their unwanted HHW for appropriate storage and recycling or disposal.

1.1 Purpose

These guidelines aim to provide guidance to organisations or consultants designing a new facility for the acceptance and storage household hazardous waste (HHW) for eventual safe recycling or disposal, or upgrading an existing facility.

The guidelines are intended to apply only to facilities that accept household volumes (up to 20 litres or 20 kilograms per package / item) of HHW for temporary storage. They are not applicable to permanent or large-scale storage facilities for hazardous or dangerous goods. The guidelines do not replace or supersede any existing Government Regulation or Code of Practice. Rather, they are intended to provide simple, practical advice to promote better practice in the design, construction and operation of HHW acceptance and storage facilities.

1.2 Principles

The principles on which these guidelines are based are:

Protection of staff and employees – facility design and operation must meet the appropriate standards for occupational health and safety.

Protection of public health – facility design and operation must meet the appropriate standards for the handling and storage of hazardous substances and dangerous goods and measures must be put in place to protect the public.

Protection of the environment – facility design and operation should minimise any potential impact on the surrounding environment.

Safe disposal or reuse – facility design and operation should maximise the ability for materials collected to be disposed of or reused safely.

Inherent safety through good design and planning – buildings and associated structures must promote safety through good design in location, construction and layout to minimise the possibility of any adverse incident occurring and to reduce the impact of any incident that might occur.

1.3 What is household hazardous waste?

Household hazardous waste (HHW) is leftover/unwanted/end of life household products that are corrosive, toxic, flammable or reactive. The exact categories of products that constitute HHW vary from jurisdiction to jurisdiction. Under Western Australia's HHW Program, household hazardous waste includes chemical waste and other hazardous materials, such as batteries, fluorescent lamps, and gas cylinders. For a full list of the materials included under the HHW Program see Tables 1 and 3; Appendices 3 and 4.

Types of household hazardous waste

Household hazardous waste can be subdivided into two broad categories: **'Low Toxicity'** materials and **'High Toxicity'** materials.

The Low Toxicity materials have relatively low toxicity or other hazardous characteristics (e.g. water-based paint, automotive batteries, LPG cylinders and fluorescent tubes and lamps). The High Toxicity category consists of a wide variety of materials that may have significant toxicity or other hazardous characteristics (e.g. pesticides, garden chemicals, acids, alkali, aerosols, fuels and many other products (Table 1, page 9).

Table 1: Types of HHW materials accepted through the HHW Program, and their relative toxicity.

High Toxicity	Low Toxicity
• Acids • Aerosols (CFC based, flammable pesticides, flammable paints and lacquers) • Alkalis • Arsenic based products • Batteries – nickel cadmium • Batteries – other (e.g. alkali, lithium ion) excludes lithium thionyl chloride • Cyanides • Engine coolants and glycols • Fire extinguishers (non-halon only) • Flammable liquids – hydrocarbons, fuels • Flammable solids • Flares • General household chemicals (e.g. cleaning products) • Heavy metal compounds • Inorganic oxidising agents (e.g. pool chlorine) • Mercury (e.g. thermometers) • Organic peroxides • Paint – metal based • Paint – other (including isocyanates and amines) • Paint – solvent based • PCB materials • Pesticides – non-Schedule X pesticides • Pesticides – Schedule X • Solvents – halogenated • Toxics	• Batteries – lead acid • Fluorescent tubes and lamps • Gas cylinders – propane • Low level radioactive substances (e.g. smoke detectors) • Paint – water based

Note that under the HHW Program, funding is not provided for the recycling or disposal of:

- asbestos
- used motor oil
- pharmaceuticals
- sharps
- halon fire extinguishers
- other types of gas cylinders (e.g. automotive LPG cylinders, large household cylinders)
- tyres
- e-waste
- EPIRBs or PLBs
- mobile phones
- printer cartridges
- explosives (other than flares), ammunition or fire arms
- empty chemical containers or drums
- any material from non-domestic sources (e.g. agricultural, commercial, veterinary or industrial waste)
- size of containers over 20 kilogram or litres.

Hazardous substances and dangerous goods

Some household hazardous waste materials may be classified as hazardous substances or dangerous goods. Hazardous substances and dangerous goods are classified according to different criteria:

Dangerous goods are substances or articles that, because of their physical, chemical (physicochemical) or acute toxicity properties, present an immediate hazard to people, property or the environment. The criteria used to determine whether substances are classified as dangerous goods are contained in the Regulations which refer to the Australian Dangerous Goods Code (ADG Code) (available at www.ntc.gov.au). This is closely aligned with the criteria of the United Nations' Recommendations on the Transport of Dangerous Goods - Model Regulations.

The ADG Code contains the list of substances classified as dangerous goods. Types of substances classified as dangerous goods include explosives, flammable liquids and gases, corrosives, chemically reactive or acutely (highly) toxic substances.

Hazardous substances are classified only on the basis of health effects on people, whether immediate or long-term. The criteria used to determine whether a substance is classified as a hazardous substance are contained in the *Approved Criteria for Classifying Hazardous Substances* published by Safe Work Australia (available at www.safeworkaustralia.gov.au).

Hazardous substances are those that, following exposure, can have an adverse effect on human health. This includes poisons, substances that cause burns or skin and eye irritation, and substances that may cause cancer.

Dangerous goods and hazardous substances are regulated under separate legislation. However, many hazardous substances are also classified as dangerous goods. Where a hazardous substance is also a dangerous good, both legislations apply.

Figure 1 illustrates the how various types of materials accepted at HHW storage facilities could be hazardous substances, dangerous goods, both or neither.

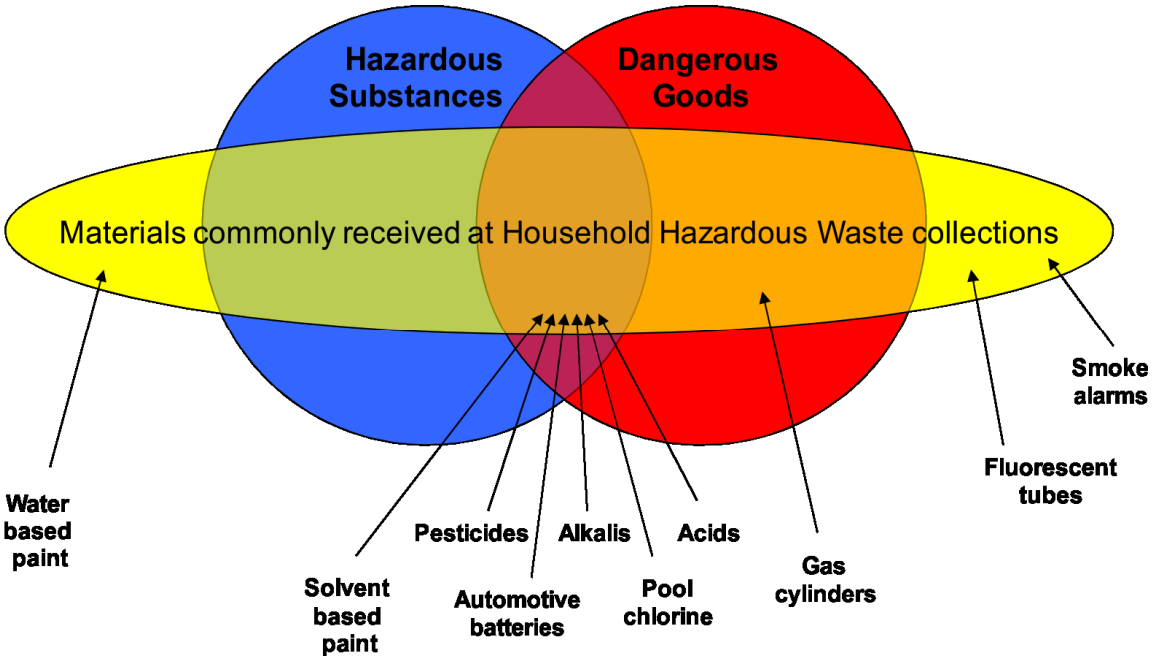


Figure 1: Defining household hazardous waste, hazardous substances and dangerous goods.

Generally most of the materials accepted at HHW facilities will need to comply with both dangerous good and hazardous substances legislative requirements. See Section 5 for information on where to find the relevant legislation and advice.

Storage facility categories

It is recommended that HHW storage facilities participating in the HHW Program segregate materials into at least the following site categories for storage and reporting purposes (see Table 15, Appendices 3 and 5):

P1: Toxics

P2: Flammable Liquids

P3: Corrosive – acids

P4: Corrosive – alkalis

P5: Flammable Solids

P6: Oxidisers

P7: Miscellaneous DG

P8: Miscellaneous non-DG

P9: Unknowns

2 RISK MANAGEMENT APPROACH

Facilities for the acceptance and storage of household hazardous waste should be designed and operated to achieve the following objectives:

- protection of staff and employees
- protection of public health
- protection of the environment
- facilitation of the safe disposal or recycling of HHW.

Risk is a combination of the likelihood and consequence of any event that will impact the achievement of objectives. For HHW acceptance and storage facilities, this means the likelihood and consequence of hazards such as:

- leakage from a HHW container exposing staff, members of the public or the environment to toxic or corrosive agents
- fire or explosion caused by leaking material coming into contact with an ignition source
- unintentional mixing of incompatible or reactive substances causing a chemical reaction, explosion or fire, and exposure to unknown substances thus generated.

Risk management is a structured way of identifying threats and opportunities in achieving these objectives, and responding to them with appropriate controls or management activities.

The key elements of the risk management process are outlined in Table 2 (with more detail given in Sections 2.1-2.3). Application of the risk management process will help identify issues unique to each facility.

Appendix 1 provides a Risk Assessment Worksheet that can be used for a more thorough risk assessment covering all applicable hazards and hazardous events. Appendix 2 illustrates the application of the risk management process to hazards arising from the various types of HHW materials likely to be found in a HHW storage facility, and possible risk control measures.

Table 2: Risk management process for HHW acceptance and storage facilities.

Step	Key Elements
Step 1 Hazard identification (Section 2.1)	• Examine all activities, work processes, plant, substances, work environment, layout and condition of the site, and any other factors • Identify all of the dangerous goods and their associated hazards • Identify the hazards in or arising from the storage and handling processes • Identify any neighbouring or external hazards
Step 2 Risks assessment (Section 2.2)	• Assess the likelihood of an incident that will cause harm taking place (L) – see Table 6 • Assess the severity of harm arising from the incident (S) – see Table 7 • Use the likelihood and severity estimates to determine the level of risk (L x S) – see Table 8 • Use the level of risk to set the priorities for action – see Table 9 • Record results of assessment
Step 3 Risk control measures (Section 2.3)	• Apply the 'hierarchy of control' measures tackling the most serious risks first • Apply practicability test (based on feasibility and cost of mitigating risk) • Determine final risk ranking • Eliminate hazards leading to risk where practicable • Determine risk control measures to reduce risk as far as practicable • Implement risk control measures • Identify any record keeping necessary to ensure controls are maintained.
Step 4 Monitor and review the control measures	• Repeat steps 1 and 2 to ensure risks are mitigated, and record results of second assessment • Implement additional risk control measures if necessary • Periodically re-do the risk assessment to ensure that safety is maintained and the risk control measures are working, and to respond to changes in work practices, activities and other conditions.

2.1 STEP 1: Hazard identification

The HHW facility operator must identify every potential hazard associated with the acceptance, handling and storage of HHW materials (hazardous substances and dangerous goods), of which knowledge is reasonably available.

When identifying hazards, the following activities should be undertaken:

- consulting with employees
- consulting with the suppliers of the dangerous goods, structures, equipment and supplies, or other persons with specific expertise
- determining the hazards associated with the types of HHW materials stored at the facility (see Section 2.2.1 below)
- walking through and inspecting the HHW acceptance area and storage facility, and reviewing the methods of storage and handling
- thoroughly examining plans of the premises, including all buildings and services, including water, electricity, drains, fire services, roads and access ways and engineering drawings of relevant plant
- discussing risks with occupiers of nearby premises and fire and emergency services
- consulting injury and illness records for the HHW storage facility, and the site in which it is located.

2.1.1 Hazards associated with HHW materials

The physical properties of HHW materials contribute to potential handling or storage hazards. These hazards may include:

- **flammability** – the potential to burn or explode in air when ignited
- **toxicity** – the immediate, delayed or long term effect on humans or animals through inhalation, skin absorption or ingestion
- **reactivity** or **sensitivity** – the potential to react with certain conditions, other chemicals, with water or other extinguishers
- **instability** – the potential to undergo a spontaneous violent reaction, such as decomposition or polymerization, under certain conditions
- **ecotoxicity** – the effect on the environment, in particular on aquatic life
- **corrosivity** – to other materials, in particular packaging or human skin.

Table 3 lists the materials accepted through the HHW Program, and their hazardous properties.

Table 4 gives the properties of materials which should be considered when assessing the hazards associated with different kinds of HHW materials.

Detailed information about the potential hazards of specific materials is available from several different sources:

Australian Dangerous Good Code (ADG7): Many (but not all) household hazardous waste materials are classified as dangerous goods under the *Australian Dangerous Goods Code* (ADG Code). The Code lists all dangerous goods and gives further information which can be used to assess the potential hazards of each material type:

- Class: Substances (including mixtures and solutions) and articles subject to the ADG Code are assigned to one of nine classes according to the hazard or the most predominant of the hazards they present. Some of these classes are subdivided into several different divisions. Appendix 7 lists the ADG classes and divisions. Appendix 3 gives detailed information about how the site categories listed on page 9 and Table 15 (P1 to P9) relate to ADG classes.
- Subsidiary risk: In addition to their primary class and division, dangerous goods may also have secondary hazards, indicated by one or more subsidiary risk categories (for example, a Class 3 Flammable Liquid may also have a subsidiary risk as a class 6 Toxic).
- Packing group: Some dangerous goods are assigned a packing group (I, II or III). Each class has its own standards and testing procedures for assigning a packing group, but in general packing group I indicates the highest risk materials, and packing group III the lowest risk. Appendix 6 gives examples of some materials likely to be collected at HHW storage facilities, and their associated packing group.

In Western Australia, the authority responsible for the administration of the dangerous goods Safety Act 2004 is the Department of Mines and Petroleum (www.dmp.wa.gov.au). To download or purchase a copy of the ADG Code visit the National Transport Commission website (www.ntc.gov.au).

Material safety data sheets (MSDS): are an internationally used system for documenting the hazardous properties of chemicals and other hazardous agents. MSDSs are provided by the companies that manufacture hazardous products, and give staff that handle HHW the necessary information to safely manage the risk from hazardous substance exposure. MSDSs are available:

- by request from the manufacturer or importer of a hazardous substance
- from a number of online databases (e.g. www.msds.com.au). Customers pay a subscription fee for access to MSDSs
- for some materials, free on the internet (e.g. at manufacturer websites).

Where a material is not well known, or does not fall easily into one of the site categories (see page 9, Table 15 and Appendix 3), its MSDS should be consulted to identify appropriate means of storage and handling the material. Care needs to be taken to extract all relevant hazard information for MSDSs, however, as:

- all hazard information is not always grouped together
- some of the properties which may constitute hazards when storing and handling dangerous goods may be listed as physical properties
- MSDSs historically have tended to emphasise the toxicological hazards which are crucial for workplace hazardous substances, whereas the acute physico-chemical hazards are of primary importance with dangerous goods.

Note that a MSDS will be replaced by safety data sheets (SDS) with changes to workplace safety legislation.

Table 3: Materials likely to be found in HHW storage facilities and their hazards.

Material	Hazard
Acids	Corrosive
Aerosols – CFC based / flammable	Environmental hazard / flammable gas
Aerosols – flammable (pesticides or paints and lacquers)	Flammable Gas / toxic
Alkalis	Corrosive
Arsenic based products	Toxic
Batteries – lead acid	Corrosive
Batteries – nickel cadmium / other	Environmental hazard / toxic
Cyanide	Toxic
Engine coolants and glycols	Flammable
Fire extinguishers – non-halon	Compressed gas / low oxygen atmosphere
Flammable liquids – hydrocarbons, fuels and solvents	Flammable
Flammable solids	Flammable
Flares	Explosive
Fluorescent tubes and lamps	Toxic
Gas cylinders – propane / other	Compressed Gas / flammable
General household chemicals e.g. cleaners	Low level Toxic / corrosive
Heavy metal compounds	Toxic
Low level radioactive substances e.g. smoke detectors	Radioactive – toxic
Organic peroxides	Reactive / flammable
Mercury – elemental e.g. thermometers	Toxic / corrosive
Oxidising agents e.g. pool chlorine	Reactive
Paint – other, including isocyanates and amines	Flammable / toxic

Material	Hazard
Paint – solvent based	Flammable
Paint – metal based	Toxic
Paint – recyclable	Low level ecotoxic
Paint – water based	Low level ecotoxic
PCB materials	Toxic
Pesticides – non Schedule X (non-organochlorine)	Toxic / flammable
Pesticides – Schedule X (organochlorine)	Toxic / flammable / ecotoxic
Solvents – halogenated	Toxic

Table 4: Properties of materials to be considered in HHW hazard identification.

Physical state Compressed gas Gas dissolved under pressure Liquefied gas Cryogenic liquid Mobile liquid Viscous liquid Volatile liquid Liquid with solids in solution or suspension Finely divided solid Granular / flaked solid Caked or undivided solid Physical state as stored / handled if different from above	**Physical properties** Solubility in water Boiling point / range Melting point / range Odour Electrical conductivity / resistance Relative density Pressure as packed Vapour pressure Polarity pH as stored and handled pH of solution
Flammability Flashpoint Sustains flame Auto ignition temperature Flammability range lower explosive limit – upper explosive limit Evolves / produces hazardous combustion products Explosion potential	**Toxicity** Exposure limits Toxicity Irritant Carcinogen (known / suspected) Mutagen Sensitiser Biologically active
Reactivity With air With water With other materials (details) Self reactive **Sensitivity** To shock To heat To radiation To moisture To contamination with other materials:	**Instability** Decomposition conditions Hazardous decomposition effects Hazardous decomposition products Polymerisation potential Hazardous polymerisation effects Inhibitor required Phlegmatiser required Blanketing material required Self accelerating decomposition temperature Control temperature Other special controls required
Ecotoxicity Atmospheric pollutant Ozone depleter Odorous Visual pollutant Marine pollutant Ground water pollutant Soil pollutant Relevant half life information Special neutralising / absorbent material requirements	**Corrosivity** Skin Metals Other materials

2.1.2 Storage and handling

In addition to the risks arising from the nature of the HHW materials, other hazards may arise from the structures, equipment, systems of work and activities used in the handling and storage of HHW material. Such hazards can be identified by considering the following:

Systems of work: these predominately relate to the activities involved in accepting HHW materials from householders, transferring these materials to the HHW storage facility, and the regular clearance of the HHW storage facility for treatment, recycling or disposal of the materials.

Structures, plant or equipment: used in the storage or handling of materials. This could include, but is not limited to:

- containers in which HHW is aggregated for storage (e.g. IBCs, drums, boxes)
- shelves or racks used for HHW storage
- spill containment systems (e.g. plastic trays, bunding, drainage systems (including pipes, valves, pumps etc.) associated with holding tanks or sumps)
- vehicles used for the transport or transfer of HHW materials (e.g. forklift)
- fire fighting or fire protection systems and equipment.

Chemical reactions: are those that result in a chemical change in one or more of the goods when they come into contact. Physical processes include dilution, dissolution, abrasion, phase change, leaching and absorption. Consider the following hazards:

- physical process of phase change (freezing) causing containers to split and leak
- chemical reaction resulting from contact with other substances (e.g. an oxidising agent such as pool chlorine coming into contact with a material such as brake fluid).

Many different types of materials are generally found in a HHW storage facility, with relatively low quantities of each material. To reduce the risk of dangerous chemical reactions caused by the mixing of incompatible materials, it is useful to group materials into a number of site categories. These categories are based primarily on the dangerous goods class of the materials, but also take into consideration toxicological hazards. The site categories recommended are (see Table 15, Appendix 3):

P1: Toxics

P2: Flammable liquids

P3: Corrosive – acids

P4: Corrosive – alkalis

P5: Flammable solids

P6: Oxidisers

P7: Miscellaneous DG

P8: Miscellaneous non-DG

P9: Unknowns

Appendices 3 and 4 give detailed information about how the site categories listed above (P1 to P9) relate to ADG code classes, and also gives hazard information and examples of material types. Table 15 shows the DG label required for each site category.

Table 5 illustrates the compatibility between different classes and divisions of dangerous goods as defined in the Australian Dangerous Goods Code.

Table 5: Compatibility of materials likely to be found in a HHW storage facility.

DG class / division		**2.1**	**2.2**	**3**	**4.1**	**5.1**	**5.2**	**6.1**	**8**	**9**
2.1	Flammable gas	A								
2.2	Non-flammable non-toxic gas	E	A							
3	Flammable liquid	B	E	A						
4.1	Flammable solid	B	E	B	A					
5.1	Oxidising agent	D	B	D	D	A				
5.2	Organic peroxide	D	E	D	D	D	G			
6.1	Toxic	C	B	C	C	F	F	A		
8	Corrosive	B	B	B	B	D	D	B	G	
9	Miscellaneous	B	B	B	B	F	F	B	B	A

Note: In this table, combustible liquids should be included with Class (Division) 3.

A	Most dangerous goods of the same class (division) have similar primary hazards and are usually considered to be compatible. Please note, however, that there are a number of different types of solid 'pool chlorine' materials within Division 5.1 which are mutually incompatible – refer to MSDS for further information.
B	With a few exceptions, which should be indicated on MSDS, goods of these two classes (divisions) are usually non-reactive with each other. However, in an emergency such as a spill, leak or fire, the presence of the second class (division) may lead to different hazards or increased risk such that additional control measures are required.
C	While goods of these two classes (divisions) are usually non-reactive with each other, a fire involving the fire risk goods may lead to the release of large clouds of toxic gases or vapours.
D	Goods of these two classes (divisions) are likely to interact with each other in such a way as to significantly increase risk. In some cases, interaction may result in fire or evolution of toxic vapours. For those that do not interact, a fire involving one may be violently accelerated by the presence of the other. These classes (divisions) should not be kept in the same area unless it can be demonstrated that the risks are fully controlled.
E	If the division 2.2 has a subsidiary risk 5.1, then this is D, otherwise it is B.
F	If the division 6.1 or 9 is a fire risk substance, then this is D, otherwise it is B.
G	If one material is a concentrated, strong acid and the other is a concentrated, strong alkali, then this is D, otherwise it is A.

(Adapted from WA DMP Storage and Handling of Dangerous Goods Code of Practice Appendix 2)

2.1.3 Hazards within the site of the HHW storage facility

HHW storage facilities are often located within the site of an existing transfer station or landfill. Some activities, systems of work, structures and equipment that are not directly involved with the handling and storage of HHW materials may constitute a hazard for the HHW acceptance and storage facilities. Potential external hazard sources may include:

- any adjacent storage facilities
- the proximity of other work areas, including on-site offices
- plant used or moved on the site (e.g. ignition sources from engines)
- vehicle movements on the site
- deliveries of other dangerous goods
- transfer of HHW materials between containers on the site
- personnel movements in normal and emergency situations
- visitor access, and unauthorised access to the HHW acceptance or storage areas
- portable sources of ignition, generation of static electricity
- fire hazards including buildings, concentrations of combustible material and uncontrolled vegetation
- weather conditions such as temperature extremes, wind, lightning, or rainfall including the potential for flooding.

Employees are commonly aware of these hazards and operators/designers should consult them during the hazard identification process.

2.1.4 Hazards external to the site of the HHW storage facility

There may also be hazards that are external to the site in which the HHW storage facility is located. For example, an adjacent vegetated area with densely grouped eucalypt trees is an external fire risk, because if the trees catch fire, this hazard could impinge on the dangerous goods.

Potential external hazards may include:

- any dangerous goods or incompatible substances stored at other adjacent premises or public places
- activities, facilities or installations on neighbouring premises that could create a hazard (e.g. an ignition source)
- the effects of infrastructure such as a road, rail line, airport, pipeline, power line, radio transmitter or telephone tower
- fire hazards within 5 metres, including concentrations of combustible material or uncontrolled vegetation on neighbouring premises or public areas.

2.1.5 Past incidents

Incident information, such as past accidents or spills, contributes to knowledge about hazards and risk. It is important to obtain and consider information about past incidents and near misses that involved handling and storage of HHW materials at the acceptance and storage facility, and at other similar facilities. This information should include the nature and cause of the incident, and the effectiveness of controls and how they could be improved.

2.2 STEP 2: Risk assessment

Once the hazards have been identified, the next step in the risk management process is to assess the risks.

For HHW storage facilities, hazardous events (or incidents) are those that are likely to cause harm to staff, members of the public, or the environment, or affect the potential for safe recycling or disposal of HHW.

Risk is the combination of the **likelihood (L)** of such an incident, and its **severity (S)**. In order to assess the risk, therefore, it is important to gather information about both the likelihood and the severity of incidents, including a review of historical information at the HHW storage facility or similar facilities, and an estimation of the frequency of various activities.

Components of the risk assessment: The risk assessment should include:

- identification of the events with hazard potential that could give rise to the risk
- the extent of the risk to people (workers and members of the public), other dangerous goods, other substances, and plant or buildings both on the site and beyond – in terms of the probability of the event occurring and the nature of the harm that would arise from its occurrence
- the extent and type of controls necessary to reduce the risk to a level that is appropriate
- the priority with which controls should be implemented.

Risk assessment to be documented and reviewed regularly: The risk assessment must be documented and records of the assessment kept. In general it is recommended that risk assessments should be reviewed at least every five years, but in the case of a HHW storage facility at least every two years, and following any significant incident or changes to the site (see 2.2.4).

Employees to be consulted as part of the risk assessment: Facility operators and designers must consult with employees on the site involved with the operation of the HHW storage facility during the risk assessment process, and make them aware

of the results of the assessment and its implications for design and operation of the facility.

2.2.1 Events with hazard potential arising from HHW facilities

HHW acceptance and storage facilities have two main functions, each associated with its own potentially hazardous events:

1. **Acceptance area:** the area accessed by the public, where customers (community members) can drop off their unwanted HHW materials
2. **Storage facility:** the area where HHW is sorted, recorded and stored for the short term, before it is recycled or disposed of.

The general hazards arising from the operation of HHW acceptance and storage areas may include:

Loss of containment exposes staff, members of the public or the environment to dangerous materials. Examples of such events:

- customer or operator drops container when removing from vehicle;
- customer, facility, or disposal contractor vehicle collides with HHW acceptance area or storage facility
- operator drops container when transferring from HHW acceptance area to the storage facility
- container fails in HHW acceptance area (e.g. heat from direct sunlight increases vapour pressure)
- container fails in HHW storage facility due to sensitivity of material to environmental conditions or ageing of container
- violent storm destroys or damages HHW acceptance area or storage facility
- shelves in HHW storage facility collapse causing multiple container failure.

Fire or explosion caused by uncontained material coming into contact with an ignition source harms staff, members of the public, or property. Examples of such events:

- ignition source (e.g. customer smoking, static discharge, vehicle ignition or electrical spark) near HHW acceptance area ignites flammable atmosphere
- ignition source in HHW storage facility ignites flammable atmosphere
- fire in neighbouring property ignites HHW storage facility
- fire in within the site ignites the HHW acceptance area or storage facility.

Mixing of incompatible or reactive substances causes a chemical reaction, explosion or fire, and exposure to harmful substances thus generated**.** Examples of such events:

- operator places incompatible substances in same area of HHW storage facility, with subsequent loss of containment of two or more incompatible materials
- containers of incompatible or reactive substances fail simultaneously and mix.

Unstable materials may react or explode even without accidental loss of containment or mixing with incompatible substances. Some materials may become unstable due to prolonged storage. Examples of unstable substances include some peroxide hardeners, some solvents, MEKP, picric acid.

Location specific hazards arise from the features of the site in which the HHW acceptance area and storage facility are located, and must be identified for each specific facility. Examples of such events:

- other buildings and work areas including site-offices
- other dangerous goods storages within the facility or in adjacent premises
- vehicle movements near the HHW acceptance area or storage facility
- activities, facilities or installations on neighbouring premises
- other infrastructure such as road, rail, pipeline, powerline, or telephone tower
- occasional work such as repairs or maintenance on the HHW storage facility.

2.2.2 Calculating the level of risk

Risk assessments may be qualitative, quantitative, or a combination of both. Due to the many different types of materials likely to be found at a HHW storage facility, it is appropriate to use qualitative assessment. There are four steps involved in determining level of risk:

1. Estimate of the likelihood (L) of an incident that will cause harm occurring (Table 6)
2. Estimate the severity (S) of harm arising from the incident (Table 7)
3. Use the L and S estimates to determine the Level of Risk (Table 8)
4. Use the level of risk to set priorities for action (Table 9)

Table 6: Likely occurrence and frequency of an incident, used to estimate its Likelihood score (L)

L	Likelihood of occurrence	Indicative frequency
0	Totally eliminated	Zero
1	Rare	Could happen, but improbable
2	Unlikely	Remote, could happen but rarely
3	Likely	Could happen occasionally
4	Certain	Could happen frequently
5	Imminent	Very likely to happen/will happen

Table 7: Factors used to estimate the Severity score (S) of an incident.

S	Extent of consequence	Harm to persons on or offsite	Community damage & disruption	Onsite damage	Off-site environment damage
1	Minor	No harm to persons	No disruption or damage	No damage or interruption to operations	No offsite environmental impact
2	Moderate	Slight injury requiring first aid treatment	No disruption or damage	Slight damage Interruption to operations < 24 hours	Offsite environmental impact but is not significant
3	Significant	Medical treatment with immediate recovery Hospitalisation < 24 hours Restricted or lost work < 4 days	Disruption to essential utilities, road closures or evacuation required	Localised damage Interruption to operations 1-7 days	Some off site environmental impact and damage is significant
4	Major	Multiple injuries Hospitalisation for more than 24 hours Delayed symptoms	Disruption to essential utilities, road closures or evacuation required for some time Some damage to offsite private property, dwellings still inhabitable.	Major damage Interruption to operations 1 to 12 weeks	Environmental damage is significant and recovery will take more than 20 years
5	Catastrophic	Fatality or total permanent disability	Disruption to essential utilities, road closures or evacuation required for extensive period. Major damage to offsite private property, dwellings uninhabitable	Extensive damage Long-term interruption to operations > 12 weeks	Offsite environmental impact extends to more than 500m radius around incident site. Recovery will take more than 20 years.

Table 8: Risk level (determined through a combination of Likelihood (L) and Severity (S) scores).

Likelihood (L)	Severity (S)				
	5 Catastrophic	4 Major	3 Significant	2 Moderate	1 Minor
5 Imminent	Extreme	Extreme	Extreme	High	Medium
4 Certain	Extreme	Extreme	High	Medium	Medium
3 Likely	Extreme	High	Medium	Medium	Low
2 Unlikely	High	Medium	Medium	Low	Very low
1 Rare	Medium	Medium	Low	Very low	Very low

Table 9: Priority for action (determined based on risk level).

Risk Level	Priority for action
Extreme	Cease operations until additional controls are implemented
High	Take immediate action to implement additional controls
Medium	Action to implement additional controls is a priority
Low	Action to implement additional controls can be scheduled
Very low	Low priority for action

2.2.3 Records

A record of the risk assessment should include:

- Date
- Name of assessor
- Names of people who provided specialist advice
- Site, storage location, area
- Dangerous goods/ hazardous substances involved
- Identified risks
- Controls required to reduce risk to an acceptable level
- Existing controls in place
- Controls that need to be implemented
- Basis for decision making (MSDS, Australian Standard etc.).

2.2.4 Changes triggering a review of the risk assessment

The risk assessment should be reviewed when:

- new dangerous goods are introduced
- quantities of dangerous goods at the site change
- goods are moved to a different location on the site

- a process or plant is modified
- new information on hazards or risks becomes available
- monitoring indicates inadequate controls
- an incident has occurred
- there are changes on a neighbouring property
- there are changes to the site, structure or buildings
- there are changes in personnel – the number and /or knowledge and skills of staff.

2.3 Risk control measures

When risks have been assigned a risk level and priority for action (see Tables 6 to 9), measures should be implemented to control these risks, control measures should, wherever possible, be applied to risks in order of priority. Effective risk control may require the application of more than one control measure, and a hierarchy of control measures should be used (Table 10).

Table 10: Hierarchy of risk control measures.

Hierarchy of control measures		Examples	Examples of how this can be applied to HHW Storage Facility
Most effective	Elimination	Use a non-harmful substance	Not feasible – the purpose of a HHW storage facility is to accept and store Dangerous Goods and hazardous substances
		Eliminate ignition sources in hazardous areas	Prohibit carriage of matches, lighters and spark producing tools in the HHW storage facility; Where possible, eliminate the need for electrical wiring in the storage facility e.g. through use of natural ventilation and lighting
	Substitution	Use a less hazardous substance	Not feasible – purpose of HHW storage facility is to accept and store Dangerous Goods and hazardous substances
		Use non-sparking tools in a hazardous area	Ensure operations and maintenance procedures specify use of non-sparking tools in HHW storage facility
	Quantity Reduction	Reduce the inventory of Dangerous Goods	Design HHW storage facility to contain specific limited quantities of certain types materials; Ensure the facility is cleared regularly to keep quantities within design limits
	Isolation	Introduce a restricted work area	Locate HHW drop off point (the acceptance facility) away from storage facility and restrict access to the storage facility to trained operators only
		Separate goods from other hazards	Locate HHW storage facility away from other activities on the site, including a minimum 3m separation from combustible materials (e.g. tyres, pallets, vegetation).
		Segregate incompatible substances	Design and operate HHW storage facility with internal segregation for incompatible substances
	Engineering Controls	'Total enclosure' of Dangerous Goods	Storage of materials such as oxidizers and flares in specific purpose cabinets/cages within the HHW

 Least effective			storage facility.
		Ventilation to eliminate flammable or toxic atmospheres	Installation of natural ventilation in the HHW storage facility
		Provide spill control such as bunds or sumps	Construct separate bunds for different types of material within the HHW storage facility
		Install detection systems and alarms for fire or hazardous atmospheres	Include fire detection system on the site, and within the HHW storage facility
	Administrative Controls	Procedures, training, emergency plans, signs, placarding	Implement these for the operation of the HHW storage facility as appropriate
	Personal Protective Equipment	E.g. gloves, respirators, safety showers, eye wash facilities, spill kits	Implement these for the operation of the HHW storage facility as appropriate

2.3.1 Possible controls

The preferred sequence of application of risk control measures is outlined in Table 10. Examples of types of control measures that can be applied are listed below:

Elimination and substitution: Risk is controlled to some extent at HHW storage facilities through restricting the types and quantities of materials that are stored in them (see list of materials not accepted on page 9). However, the purpose of these facilities is to temporarily store a wide variety of dangerous goods and hazardous substances, and it is not possible to eliminate or substitute these.

Quantity Reduction: The careful management of the quantity of materials in a HHW storage facility can be achieved by designing the facility to contain limited quantities of the materials likely to be received, and by ensuring the facility is cleared regularly to keep those quantities below design limits.

Isolation: Isolating potential hazards can be achieved by:

- physical separation of HHW related activities from other on-site activities and buildings, property on adjoining premises, other dangerous goods, people and other property
- storing incompatible materials (such as oxidizing agents and flammable materials) in separate buildings that are sufficiently separate that interaction is impossible and an incident in one will not involve the other
- separation of stored HHW from ignition sources
- segregation of incompatible materials within the storage area(e.g. enclosed in separate cabinets, with as much inter cabinet separation as possible).

Engineering controls: the role of engineering controls is to:

- ensure the effectiveness and integrity of buildings, plant and equipment
- contain or suppress dangerous goods e.g. vapours or dusts
- eliminate or confine processes or plant that may impinge on dangerous goods
- protect dangerous goods from environment e.g. rain and direct sunlight
- limit the area of contamination in the event of spills or leaks.

Types of engineering controls may include:

- total or partial enclosure
- ventilation
- control devices, alarms or shutdown devices
- appropriately rated electrical plant and circuitry to minimise ignition hazards
- spill control to contain the largest foreseeable spill
- effective barriers between incompatible goods
- detection systems and alarms for hazardous atmospheres and fires
- protection from external hazards e.g. crash barriers
- fire control and suppression systems.

Administrative controls: These may be achieved through the implementation of various processes and procedures. Examples may include:

1. **Operations**
    - safe work procedures
    - keeping an up-to-date inventory of the materials stored in the HHW storage facility

- scheduling HHW transfers at 'low-traffic' times
- preventing use of HHW storage area as a thoroughfare
- transfer of HHW packages by trolley rather than by hand
- keeping lids on containers when not in immediate use
- not opening containers for identification of materials
- control of access to HHW handling and storage and areas
- control of public 'scavenging' of HHW materials
- prohibition of the carriage of matches, lighters or spark producing tools.

2. Maintenance

- Maintenance procedures that ensure integrity of plant and structures
- Procedures to ensure adequacy of other controls e.g. monitoring of inventory, operation of bunding and fire systems
- Procedures for hot work in or around the storage area.

3. Spills and emergencies

- Procedures and properly maintained equipment for spill cleanup and decontamination
- Procedures for waste disposal (including spilled/ contaminated waste/ waste tracking)
- Emergency procedures
- Safety showers, eye washes and hygiene facilities.

4. Signage and labelling

- Labelling of HHW packages and storage areas/containers
- Instructions and warnings to operators and visitors
- Placarding (where appropriate).

Personal protective equipment (PPE)

- Eye protection
- Gloves, aprons, coats and overalls
- Respiratory protection
- Footwear
- Hearing protection.

3 FACILITY DESIGN

3.1 Location

The HHW acceptance and storage facilities should be sufficiently separated from other facilities/activities on the site so as to protect it and its contents from external hazards, and, conversely, to protect other facilities from possible incidents at the HHW acceptance and storage facilities. Site selection and orientation that take advantage of the natural attributes of a site can reduce the requirement for expensive engineering works. As many HHW facilities will be constructed adjacent to an existing waste facility, there are likely to be space and location constraints. However, the following factors should be taken into consideration as far as possible.

3.1.1 Accessibility

The HHW acceptance facility: should be easily accessible to the general public during opening hours (under operator supervision), but inaccessible after hours. Members of the public should be able to drive as close to the acceptance area as possible to drop off their chemicals, to eliminate the need to carry HHW over long distances. A table where unwanted chemicals can be placed should be provided, with suitable containers (e.g. plastic trays) to contain any leaks or spills.

The HHW storage facility: should not be accessible to the public (or, where it is combined with/adjacent to the HHW acceptance area, stored HHW should be kept in locked cabinets or secure locked shelving). The storage area should be accessible to waste collection contractors that will remove material from the storage facility for disposal, and to emergency services personnel in the event of an accident. It should be located where there are access roads of adequate load-bearing capacity to support emergency and waste collection vehicles.

3.1.2 Separation from site boundaries

The Standards and Codes applicable to hazardous substances and dangerous goods assign widely varying separation distances from site boundaries, depending on ADG code class (division) and packing group, the quantity of dangerous goods, and whether these are in closed or open packages. Alternative approaches to determining the appropriate separation distances from boundaries are to use:

- distances from an Australian Standard appropriate to each class (division) of dangerous goods (e.g. *AS 1940-2004* for Class 3 (Flammable liquids))
- distances from *AS/NZS 3833-2007 (The storage and handling of mixed classes of Dangerous Goods in packages and bulk containers)* for mixed classes of HHW
- distances from other codes of practice
- other distances based on risk assessment.

3.1.3 Proximity to neighbouring land uses

Proximity to protected places

Australian Standard AS1940-2004 (The Storage and Handling of Flammable and Combustible Liquids) defines a protected place (*inter alia*) as:

a) *a dwelling, residential building, place of worship, public building, school or college, hospital, theatre, and any other building or open area in which persons are accustomed to assemble whether it is within or outside the property boundary of the installation;*

b) *a factory, workshop, office, store, warehouse, shop, or building where persons are employed, that is outside the property boundary of the installation.*

AS 1940–2004 assigns separation distances from protected places from 0 to 50 metres for flammable and combustible liquids, depending on class, packing group and quantity stored. Other standards such as *AS 3780* (for Class 8) also specify different separation distances depending on the packing group, and specify different distances for closed and opened packages, for liquids and solids in bulk and for larger bulk storages, ranging from 3 to 15 metres. *AS/NZS 3833* has a different approach for goods with a flammability hazard than others. The following alternative approaches may be used to determine the appropriate separation distances from an HHW store to a protected place:

- distances from an Australian Standard appropriate to each class (division) of dangerous goods (e.g. *AS 1940* for Class 3 (Flammable liquids))
- distances from *AS/NZS 3833* for mixed classes
- distances from other Codes of Practice
- other distances based on risk assessment.

Proximity to residential areas

It is recommended that the HHW storage facility be at least 300 metres from the nearest residential dwellings.

Proximity to neighbouring non-residential properties

Non-residential properties will fall within the definition of a protected place, as given above if it is a place where people customarily assemble. In such cases, non-residential properties should be treated as protected places.

The proximity of a HHW storage facility to neighbouring non-residential properties where people do not customarily assemble will depend on the nature of such properties, such as whether they are being employed for sensitive forms of land use or whether activities on the neighbouring property pose a potential hazard.

3.1.4 Environmental factors

Wind direction

The prevailing wind at a particular site can have both a negative and a positive aspect. In the event of a fire or chemical reaction that produces gas, the prevailing wind will disperse the smoke and fumes generally in one direction. It is therefore important that residential areas or sensitive land use zones are not directly downwind of the facility.

On the positive side, however, the facility can be oriented to take advantage of passive ventilation from the prevailing wind. Care must be taken in the design to ensure that neither the acceptance area nor the stored materials are exposed to rain or winds. If possible, it is recommended that a 'windsock' should be installed on or near the facility to show wind direction in the event of an accident.

Proximity to surface water

Water bodies and wetlands (permanent and seasonal) are classified according to their condition, use and conservation values. The appropriate separation distance between a HHW storage facility and water bodies/wetlands will change depending on the classification of the water body/wetland, and the location of the facility in relation to the water body/wetland and the water table which feeds it. Separation distances should preferably be determined using a risk assessment approach, as outlined in the previous section. For information about the classification of a water body, contact the Department of Environment and Conservation.

Proximity to groundwater

Reference should be made to the relevant Department of Environment and Conservation regional office/ Department of Water to determine recommended vertical separation distance from the bottom of the HHW storage facility foundation to the top of the wet season water table.

Proximity to drinking water sources

It is important to determine whether a proposed site for a HHW storage facility lies within a public drinking waste source area (PDWSA). The Department of Water prepares drinking water source protection plans for each drinking water catchment, which determines priority areas, protection zones and the catchment boundaries. These plans identify which land uses are acceptable, compatible with conditions, or incompatible with each PDWSA. For further information, refer to the Department of Water's Water Quality Protection Note Land Use Compatibility in Public Drinking Water Source Areas (available at http://drinkingwater.water.wa.gov.au or contact the Water Source Protection Branch of the Department of Water).

3.1.5 Separation from other dangerous goods storages

Each of the Australian Standards applying to different classes of dangerous goods specifies minimum separation distances between dangerous goods storages. For most dangerous goods with a flammability hazard, these distances vary with quantity.

Distances given in the various Australian Standards are designed to provide safety with most possible combinations of dangerous goods of the classes concerned. Because, for example, some Class 8 materials react dangerously with some Class 5.1 materials, distances given assume that all goods of these classes are incompatible, even though this can be demonstrated to be false with some combinations. Therefore for some combinations lesser distances may be determined based on risk assessment than by following minimum separation distances determined from the Standards. For this to be effective, however, the assessment must be based on the specific hazards of the actual dangerous goods being stored (see MSDS for that material), rather than on only class hazards.

3.1.6 Separation from on-site facilities

Some codes and standards permit lesser distances between dangerous goods storage and other facilities on the same premises than apply to similar facilities on other premises. Others require full protected works distances. Given that the occupier will normally have control of the other on-site facilities and that emergency plans and procedures would be expected to include those facilities, a risk assessment may well determine that lesser distances are appropriate provided other controls are put in place. Alternative approaches include:

- distances determined by risk assessment
- on-site facilities distances as determined from standards applicable to minor quantities
- protected works distances from standards applicable to minor quantities.

3.1.7 Separation from ignition sources

For dangerous goods with a flammability hazard, distances determined from *AS/NZS 60079.10:2004 Classification of Hazardous Areas (IEC 60079 –10:2002 MOD)* should be regarded as minimum. Because of the potential impact of fires involving dangerous goods, even those without a flammability hazard, ignition sources should be kept away from all dangerous goods storage facilities as far as practicable. Advice on safe ignition source distances is found in the individual Class Standards and in *AS/NZS 3833*.

Separation from heat sources should also be considered where they may increase vapour pressure within stored chemicals or cause packaging to deteriorate.

3.1.8 Separation from combustible materials

The area around a HHW storage facility should be clear of combustible materials (e.g. vegetation, rubbish, tyres, pallets) to a distance of 3 metres, in accordance with the Regulations.

3.1.9 Separation from external hazards

Separation from external hazards needs to be determined on a case by case basis, depending on the nature of those hazards and the types of dangerous goods stored and handled. Consultation may need to take place with neighbours, utility providers, local and state government and fire and emergency services.

3.1.10 Above flood levels

As most dangerous goods and combustible liquids are hazardous to the environment, areas where they are stored and handled should, as far as practicable, be above recorded flood levels. Where this is not practicable, the dangerous goods and combustible liquids should be in closed, impervious containers which are appropriately restrained. Run-off from rain should flow around the HHW storage facility, not directly to it or into it. It might be necessary either to build up the site of the HHW facility or to install stormwater/rainwater run-off diversion channels around the area.

3.2 Building construction

3.2.1 Approvals

As with all building developments, buildings for storage and handling of household hazardous waste must:

- comply with the Building Code of Australia (BCA)
- have local government planning approval before construction begins
- if the quantity of HHW stored exceeds manifest quantities (see Figure 2/Table 11), have a Dangerous Goods Site Licence from the Department of Mines and Petroleum (and should seek specialist design and operational advice beyond that contained in this document).

3.2.2 Suitable for purpose

Buildings for the storage and handling of household hazardous waste should:

- be compatible with or protected from the HHW
- as far as practicable be of non-combustible construction
- be designed to contain and stop the spread of an incident
- if necessary, be designed with a frangible panel or roof to allow any internal explosion to dissipate with minimal impact on surrounding facilities

- provide suitable protection from adjoining and surrounding facilities by means of appropriately fire rated screen walls or doors.

Building materials

The HHW storage facility should be constructed of materials that are impervious to chemicals, such as brick or metal sheeting (such as Colorbond®), and must be approved under the local building code. Floors should be made out of impervious reinforced concrete, and not liable to degradation, chemical attack or sparking. As concrete is subject to cracking due to construction and aging, is very difficult to guarantee an impervious concrete floor. It is recommended that the facility floors are coated with an acid resistant sealant and the coating should extend at least 150 millimetres up the wall. The sealant should also be applied to the sides and bottom of any sump if provided.

Doorways

Separate access and exit doorways must be incorporated in the design of the store to allow emergency exit should a spill occur. There should be easy access to the storage room for fire and emergency services or other emergency workers in the event of a fire or chemical spill.

Doorways of a lockable open mesh design are recommended as they provide security, allow staff to detect any spills without entering the facility as all areas are visible, allow good ventilation, and enable fire and emergency services to attack any fire without entering the facility and readily identify chemicals spilt.

All doors should be outward opening and have easy egress handles which will operate under emergency conditions. No key locks should be installed on the inside of the doors.

Water supply

Water should be installed at adequate volume and pressure to supply safety showers, eye wash stations, water hoses, automatic sprinklers or water spray systems.

Electrical wiring and fixtures

Interior light levels must be sufficient to ensure the easy reading of the labels identifying the chemical compounds on containers as well as being able to identify the location of any leaks and spills.

For the purposes of fire safety, it is recommended that, if possible, no internal electrical lighting should be used in the HHW storage facility. Sky lights are recommended as a preferable option. In instances where use of electrical

components is unavoidable, such as on an alarm system, it is recommended that all wiring and switches are suitable for use with explosive gas atmospheres. In this regard, reference should be made to the relevant set to AS/NZL60079. Furthermore, no vehicle should be allowed to enter the store unless all wiring and switches are also suitable for use with explosive gas atmosphere.

3.3 Spillage control

3.3.1 Prevention

The most effective spillage control system is prevention. Careful design of structures and plant, selection of equipment, and sound operating procedures and training will minimise spillages. Care should be taken to ensure that the design of the spillage control system does not contribute to additional spills (e.g. high bund walls may necessitate long or steep ramps causing load instability on materials handling equipment).

Spillage control should provide sufficient capacity to hold the largest foreseeable spill under any possible conditions. Dangerous goods standards and codes give guidelines on spill capacity calculation. For HHW storage facilities, particularly those for small packages of packing group II and III, risk assessment may show these guidelines to be excessive, and lesser capacity may be determined based on risk assessment.

3.3.2 Bunding

Bunding is the most frequently specified system for containing dangerous goods spillages in HHW acceptance and storage areas. It has the convenience of being able to be retrofitted to existing buildings and outdoor installations. Bunding is the preferred method for above ground bulk storage installations.

The construction of bunds and storage areas must comply with the requirements of Australian Standard 1940 'The Storage and Handling of Flammable and Combustible Liquids'.

Bund walls may be constructed from a variety of materials including:

- **Concrete kerbing:** preferably reinforced and integrally constructed with the flooring. If separate, it must be firmly anchored, adhered and sealed to prevent traffic damage
- **Brick and concrete block walls:** these are only acceptable where they are protected from damage by materials handling operations
- **Steel angles or other sections:** these must be firmly anchored to the floor and sealed, usually with a silicone based sealant
- **Flexible bunding**: there are a number of plastic/rubber bunding systems available, which may be attached to an existing concrete floor slab.

Temporary bund construction materials include:

- **Raised earthen walls:** preferably with an impervious membrane unless contingency plans are in place for the recovery or disposal of contaminated earth after a spill.
- **Bags of sand:** or other compatible absorbent material.

For specially constructed bunded stores, the need for entry ramps may be avoided by gently sloping floors away from entries; however, such slopes need to be minimised to avoid instability of materials handling equipment when placing loads in high rise racking.

External bunds should be provided with additional capacity to deal with rainwater and run off, and have a drainage system for the removal of that water. External bunds should therefore be subjected to the full hazard identification, risk assessment and control process.

The effects of fire on bund material should be considered during construction.

3.3.3 Drains, tanks and sumps

Spilled material may be drained to an underground tank or sump or an external pit; however, the tank, pit or sump itself becomes a potential source of hazards, as does the network of drains. Generally each such containment system should be exclusively for the effluent from one HHW storage or acceptance area unless all the dangerous goods and combustible liquids are compatible and effective provision is made to prevent flashback. Such containment systems should, if at all possible, be prevented from collecting rainwater. These systems are frequently out of sight so controls need to be in place to ensure they are fully available for use when required. They should therefore be subjected to the full hazard identification, risk assessment and control process.

3.4 Safe atmosphere

3.4.1 Natural ventilation

Natural ventilation is the preferred method of ventilation, as it does not necessitate electrical wiring within the HHW storage area.

Most dangerous goods standards and godes provide some guidelines on the design of natural ventilation systems. Many dangerous goods vapours are heavier than air, so to prevent buildup of hazardous concentrations, vents should normally be provided at a level immediately above any spill containment, on opposite sides of the HHW storage area to provide for air flow. High level ventilation may also be necessary for temperature control. Vents should be located away from any external

potential ignition sources. Vents in screen walls negate any fire protection or vapour barrier effects. Refer to the relevant standards and codes for guidance.

3.4.2 Mechanical ventilation

Mechanical ventilation should only be used where natural ventilation is not possible. Inlet and outlet vents should normally be located on opposite sides of the HHW storage area at low levels to as far as practicable provide a laminar airflow across the floor. Where both inlet and exhaust are mechanically assisted, capacities and rates should be adjusted to ensure that the pressure inside the store never exceeds that outside, and especially in any adjoining offices or other work areas to prevent air flow from the store. Refer to the relevant Standards and Codes for guidance.

3.4.3 Local exhaust ventilation

Mechanical extraction of atmospheric contaminants at the source is usually more effective in providing a safe working atmosphere than is general ventilation. Extraction vents should be placed and have sufficient capacity under all atmospheric conditions so as to prevent the escape of contaminants into the work area. Discharge points should be located so as to prevent further contamination of this or any other work area. Extraction ducting should not be linked to multiple items of plant if fire could spread through the ducting. Provision against flashback may be required. The exhaust system should be resistant to attack by the vapours, mists and dusts being exhausted.

3.4.4 Exhaust cleaning

Where exhaust ventilation may carry atmospheric contamination which may cause environmental pollution or nuisance, it may be necessary to fit some mechanism to clean the exhaust prior to discharge to atmosphere. Suitable mechanisms may include various types of filtration for particulates, or absorbents, catalysts, scrubbers or burners for other contaminants.

3.5 Facility layout

The layout of the HHW acceptance and storage facilities should minimise the possibility of an adverse incident occurring, and should aim to minimise the impact of such an incident if one should occur. The potential for chemicals to react with each other if mixed must be considered, and the design must therefore provide sufficient space to allow for the separate storage of incompatible chemicals. The HHW acceptance and storage facilities must provide space for staff to work comfortably in the area; provide suitable access for staff and the public; and ensure that all necessary access for emergency services personnel is a priority.

3.5.1 HHW acceptance areas

The HHW acceptance area, where the public drop their HHW, should incorporate a covered hardstand and a table with large plastic tubs into which members of the

public can deposit their unwanted chemicals. The area should be located within an area that is locked each day. The acceptance area should be bunded to capture any accidental spills or leaks. An emergency spill kit and fire extinguisher should be located close by. Trained staff should be available to remove chemicals from vehicles or trailers, check all containers for leaks and question the public on the possible identity of unknown chemicals.

3.5.2 HHW storage facilities

Items NOT to be stored in HHW storage buildings

Due to the potential volatility of the contents of some items, such as compressed gas cylinders, liquefied petroleum gas (LPG) cylinders, and motor vehicle lead–acid batteries, these items should not be kept within the HHW storage building. They should be securely locked in a separate compound. For further information on items not to be kept in a HHW storage building contact the Department of Mines and Petroleum (Dangerous Goods Branch) or seek specialist consultant advice.

Keeping incompatible chemicals apart

The HHW storage facility needs to be designed to ensure that incompatible chemicals are kept apart. This is best achieved through distinctly separate and well signed storage areas for each chemical category (P1-P9 – see page 4). Where separate storage areas are provided for different categories of material, each storage area should be bunded, graded and supplied with a drain to its own sump to prevent incompatible chemicals mixing in a common underground tank in the event of a spill.

Storage system construction

Construction of racking and shelving for chemical storage should be compatible with or protected from the dangerous goods. Racking and shelving should be located so as to provide ready access to all storage, both for normal operation and in emergencies, and should be set out so that stored HHW containers are clearly visible.

Racking and shelving should be made of galvanised steel or acid-resistant shelving, with surfaces resistant to attack by spilt chemicals. It should be able to handle a minimum load of 100 kliograms and must not fold or collapse under a continuous load. HHW containers should not be stored on shelves higher than 1.5 metres (or the average ‘eye height’ of staff) for ease of handling. Liquids should be placed on lower shelves and solids on higher shelves.

HHW containers should not be placed directly onto shelves, but into secondary containers (e.g. chemical resistant plastic tubs or trays) with other compatible materials. This will help ensure that any spills are contained and mixing of incompatible materials is prevented.

3.5.3 Intermediate storage containers

Where intermediate storage containers (e.g. drums, boxes) are used they should be compatible with the materials being stored, in a suitable condition, and repacked in accordance with the Australian Dangerous Goods Code or the Hazardous Substances Regulations.

3.6 Administration areas

3.6.1 Administration and record keeping

The administration functions which relate to the HHW acceptance and storage facilities (e.g. computer for recording chemicals received and dispatched, a whiteboard for leaving messages, a pin board for displaying hazardous waste information from regulatory authorities, and a box for material safety data sheets) should be separate from the HHW acceptance and storage areas, preferably in a different building.

3.6.2 Material safety data sheets (MSDSs)

MSDSs are information sheets which are prepared and supplied by the manufacturers or suppliers of chemicals. An MSDS provides information to users of a particular substance about its properties, uses and affects on health, as well as on safe handling procedures and the precautions necessary for its use. MSDSs for all items stored in the facility must be readily accessible to staff handling materials received from the public. MSDSs must also be located in a place convenient to emergency services personnel responding to a call for assistance. Placement of MSDSs should be considered during the facility design stage. The use of an automatically updated MSDS database is recommended.

3.7 Security and safety

3.7.1 Fire protection

The fire protection system includes fire detection, fire suppression and firefighting equipment, which may be fixed or portable. Under the Western Australian Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007, operators must ensure that appropriate fire protection and firefighting equipment are provided, installed, and maintained. This is in addition to any fire protection required by the Building Code of Australia (BCA). Portable fire extinguishers should be provided, appropriate to the type and quantity of materials stored, near the place where those materials are being stored or handled. The number of and size of extinguishers is determined by the size of the risk and use as determined by *AS 2444, Portable fire extinguishers and fire blankets: selection and location and the requirements of relevant dangerous goods standards*. These extinguishers must be boldly labelled so that workers faced with an emergency, and under pressure, will confidently select the appropriate type. Fire extinguishers should have a minimum rating of 2A60B(E).

A supply of water should be readily available for emergency use to fight fires. The advice of fire and emergency services should be requested to determine whether the location and type of fire protection system meets with their operational requirements. Fire and emergency services should also be consulted when designing or altering the system.

3.7.2 Communication and alarm system

A communication and alarm system should be installed within 10 m of the HHW storage facility or another occupied office within the facility complex. The alarm system should be linked to a manned onsite office and then if applicable to fire and emergency services.

Fire-alarm systems should be designed and installed to achieve the following:

- Automatic systems should be capable of being manually activated at clearly identified manual alarm activation points at convenient and safe locations near work areas;
- Alarm signals should be distinguishable from other signals to allow ready recognition, and should be clearly audible throughout the HHW storage facility and site;
- Effective alternative alarm systems, such as visual systems, should be installed where high noise levels or the use of personal protective equipment (PPE) may prevent a worker from hearing or recognising an alarm signal;
- The system should remain operable when the main power supply fails.

Further advice is provided in Australian standards *AS 1603, Automatic fire detection and alarm systems* and *AS 1670, Fire detection, warning, control and intercom systems*.

3.7.3 Access control

Because of the hazards associated with chemicals and dangerous goods, access to HHW acceptance and storage areas must be controlled and restricted to those persons having a legitimate reason to be there. Operators of sites have a duty, so far as is reasonably practicable, to prevent access to the operator's site by unauthorised persons and unauthorised activities occurring on those sites. A security fence with locks on all gates and doors should be installed around the facility holding the HHW. Only trained facility staff should be able to enter the HHW storage facility. Signs should be posted in sufficient numbers to be seen from any of the approaches to the facility with a legend such as "Danger! Keep Out! Authorised Personnel Only".

3.7.4 Spill kits

It is imperative that all HHW storage facilities are able to handle any small chemical spill and that all chemical spills should receive immediate attention. Spill kits should

be located in high-risk areas. They should be easily identifiable and accessible. Contents should include stocks of absorbent material, such as pillows, soil or sawdust ('kitty litter'); protective clothing; and secure skips for these materials once they have been used and contaminated.

3.7.5 Safety and first-aid equipment

Showers and eyewash station

Emergency eyewash and shower equipment should be located between 2 and 10 metres from the HHW storage facility and the time taken for workers to reach the washing units from any given point in the facility should not exceed 10 seconds. Eyewash and shower equipment shall comply with AS 4775 Emergency Eyewash and Shower and will be maintained and tested on a regular basis.

The washing facilities should not be within 2 metres of the HHW acceptance or storage areas to avoid possible contamination of the washing facility itself.

Safety equipment

The operator must ensure that appropriate PPE for chemical and hazardous material (Hazmat) protection such as hard hats, safety glasses and/or other eye protection, overalls, gloves, chemical splash suits, masks, boots, etc., is kept at the site and is accessible. Lockers for equipment such as protective clothing, gloves and self-contained breathing apparatus should be provided for personnel operating within the HHW storage facility.

PPE must be provided by the employer and replaced when necessary. Australian / New Zealand Standard *AS/NZS 1336:1997, Recommended practices for occupational eye protection* gives the requirements for the selection of the correct type of eyeware.

First aid kit

A suitable fully stocked and easily accessible first aid kit should be located within the HHW storage facility or within 10 metres of it.

3.7.6 Emergency Information

A document box should be installed at the main gate entrance to the HHW storage facility which would contain the following information for facility staff and fire and emergency services:

- An up-to-date inventory of the total chemicals held in the facility by volume/weight and type (P1-P9), with any storage areas for flares clearly identified.
- Scale drawings of the facility showing:
    - storage location and capacity of HHW by type (P1-P9), with specific reference to storage areas for gas cylinders and flares

  - isolation of services (e.g. electricity, gas, water)
  - site drainage (sewer and stormwater)
  - fencing
  - signs
  - fire hydrants and hose reels
  - storage areas for PPE
  - spill response equipment
  - emergency shower and eyewash facilities.
- A staff contact list.

3.8 Signs and labelling

Signs and labels are to be provided to ensure a safe working environment for staff, practical guidance for emergency services, and a safe environment for the public. The location of signs is important, and should be considered during the design phase.

All HHW storage areas must be clearly and individually labelled to indicate which materials are stored in each area. Labels should be in large print and plain English. For some materials, a diagram or a list of products fitting into the material category may also be appropriate. Some examples are available from Sustainability Victoria (www.sustainability.vic.gov.au/www/html/1946-signs-for-transfer-stations-and-landfills.asp).

Placards are required by law under the Western Australian Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007, and are explained in the Dangerous Goods Storage and Handling Code of Practice (available at www.dmp.wa.gov.au). Safety signage and placarding should comply with Australian Standards *AS 1216:1995, Class labels for dangerous goods* and *AS 1319:1994, Safety signs for the occupational environment*. As a minimum, Hazchem signs ('diamonds') for Dangerous Goods Classes 6 (toxic materials), 8 (corrosive materials), and 3 (flammable liquids) must be placed on the surrounds of the HHW storage facility, together with a "No Smoking" sign.

Signage indicating opening times, access and restricted access should be placed on the exterior of the facility; a Hazchem outer warning placard should be placed at the outer entrance to the facility. A list of emergency phone numbers should be clearly displayed at a location within the HHW storage facility that can be seen by both staff and members of the public.

3.9 Considerations for specific materials

3.9.1 Flares

There are a number of locations specified for disposal of flares to ensure they are safely destroyed:

Department of Transport:

- Marine Operations Centre, 14 Capo D'Orlando Drive, Fremantle.
- Regional Transport Offices may be found at http://www.transport.wa.gov.au/imarine/19165.asp#Disposal.

Department of Fisheries:

- Hillary's Office, 39 Northside Drive Hillarys.
- Rockingham Office, Suite 4, Commerce House, 3 Benjamin Way, Rockingham.
- Mandurah District Office, 107 Breakwater Parade, Mandurah Marina.

HHW storage facilities may accept flares from householders (flares are covered under the HHW Program). If flares are accepted the following requirements should be observed:

- **Licensing:** The number of flares stored should be minimised (up to 25 can be held without a licence, providing there are not more than 2.5 kilograms of classification code 1.1 or 1.2, 15 kilograms of classification code 1.3; and 30 kilograms of classification code 1.4 at the place. Typically hand held smoke and red flares are classification code 1.4, and parachute flares are classification code 1.3).
- **Storage:** Flares should be kept away from heat sources, and separate to the main HHW storage area (see Section 3.11). To minimise the risk in a fire, flares that may have a projection hazard (parachute flares) should be stored in a metal cage which would contain them in a fire. Such a cage could be quite small, and would need to be made of heavy steel rod/bar mesh with an aperture size smaller than the diameter of the flares, and be bolted down. The number of flares stored should be kept to a minimum as significantly more onerous storage requirements apply if the licensing thresholds (see above) are reached.
- **Transport:** Facility operators should not transport flares off site for disposal.

3.9.2 LP gas cylinders

Where limited quantities of LP gas cylinders are accepted and stored (up to a maximum of two pallet sized cages), the following requirements should be observed:

- The storage of cylinders of LP gas indoors, whether full or nominally empty, should be avoided wherever practicable. Cylinders should preferably be stored out-of-doors.
- Cylinders shall be kept upright in a well-ventilated area away from any flame, heat or other ignition sources.
- Cylinders shall be protected from excessive temperature rise.
- Cylinders shall be protected from physical impact.
- Cylinders shall be located so that they are not likely to be damaged or dislodged under normal circumstances of use. Any trolley or stand in which the cylinder is housed shall be of metal construction and of adequate stability.
- Cylinders shall be kept in a location that does not hinder the escape of people, and is at least 3 metres away from any combustible or waste materials;
- LP cylinders shall be stored separately to other types of gas cylinders (e.g. refrigerant or fumigant gas, helium cylinders).
- Cylinders shall be kept at least 3 metres from oxidizing gases.
- Cylinders shall be stored with all cylinder valves closed.
- Cylinders shall be stored at least 1 metres horizontally away from an opening into, and shall be outside of, any building that is not used solely for storage, filling and/or handling of gas cylinders.
- The distance between any cylinder and any above-ground LP Gas storage tank or flammable liquid storage that exceeds 250 litres capacity shall be at least 3 metres.
- Cylinders shall not be stored within any compound (bunded area) for flammable liquid storages.

Where more than limited quantities of LP gas cylinders are stored, the specific requirements of *AS1596:2008* should be observed.

3.9.3 Oxidising agents

Oxidising agents present a unique risk in that they are reactive and support combustion while not being classed as flammable. As such they should be kept away from combustible or readily oxidisable materials such as flammable liquids, paper and wood, and away from heat sources. Oxidising materials are generally mutually non-compatible (as per Table 5) and should be stored separately (for further information refer to MSDS or seek expert advice).

Oxidising agents should therefore be kept in a separate purpose built dangerous goods cabinet, either located inside a HHW storage facility, or outside the building in a securely locked compound.

3.10 Sizing of HHW stores

The requirements of the *Western Australian Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2007* (the Regulations) become more stringent as the quantity of dangerous goods stored and handled at a site increases. The classification of dangerous goods sites under the Regulations is outlined in Figure 2.

Figure 2: Classification of dangerous goods sites.

The classification applied to a site depends on the quantities of dangerous goods stored, and is specified in Schedule 1 of the Regulations. As indicated in Figure 2 sites with more than manifest quantities of dangerous goods are required to be licensed. The quantities of dangerous goods relevant to HHW storage facilities specified in Schedule 1 of the Regulations are outlined in Table 11.

Table 11: Placarding and manifest quantities of Dangerous Goods.

Dangerous goods	Packing group	Placarding quantity	Manifest quantity
Division 2.1 except aerosols	N/A	500 L	5 000 L
Division 2.2 except aerosols	N/A	1 000 L	10 000 L
Division 2.1 and 2.2 aerosols	N/A	5 000 L	10 000 L
Any one of Class 3, Division 4.1, 4.2 or 4.3, Division 5.1 or 5.2, Division 6.1, Class 8 or Class 9, or any combination of those classes or divisions	I	50 kg or L	500kg or L
	II and III (aggregate)	1 000 kg or L	10 000 kg or L
	I, II and III (aggregate) where quantity of goods in packing group I does not exceed 50 kg or L	1 000 kg or L	10 000 kg or L

Dangerous goods	Packing group	Placarding quantity	Manifest quantity
C1 combustible liquids with fire risk dangerous goods	N/A	1 000 L	10 000 L
Other C1 combustible liquids	N/A	10 000 L	100 000 L

In order to ensure that the requirements for design and operation of HHW storage facilities are kept within a scope that is feasible for most operators, the quantity of materials in the facilities should be kept below manifest quantity.

The quantity of HHW required to be stored will depend on the population served by the HHW storage facility and the frequency with which it is emptied.

3.11 Examples of HHW storage facility layouts

In this section several examples are provided for different types of HHW storage facilities. The layouts have been prepared using a number of assumptions:

1. Storage units inside the storage area

In the examples of HHW storage facility layouts below, it is assumed that materials are stored in tubs/trays on shelves that are 1.5 metres high and 0.5 metre wide, with four shelves. The bottom shelf 150 millimetres from floor level to allow cleaning, the bottom three shelves spaced 500 millimetres apart with 350 millimetres between the third and forth shelves. 1 metre length of rack therefore has a storage capacity of approximately 1.8 cubic metres.

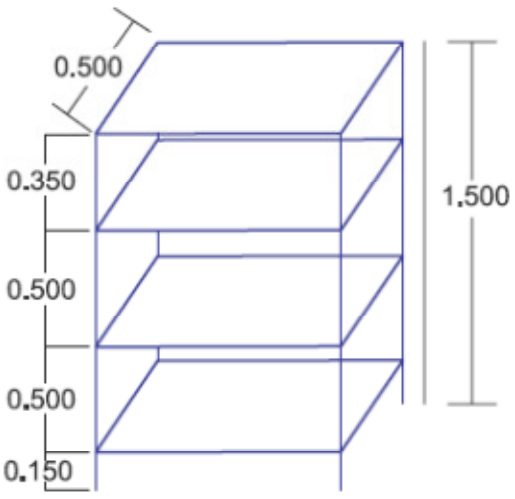


Figure 3: Example layout of shelving unit for HHW storage.

2. Storage space required inside the storage area

The proportion of rack space required for materials inside the HHW storage facility is outlined below:

Table 12: Approximate proportion of shelf space required for materials.

Dangerous goods class	Approx. proportion of shelf space required
2.1 Flammable gas	5%
3 Flammable liquid	50%
6 Toxic	15%
8 Corrosive – acid	5%
8 Corrosive – alkali	5%
9 Mixed	20%
Total	**100%**

An additional storage cabinet should be used for oxidising agents and a cage for flares.

3. Material quantities outside the storage area

LP gas cylinders, automotive batteries and water based paint are stored separately outside and away from the primary HHW storage facility, in a bunded area.

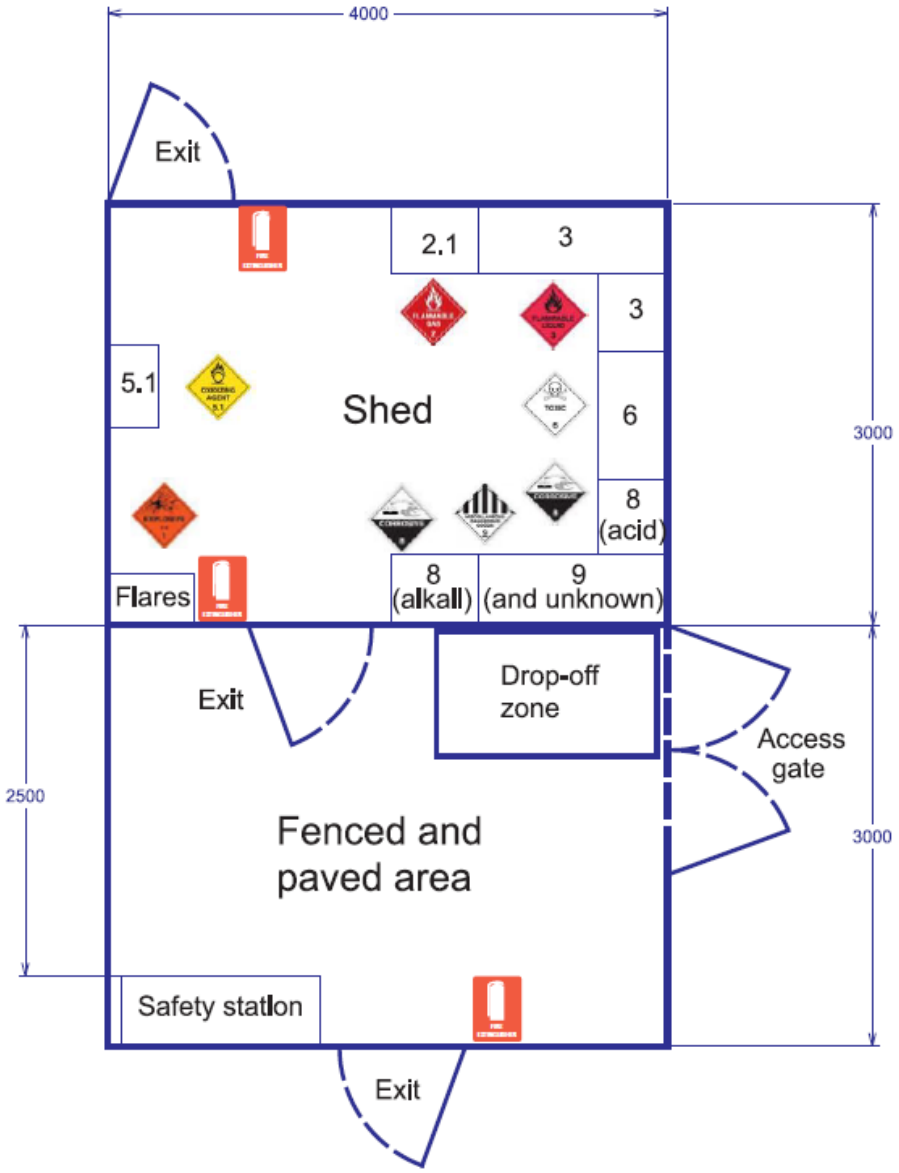
4. Safety station

The safety station indicated in the sample layouts includes an emergency eyewash and shower, first aid cabinet, and spill kit.

3.11.1 Small quantity dangerous goods storage facilities

A 'small quantity' dangerous goods location means a place where dangerous goods are stored or handled in quantities that do not exceed the Placard Quantity in Schedule 1 of the Western Australian Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2007. In simple terms this means a HHW storage facility that, in total, contains less than 1,000 kilograms or litres of materials (in this example, 6 linear meters of shelving or 10.8 square metres storage area, as per Figure 3). Most metropolitan HHW storage facilities are likely to be larger than this, however small quantity facilities may be appropriate for non-metropolitan areas.

Figure 4: Example layout for a small quantity dangerous goods storage facility (6 m shelf length = 10.8m^2 storage area).



A basic layout for a small quantity storage facility is shown in Figure 4. It does not include provision for storage of automotive batteries, LP gas cylinders or water-based paint. If a storage area for these is required, separate secure paved areas should be provided at least 5 metres from the HHW storage facility. Roofing for the entire area is recommended.

The layout in Figure 4 indicates where different materials should be located. The estimated rack space (6 metres shelf length with 4 vertically spaced shelves as per Figure 3, which gives 10.8 square metres of storage area) is outlined in Table 13:

Table 13: Approximate rack space required for different classes of dangerous goods in a 'small quantity' dangerous goods storage area.

Dangerous goods class	Approximate rack space required for a HHW storage facility with approximately 12m^2 shelving area
2.1 Flammable gas	0.6 m^2
3 Flammable liquid	6 m^2
6 Toxic	1.8 m^2
8 Corrosive – acid	0.6 m^2
8 Corrosive – alkali	0.6 m^2
9 Mixed	2.4 m^2
Total	**12 m^2**

NOTE: additional storage cabinets required for oxidising agents and flares.

3.11.2 Larger HHW storage facilities

In this example, a 'large' facility is considered to be one which provides 20 linear metres of shelving, equivalent to 40 square metres of storage area. Figure 5 gives the layout of the complete facility including HHW storage area (labeled 'shed' in Figure 5), and space for automotive batteries, LP gas cylinders and water-based paint. Figure 6 shows the internal layout of the HHW storage area (labeled 'shed' in Figure 5), indicating where different materials should be located. Roofing for the entire area is recommended. The estimated rack space (4 vertically spaced shelves) is outlined in Table 14:

Table 14: Approximate rack space required for different classes of dangerous goods in a larger dangerous goods storage area (approx 40 m^2 total rack space).

Dangerous Goods Class	Approximate rack space required for a HHW storage facility with approximately 40m^2 shelving area
2.1 Flammable gas	2 m^2
3 Flammable liquid	20 m^2
6 Toxic	6 m^2
8 Corrosive – acid	2 m^2
8 Corrosive – alkali	2 m^2
9 Mixed	8 m^2
Total	**40 m^2**

NOTE: additional storage cabinets required for oxidising agents and flares.

A disadvantage of storing flammable HHW within the HHW storage facility is that the entire building must be constructed of non-flammable materials, and all electrical

wiring and fixtures must be suitable for use in explosive atmospheres. An alternative is to store flammable HHW in a separate cabinet.

Figure 5: Example layout for a HHW storage facility, including dangerous goods (shed of 40 m^2 shelving area), automotive batteries, water-based paint and LG gas cylinder storage areas.

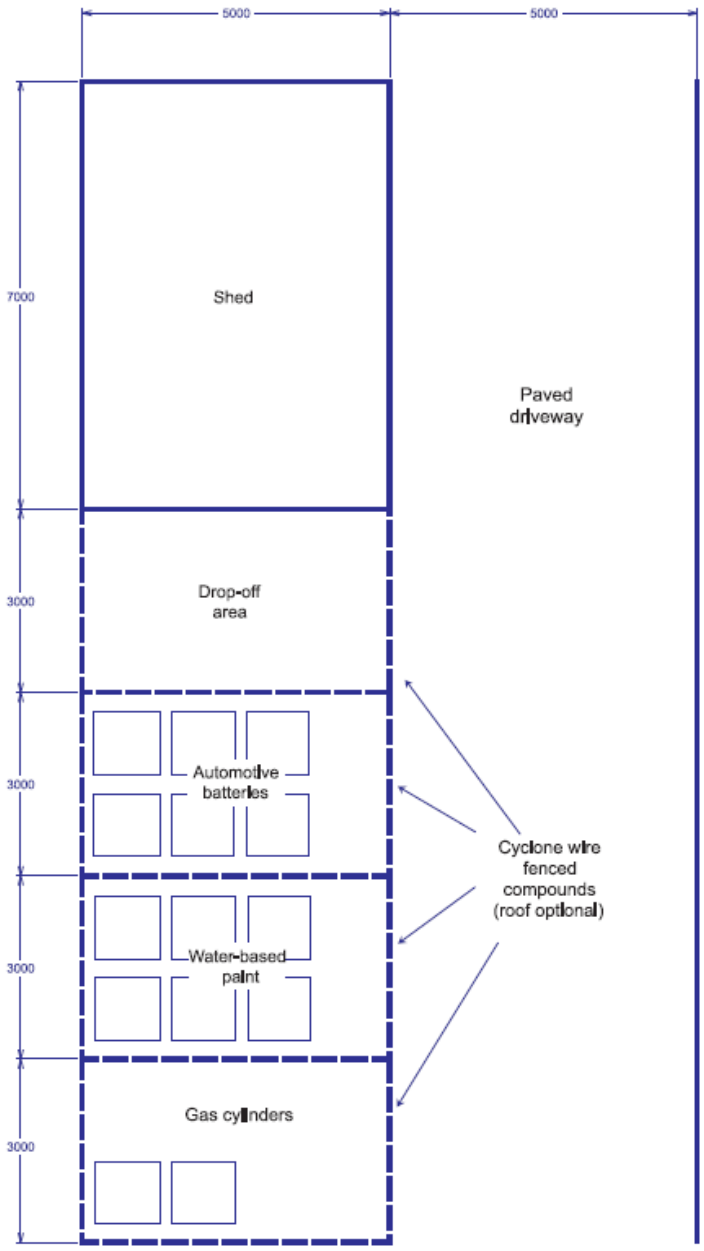
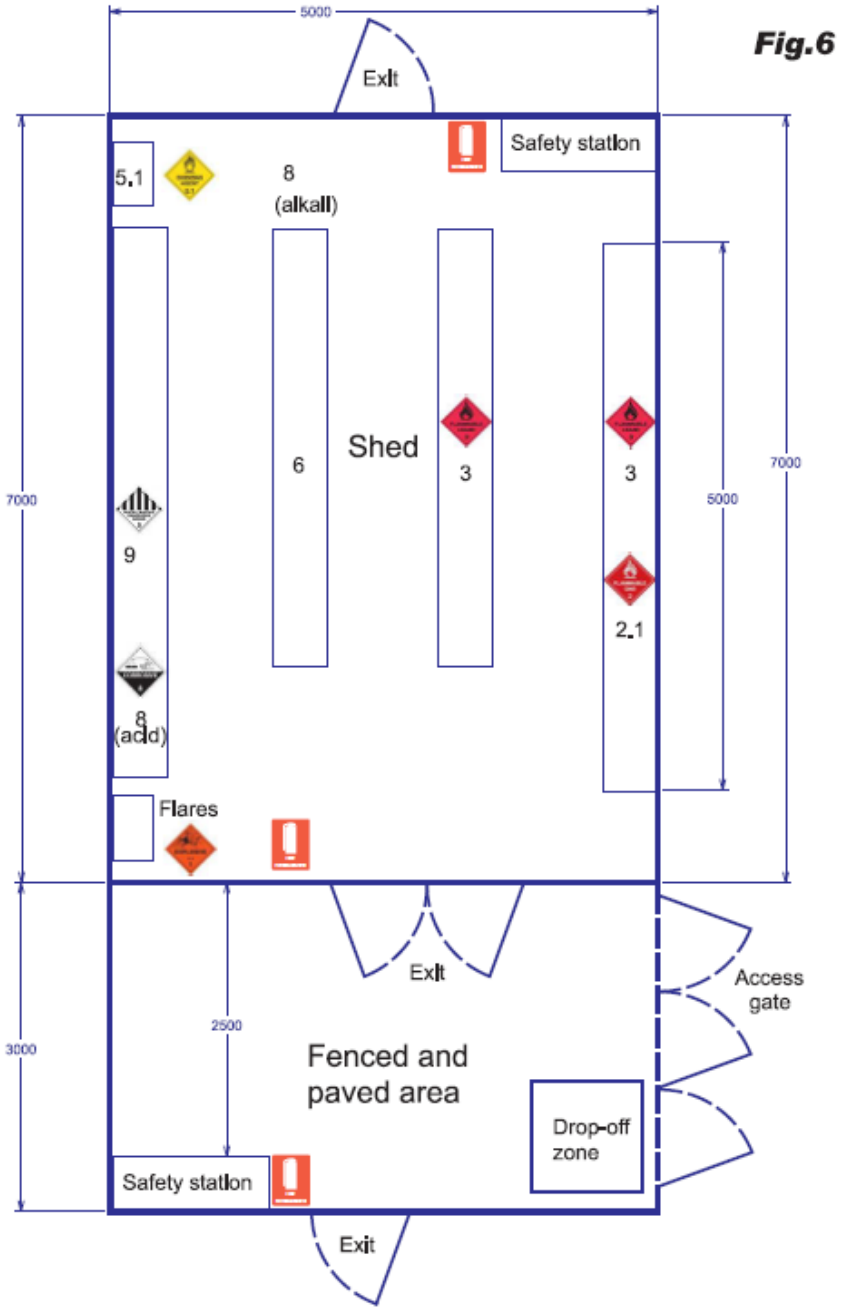


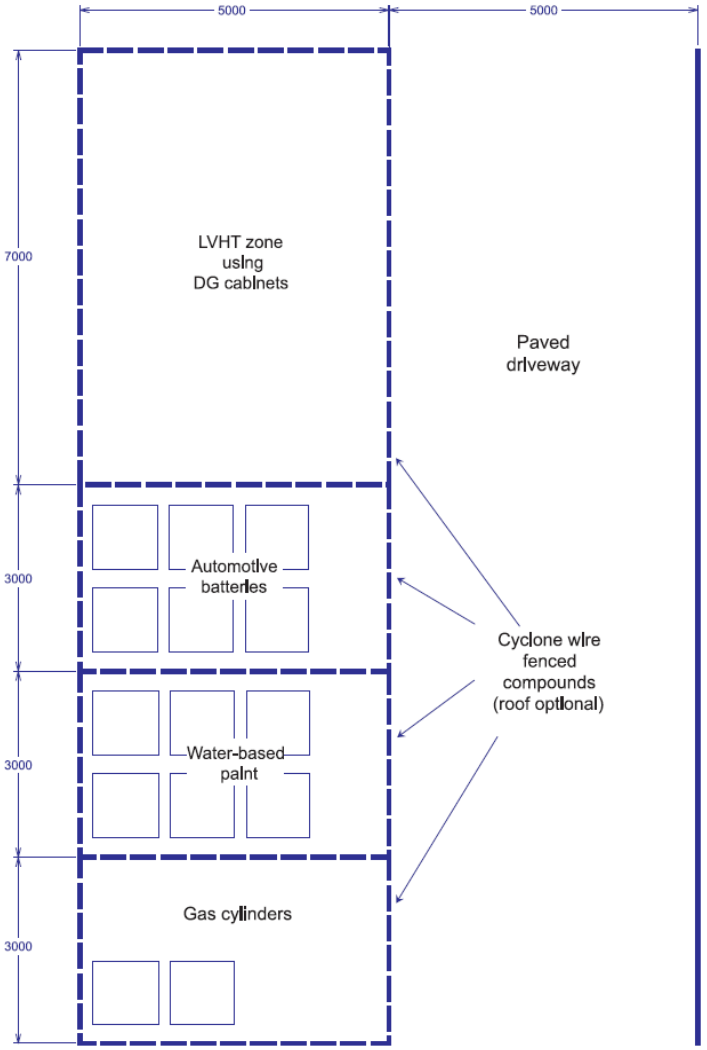
Figure 6: Example layout for a larger quantity dangerous goods storage area (approx 40 m^2 storage area) – including flammables.



3.11.3 Use of dangerous goods storage cabinets

The use of purpose-built dangerous goods storage cabinets is also possible. Figures 7 and 8 illustrate an example layout for a large storage capacity for dangerous goods using two separate banks of cabinets each 1 metre wide, 5 metres long and 2 metres high, with five individually lockable and bunded storage compartments. Figure 7 shows a layout for the complete facility including dangerous goods storage area, and space for automotive batteries, LP gas cylinders and water-based paint. Roofing for the entire area is recommended. Figure 8 shows the internal layout of the dangerous goods storage area, including the allocation of compartments to different types of materials. Figure 9 gives an elevation view of the dangerous goods storage cabinets.

Figure 7: Example layout for a HHW storage facility, including dangerous goods, automotive batteries, water-based paint and LG gas cylinder storage areas.



Note: LVHT – low volume high toxicity

Figure 8: Example layout for a dangerous goods storage area using DG cabinets – including flammables.

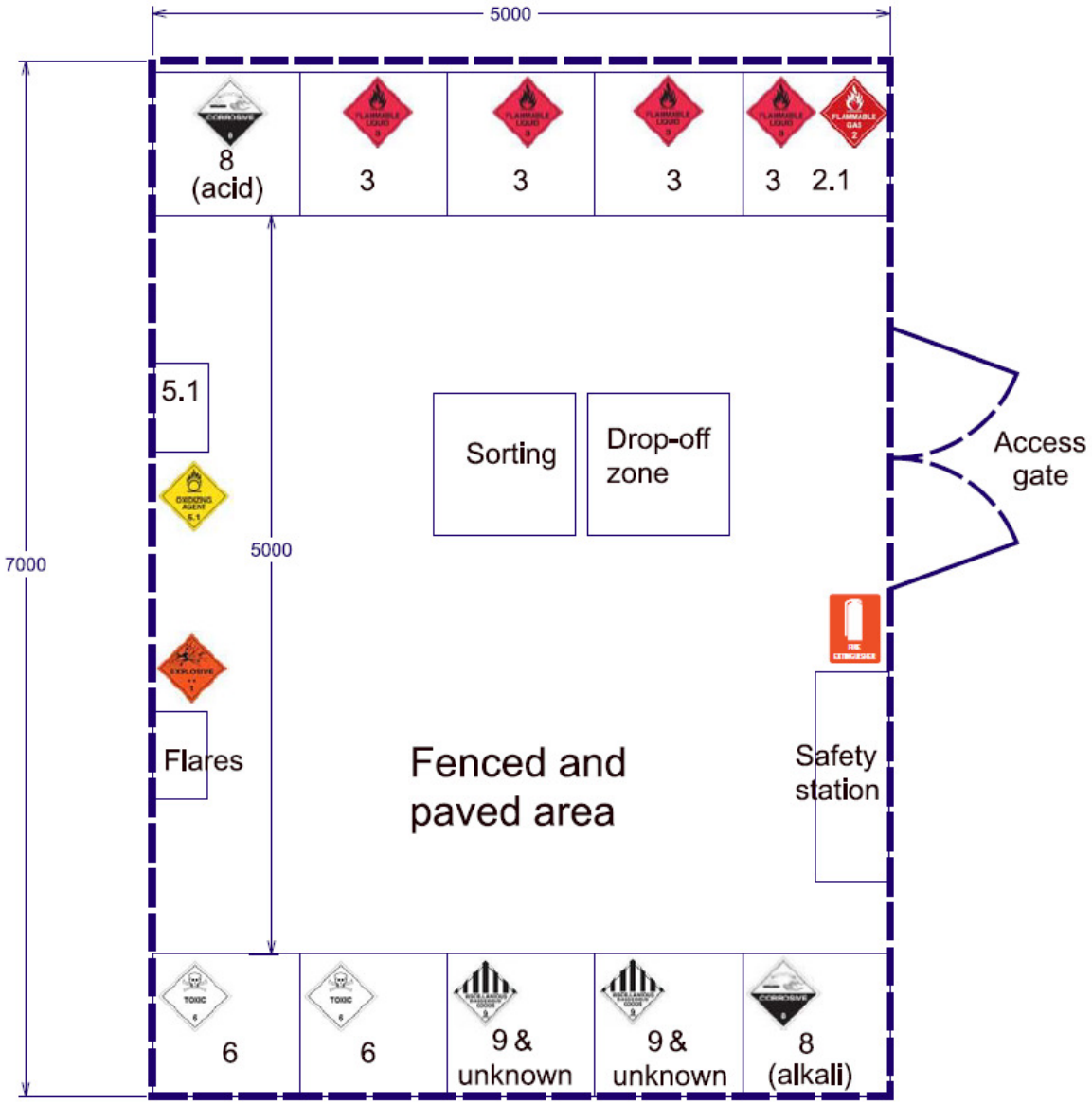
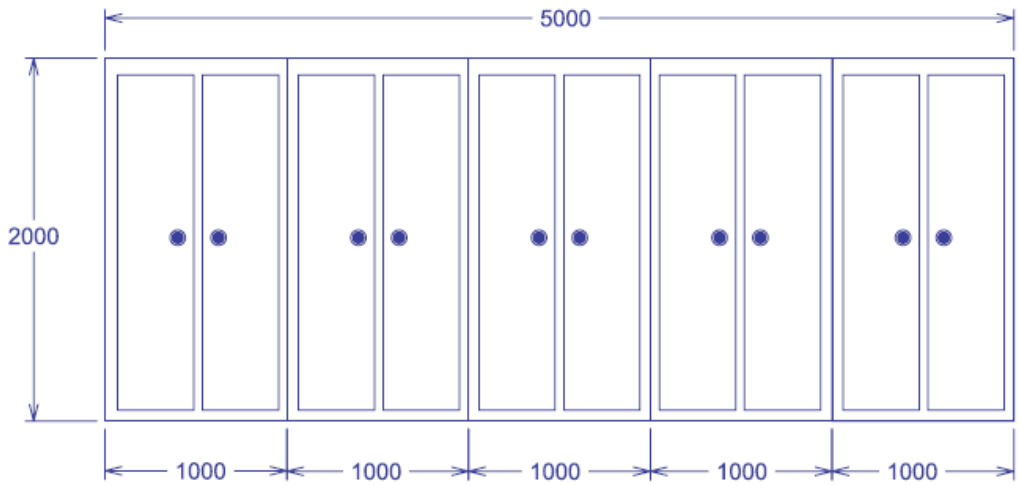


Figure 9: Elevation view of DG cabinets.



3.11.4 Use of separate storage for flammable HHW

As mentioned previously, a disadvantage of storing flammable HHW in a HHW storage facility is that the building must be constructed of non-flammable materials, and if used, electrical wiring and fixtures must be suitable for use in explosive atmospheres.

An alternative is to use a one facility/building for the storage of non-flammable materials, and use a separate dangerous goods storage cabinet for storing flammable materials. The example in Figure 10 uses 10 linear metres of shelving (approx 20 square metres storage area) for non-flammables, and dangerous goods storage cabinets for flammables. Figure 10 shows the layout of the entire facility. Figure 11 shows the layout inside the shed and the drop-off and flammable HHW storage area. Again, inside the shed racks with 4 vertically spaced shelves are used. The dangerous goods storage cabinet is identical in concept to the one illustrated in Figures 8 and 9.

Figure 10: Example layout for a HHW storage facility, including dangerous goods 'shed' area (approx 20 m^2 shelf area), DG cabinets for flammable HHW (10 m^3 storage capacity), automotive batteries, water-based paint and LG gas cylinder storage areas.

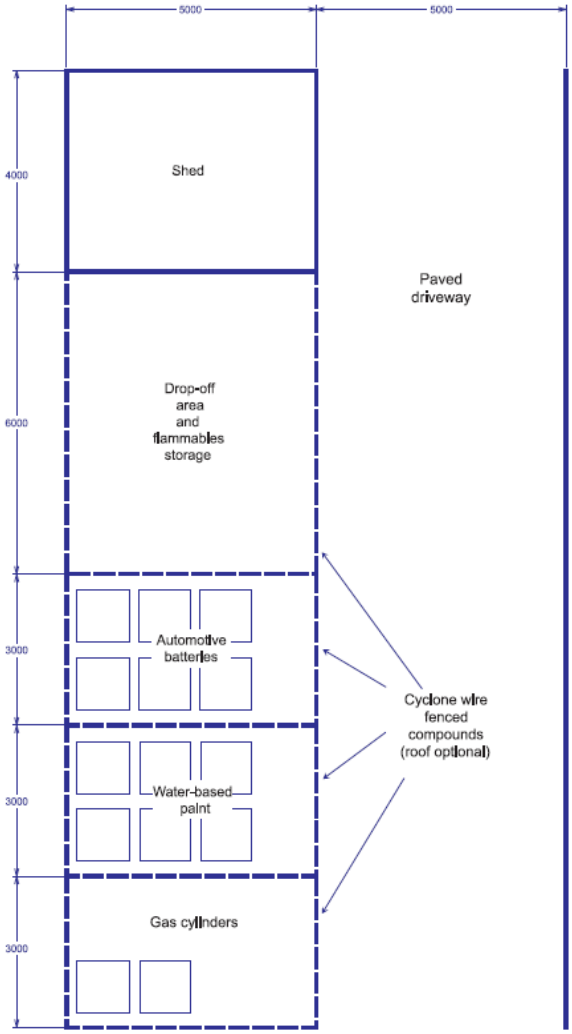
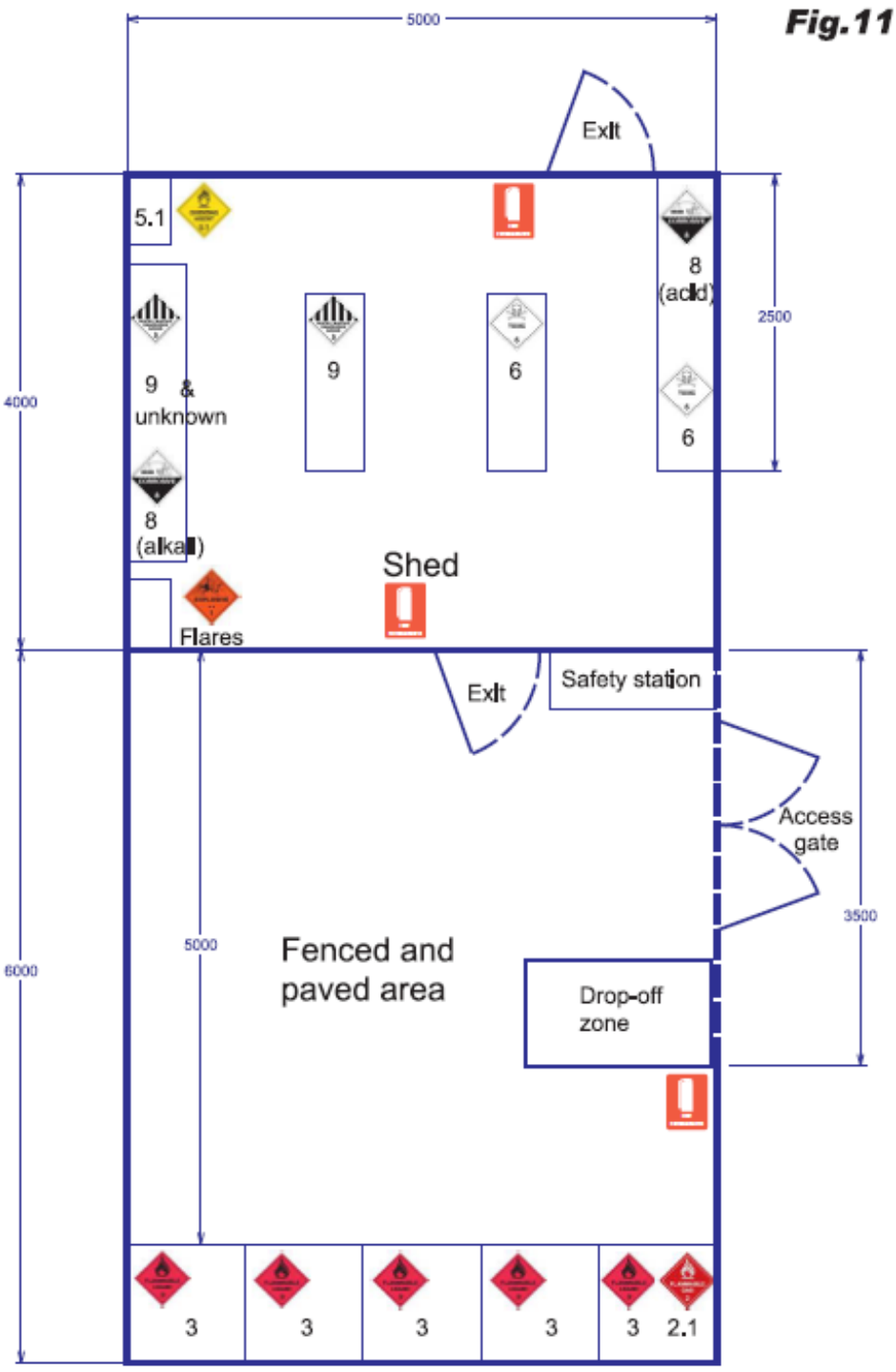


Figure 11: Example layout for a dangerous goods storage area using DG cabinets for flammable HHW and a dangerous goods 'shed' area for other types of HHW (approx 20 m2 storage area)



4 FACILITY OPERATIONS

4.1 General public safety

The safety of members of the public, including those who may live near the site, those who are visiting the site for other purposes, and customers who are bringing HHW to the site is of the utmost importance. The following must be observed:

- Signage at the facility should direct customers to the HHW acceptance area (where they can drop off their HHW) and advise them to wait in their vehicle for an operator. The customer should unload HHW under the supervision of the operator.
- Signage and the operator should direct customers that children, if present, should remain in the vehicle.
- Signage should clearly list which materials area and aren't accepted at the HHW storage facility.
- Once the materials are safely unloaded by the customer or operator, the customer should be directed to leave the acceptance area immediately.
- Members of the public are not to remove any materials from the drop-off area or the HHW storage area. This should be clearly indicated by appropriate signs, and instructions by the operator.
- Members of the public are not to enter the HHW storage area unless, as illustrated in Figures 7 and 10, the acceptance area is in the same facility as HHW stored in locked DG cabinets.
- The facility supervisor or manager should be advised of all spills or loss of containment immediately, and appropriate spill and/or emergency response procedures initiated. These should include notification of members of the public on and surrounding the site if necessary.

4.2 Material redistribution to the public

The redistribution of HHW to the general public is not recommended, with the exception of water-based paint that is in adequate condition in a secure container.

4.3 Acceptance and storage requirements

4.3.1 Acceptance of HHW materials

Acceptance of HHW materials should take place under the supervision of an appropriately trained and qualified operator. Signage at the facility should direct customers to the HHW drop-off point and advise them to wait in their vehicle for an operator.

The facility should establish a way in which relevant operators can be made aware that a customer is delivering HHW. For example, where staff are present in a gatehouse or weighbridge at the entrance to the facility they should ask customers if

they are delivering HHW and if so advise the relevant operator.

Signage and the operator should direct customers that children, if present, should remain in the vehicle. The customer should remove containers from their vehicle and place on designated pallet(s)/containers at the acceptance area as directed by the operator.

Operators should wear protective gloves and safety glasses before handling any HHW materials. This is particularly important if the integrity of container is questionable.

The operator should attempt to identify substances (in accordance with training) and confirm with the customer what substance is in each container. The operator must record the details of the substance and amount received in each container. This information is used to keep the HHW storage facility inventory up to date.

Once the materials are safely unloaded the customer should be immediately directed to leave the drop-off area.

Once the operator has checked that the containers are intact, not leaking and unlikely to fail, the substances are appropriately identified, and all containers have been placed securely in the relevant part of the acceptance area, the operator can lock and leave the acceptance area until it is necessary to transfer the accumulated materials from the drop-off area to the HHW storage facility.

Material that has accumulated in the acceptance area must be regularly transferred to the HHW storage facility to ensure that it is safely stored. The acceptance area should be checked and cleared if necessary at least daily.

4.3.2 Storage

The HHW storage area must remain locked at all times unless an appropriately trained and qualified operator is present. The facility should only be opened for the purpose of transferring material from the acceptance area into the store, for clearance of the material for disposal or recycling.

During transfer between area, materials should be placed directly into the area of the HHW storage facilities appropriate to the type of material. The HHW storage facility should at least have separate areas for the materials listed in Table 15 (also listed on page 4), although some facilities may choose to use more areas. All storage facilities should include an area allocated for unknown materials.

Small containers (< 20 litres) should be placed in plastic bins and then onto shelves. Larger containers (> 20 litres) should not be accepted at the facility.

Liquids should be stored at lower levels than solid or granular material. Only compatible materials of a similar dangerous goods class should be placed above each other.

Oxidising Agents such as pool chlorine must be placed in an area completely separate to any other material. The HHW storage facility should have a separate cabinet/storage area for these materials (see assumptions in Section 3.11).

Leaking or suspect packages should be placed into suitable outer containers (e.g. plastic trays), re-labelled, and then put into correct section in the HHW storage facility. A sufficient supply of suitable spare containers should be maintained.

Appropriate PPE including safety goggles, gloves and chemical apron must be worn when handling and transferring dangerous goods. Refer to Section 4.5 for more information on PPE.

Table 15: Recommended categories for HHW storage.

Material Category	DG Label
P1: Toxics	
P2: Flammable liquids	
P3: Corrosive – acids	
P4: Corrosive – alkalis	
P5: Flammable solids	
P6: Oxidisers	

P7: Miscellaneous DG	
P8: Miscellaneous non-DG	No DG label required
P9: Unknowns	

Note: Diamonds at entrances to placard stores must be no less than 100 mm on each side of the diamond.

Two acceptable versions of the various dangerous goods class/division diamonds are in the guidance note at:
http://www.dmp.wa.gov.au/documents/Misc/DG_IS_Safetyinfo.pdf

Decanting of leaking substances into other containers should not be undertaken unless absolutely necessary. Placement of the leaking container into a suitable outer container is the correct approach.

Spills should be cleaned up immediately using appropriate equipment. Appropriate PPE must be worn when cleaning up spills.

Spills or other losses of containment which create an uncontrollable hazardous situation (i.e. fumes, vapours) should be left alone and the immediate area evacuated. Refer to Section 4.6 for more information on emergency response.

PPE such as gloves and apron should be rinsed after each transfer. Hands should always be washed after each transfer (even if wearing gloves).

Eating, drinking and smoking should be prohibited in the HHW drop off and storage areas.

4.4 Disposal

The HHW storage facility must be cleared of materials at a frequency sufficient to ensure its capacity is not exceeded. In particular no more than 500 kilograms or litres of materials in Packing Group I should be stored at any one time. Examples of materials in Packing Group I are provided in Appendix 6.

4.5 Personal protective equipment

4.5.1 Acceptance and storage

The following items of PPE must be worn by site staff involved in unloading and storing HHW materials:

- eye protection – safety glasses, goggles, a face shield
- gloves – gauntlet gloves
- chemical apron for clothing protection
- respiratory protection (depending on the situation)
- heavy-duty footwear with slip reducing soles and steel caps.

4.5.2 Spill response

In the event of a leak or spill the following items may be required and should be stored near the HHW acceptance and storage areas:

- coverall suit
- chemical resistant face shield
- chemical resistant boots
- emergency respirator
- a spill kit (or kits) appropriate to the size and type of facility.

4.5.3 Maintenance of PPE

The amount and type of PPE kept on site should be sufficient all staff for everyday sorting and storing of HHW, as well as for response to any spills or other incidents.

PPE should be kept separate from normal clothing. After use, all PPE should be maintained and cleaned in accordance with the manufacturer's instructions and the relevant Australian Standard. It is recommended that staff wear clothing made from natural fibres, to minimise risk of burns in case of fire.

4.6 Emergency situations

4.6.1 Emergency procedures, equipment and facilities

For emergency situations the following procedures and facilities should be available:

- an emergency shower, eye-wash and first-aid cabinet located near the HHW storage facility
- a hose stand using reticulated fresh water for dilution and wash down
- spill response kits, including clean-up equipment, chemicals for neutralising or decontaminating spills, and suitable absorbent materials,

located near the HHW acceptance area, and the HHW storage facility. Spill kits should typically include:

- adequate quantities of absorbent material, e.g. fuller's earth, or other proprietary substances (sand or sawdust are not recommended)
- absorbent pads (for oil spills)
- calcium hydroxide, (hydrated lime), sodium carbonate (soda ash) and/or crushed calcium carbonate (limestone) for use on acidic spills
- sodium bisulfate for use with alkaline spills
- a sufficient quantity of resealable waste-recovery containers, made of materials compatible with the substances being kept, and marked for emergency use only
- shovels and brooms.

- dry chemical fire extinguisher(s) for fire response.
- foam fire extinguisher(s) for flammable liquid fires and to cover spills.
- copies of the emergency plan for the site, located near the HHW storage facility and near the entrance to the site. The emergency plan for the site should include procedures for the event of an emergency involving HHW.

4.6.2 General spill response

In the event of a spill the following initial response should be followed:

- Identify all people in the vicinity including members of the public.
- Move all persons to the designated evacuation point upwind.
- Advise site supervisor or manager.
- Avoid contact with the spilled material.
- Put on additional PPE as required (gloves, goggles, chemical apron, coverall suit, chemical resistant boots, and respirator).
- Clean up spill.
- Complete incident response form as soon as possible after the situation has been contained.

4.6.3 Clean up procedures

Minor Spills

Clean up minor spills following the 'Three C's' method: Control, Contain and Clean up:

- Neutralise the spill if necessary using the correct neutralising agent.
- Contain spill using an appropriate absorbent material.
- Scoop up and recover material and put into a waste-container.
- Repeat using appropriate absorbent material to minimise quantity and contamination of wash down water. Some chemicals should not be allowed to contact water, including sodium, potassium and magnesium, and should be contained and removed as much as possible with absorbent material.
- Apply decontamination agent if necessary and again use absorbent material to recover material and place in waste-container.
- Wash residue, brush and shovel with copious amounts of water.
- Label waste container with details of contents if known including the absorbent material used.
- Place waste container into the appropriate area of the HHW storage facility (applicable to the spilt material).

Larger spills

For larger spills, control and contain the spill if possible, secure the area, and contact fire and emergency services (000), providing details of the spilled chemical(s) if known.

4.6.4 First Aid

When any discomfort is reported, or a person has inhaled, ingested or been contaminated with a potentially hazardous or toxic substance:

- Remove the patient to a safe place prior to treatment, if safe to do so. Before effecting a rescue, put on PPE appropriate to the nature of the incident.

- Send for a designated first aid person and, at the same time, if available, obtain the MSDs for the substance involved and follow the guidance given. Summon professional medical assistance without delay. If there is any doubt as to the appropriate first aid procedure, contact the Poisons Information Centre (phone 13 11 26).

- If the patient has stopped breathing, ensure a clear airway and apply an appropriate method of artificial resuscitation. Note that the appropriate method depends on the substance involved. Oxygen resuscitation or external air resuscitation may be required.
- If the eyes are contaminated, wash thoroughly with water from a low-pressure water source for at least 15 minutes (or as specified in the MSDS).
- Remove all contaminated clothing and footwear. Wash contaminated area with soap and lukewarm water.
- Carry out appropriate first aid treatment and call an ambulance. If medical assistance is not available, transport the patient to a hospital or doctor.
- Send the MSDS (if available), product label (if available), and all relevant details of the accident, to the hospital or doctor with the patient.
- Complete incident response form as soon as possible after the incident in accordance with any Occupational Health and Safety procedures.

4.7 Induction and training

4.7.1 Operator skills

Operators of the HHW Store must have the following skills:

- storage and handling of dangerous goods including identification, keeping incompatible materials separate, and appropriate response to loss of containment
- appropriate fitting and use of PPE, including emergency respiration equipment.

4.7.2 Induction

When commencing work in the HHW storage facility, operators should be instructed in the following:

- general layout of the acceptance area and storage facility, in particular the location of safety equipment such as the MSDSs, PPE, safety shower, eyewash, first aid cabinet and evacuation points
- administrative procedures for controlling risks, such as permit to work systems
- hazardous areas and restrictions on ignition sources, especially vehicles and portable items
- security measures, signs and procedures
- record-keeping, in particular maintaining the inventory of materials stored in the HHW storage facility

- general emergency plan and procedures for the site.

4.8 Access to technical support

The facility should have access to specialist advice and support arrangements in the event of unknown materials being dropped off, and other unexpected or emergency situations.

4.9 Record-keeping

4.9.1 Inventory and reporting mechanisms

An inventory of all materials received and stored at the facility is essential both for safety reasons and for logistic reasons (as for the occasions when the store is cleared by waste contractors). Computerised systems are available to assist in maintaining a register as well as in identifying materials by category. The ease of maintaining the inventory as material is received needs to be considered during the design of the facility.

4.9.2 Scale drawings

A document box should be installed at the main gate entrance to the HHW storage facility which would contain the following information for facility staff and fire and emergency services:

- an up to date inventory of the total chemicals held in the facility by volume/weight and type (P1-P9), with any storage areas for flares clearly identified
- scale drawings of the facility showing:
  - storage location and capacity of HHW by type (P1-P9), with specific reference to storage areas for gas cylinders and flares
  - isolation of services (e.g. electricity, gas, water)
  - site drainage (sewer and stormwater)
  - fencing
  - signs
  - fire hydrants and hose reels
  - storage areas for PPE
  - spill response equipment
  - emergency shower and eyewash facilities.
- a staff contact list.

Copies should also be held in the site office and be readily available to staff and emergency services personnel.

5 WHERE TO GO FOR MORE INFORMATION

It is important that all HHW acceptance and storage facility designers, depot operators and their staff are aware of current government Acts and Regulations, as well as the license conditions imposed by the relevant regulatory agencies. Contact details and other information on state government departments and agencies that have requirements for the safe collection and storage of chemicals are provided below. These agencies can provide technical advice.

5.1 Relevant Western Australian government departments and agencies

Department of Environment Regulation (DER)

The Atrium, Level 4, 168 St Georges Terrace, Perth

Telephone: (08) 6467 5000

Telephone emergency: 1300 784 782 (Pollution Watch, 24 hours)

Email: info@der.wa.gov.au

Internet: www.der.wa.gov.au

- *Environmental Protection Act 1986*
- Environmental Protection Regulations 1987
- Environmental Protection (Controlled Waste) Regulations 2004
- Environmental Protection (Unauthorised Discharges) Regulations 2004. Licence conditions as set for each individual waste transfer station or landfill.

Department of Mines and Petroleum (DMP)
Resources Safety Division, Dangerous Goods Safety Branch

Mineral House, 100 Plain Street, East Perth

Dangerous goods enquiries , telephone: (08) 9358 8001 or 9358 8002

Email: dgsb@dmp.wa.gov.au

Internet: www.dmp.wa.gov.au

- *Dangerous Goods Safety Act 2004*
- Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2007
- Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007
- Dangerous Goods Safety (Explosives) Regulations 2007
- Guidelines, Guidance Notes, Codes of Practice and a list of Australian Standards relevant to dangerous goods storage and handling are available at the DMP website (www.dmp.wa.gov.au/6680.aspx#8955).

Department of Commerce–WorkSafe

1260 Hay Street, West Perth

Telephone: 1300 307 877 or (08) 9327 8777

Email: safety@commerce.wa.gov.au

Internet: www.commerce.wa.gov.au/WorkSafe/

- *Occupational Safety and Health Act 1984*
- Occupational Safety and Health Regulations 1996

Department of Fire and Emergency Services (DFES)

Emergency Services Complex

20 Stockton Bend

Cockburn Central WA 6164

Telephone: (08) 9395 9300

Emergency: 000

Internet: www.dfes.wa.gov.au

- Guidelines for the preparation of special risk plans

ChemCentre (WA)

Resources and Chemistry Precinct, South Wing, Building 500, South Entrance Drive (off Manning Road), Curtin University, Bentley

Telephone: (08) 9422 9800

Email: enquiries@chemcentre.wa.gov.au

Internet: www.chemcentre.wa.gov.au

- Information and inspection service to identify unknown chemicals

5.2 Australian standards

The following standards relate to the storage and handling of chemicals and are available from Standards Australia at www.saiglobal.com/shop.

- *AS/NZS 1596:2002 The storage and handling of LP Gas*
- *AS 1603 Automatic fire detection and alarm systems*
- *AS 1670 Fire detection, warning, control and intercom systems*
- *AS 1678.8A1:2004 Emergency procedure guide – Transport - Group text EPGs for Class 8 substances – Corrosive substances*
- *AS 1692:2006 Steel tanks for flammable and combustible liquids*
- *AS 1940:2004 The storage and handling of flammable and combustible liquids*
- *AS 2444:2001 Portable fire extinguishers and fire blankets: selection and location*
- *AS 2507:1998 The storage and handling of agricultural and veterinary chemicals*
- *AS 2714:1993 The storage and handling of hazardous chemical materials – Class 5.2 substances (organic peroxides)*
- *AS 2865:2001 Safe working in a confined space*
- *AS 3780:1994 The storage and handling of corrosive substances*
- *AS/NZS 3833:1998 The storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers*
- *AS 4326:1995 The storage and handling of oxidizing agents*
- *AS 4332:2004 The storage and handling of gases in cylinders*
- *AS/NZS 4452:1997 The storage and handling of toxic substances*
  - AS/NZS 1020: The control of undesirable static electricity
  - AS/NZS 1851: Maintenance of fire protection systems and equipment [all Parts]
  - AS 1894: The storage and handling of non-flammable cryogenic and refrigerated liquids
  - AS/NZS 2022: Anhydrous ammonia – Storage and handling
  - AS/NZS 4081: The storage and handling of liquid and liquefied polyfunctional isocyanates
  - AS/NZS 4681: Storage and handling of class 9 (miscellaneous) dangerous goods and articles
  - AS/NZS 1716: Respiratory protective devices
  - AS/NZS 60079.10.1: Explosive atmospheres – Classification of areas – Explosive gas atmospheres
  - AS/NZS 60079: Electrical apparatus for explosive gas atmospheres (all parts)

References

HB 76:2004 Dangerous goods – Initial emergency response guide

EMRC, Safe Work Procedure for Handling of Unwanted Household Hazardous Substances at Red Hill Waste Disposal Facility, May 2008

NOHSC, Storage and Handling of Workplace Dangerous Goods, National Code of Practice [NOHSC 2017: 2001], March 2001

WA Department of Environment, Operational Guidelines for the Safe Storage of Chemicals at Local Government Drop-off Centres, date unknown

WA Department of Mines and Petroleum, Storage and Handling of Dangerous Goods, Code of Practice, 2010.

Appendix 1 Risk assessment worksheet

Overview

Organisation	
Location / Facility	
Name of Assessor	
Date of Assessment	
Date to be reassessed	
Specialist Advice	

Site Description	

Hazard identification, assessment and control

Hazards	Hazard Events	L x S = Risk	Control Measures (Existing or Required)
Hazards arising from HHW Materials • Compressed gas / flammable • Corrosive • Explosive (flares only) • Flammable • Flammable / toxic • Flammable gas • Flammable gas / toxic • Low level ecotoxic • Low level toxic / corrosive • Radioactive – toxic • Reactive • Reactive / flammable • Toxic			

Hazards	Hazard Events	L x S = Risk	Control Measures (Existing or Required)
Hazard arising from storage and handling ***Structures, plant or equipment*** used in the storage or handling of materials including: • A container (including tank or package) • Shelves or racks used for storage • A spill containment system • A vehicle used for the transport or transfer of materials such as a forklift • Pipework and associated valves or pumps • Firefighting or fire protection system ***Systems of work*** involved in accepting HHW materials from householders, transferring these materials to the HHW storage facility, and the regular clearance of the facility for treatment, recycling or disposal of the materials. ***Chemical reactions*** that result in a chemical change in one or more of the goods when they come into contact (e.g. an oxidising agent such as pool chlorine coming into contact with a material such as brake fluid). ***Physical processes*** include dilution, , abrasion, phase change, leaching and absorption.			

Hazards	Hazard Events	L x S = Risk	Control Measures (Existing or Required)
Hazards within the site of the facility • any adjacent dangerous goods storages • the proximity of other work areas • including on-site offices • plant used or moved on the site (e.g. ignition sources from engines) • vehicle movements on the site • deliveries of other dangerous goods • transfer of HHW materials between containers on the site • personnel movements in normal and emergency situations • visitor access, and unauthorised access to the HHW drop-off area or storage facility • portable sources of ignition, generation of static electricity • fire hazards including buildings, concentrations of combustible material and uncontrolled vegetation • weather conditions such as temperature extremes, wind, lightning, or rainfall including the potential for flooding.			

Hazards	Hazard Events	L x S = Risk	Control Measures (Existing or Required)
Hazards external to the site of the facility • any dangerous goods or incompatible substances stored at other adjacent premises or public places • activities, facilities or installations on neighbouring premises that could create a hazard (e.g. an ignition source) • the effects of infrastructure such as a road, rail line, airport, pipeline, power line, radio transmitter or telephone tower • fire hazards, including concentrations of combustible material or uncontrolled vegetation on neighbouring premises or public areas.			
Hazards indicated by past incidents Accidents, spills, incidents and near misses that involved storage and handling of HHW materials at the facility and at other facilities including the nature and cause of the incident, and the effectiveness of controls and how they could be improved. Security considerations – investigate any history of break ins at the site.			

Implementation of controls

Control required	Action by	Action due

Appendix 2 Hazards arising from HHW materials and possible controls

The table below outlines the hazards arising from HHW materials commonly accepted at HHW storage facilities and possible risk control measures.

Hazard	Material	Hazard events	L / S / Risk	Possible controls
Compressed gas / flammable	Gas cylinders – other / propane	Container failure Container dropped Vehicle collision Shelving collapse Ignition of atmosphere Adjacent fire	3 / 2 / Medium 3 / 2/ Medium 2 / 4 / Medium 2 / 4 / Medium 3 / 4 / High 1 / 4 / Medium	Emergency response Procedures and training Store separate from traffic Do not stack cylinders Store securely and separately outdoors Separation / fire suppression / emergency response
Compressed gas / low oxygen atmosphere	Fire extinguishers – non-halon	Container failure Container dropped Vehicle collision Shelving collapse	3 / 2 / Medium 3 / 2/ Medium 2 / 4 / Medium 2 / 4 / Medium	Emergency response Procedures and training Separation from vehicles Do not stack cylinders
Corrosive	Acids Alkalis Batteries – lead acid Batteries – nickel cadmium / other	Container failure Container dropped Vehicle collision Shelving corrosion Shelving collapse Mixing of incompatible substances	3 / 2 /Medium 3 / 2 /Medium 2 / 4 / Medium 2 / 2 / Low 2 / 4 / Medium 3 / 4 / High	Use intermediate containers / spill containment Use intermediate container / procedures and training Do not stack lead acid batteries Store separate from traffic Use intermediate containers Store acids and alkalis separately, procedures
Explosive	Flares	Explosion and fire	2 / 3 / Medium	Store in segregation device
Flammable	Flammable liquids – hydrocarbons, fuels and solvents Flammable Solids Paint – solvent based	Container failure in store Vehicle collision Shelving collapse Ignition of atmosphere Adjacent fire	3 / 2 / Medium 2 / 4 / Medium 2 / 3 / Medium 3 / 4 / High 1 / 4 / Medium	Use intermediate containers / spill containment Store separate from traffic Ensure adequate shelving design Isolate from ignition / security / ventilate store Separation / fire suppression / emergency response

Flammable / toxic	Paint – other, including isocyanates and amines	Container failure in store Vehicle collision Shelving collapse Ignition of atmosphere Adjacent fire	3 / 2 / Medium 2 / 5 / High 2 / 3 / Medium 3 / 4 / High 1 / 4 / Medium	Use intermediate containers / spill containment Store separate from traffic Ensure adequate shelving design Isolate from ignition / security / ventilate store Separation / fire suppression / emergency response
Flammable gas	Aerosols – CFC based / flammable	Container failure Ignition of atmosphere Adjacent fire	3 / 1 / Low 3 / 4 / High 1 / 4 / Medium	Emergency response Isolate from ignition / ventilate store Separation / fire suppression / emergency response
Flammable gas / toxic	Aerosols – flammable, pesticide	Container failure Ignition of atmosphere Adjacent fire	3 / 1 / Low 3 / 4 / High 1 / 4 / Medium	Emergency response Isolate from ignition / ventilate store Separation / fire suppression / emergency response
Low level ecotoxic	Paint – recyclable Paint – water based	Container failure Container dropped Vehicle collision Shelving collapse	3 / 1 / Low 3 / 1 / Low 2 / 2 / Low 2 / 1 / Very low	Use intermediate containers / spill containment Spill containment / emergency response Store separate from traffic, environment Ensure adequate shelving design
Low level toxic / corrosive	General household chemical	Container failure Container dropped Vehicle collision Shelving collapse Shelving corrosion Mixing of incompatible substances	3 / 1 / Low 3 / 1 / Low 2 / 2 / Low 2 / 1 / Very low 2 / 1 / Very low 2 / 2 / Low	Use intermediate containers / spill containment Spill containment / emergency response Store separate from traffic, environment Ensure adequate shelving design Use intermediate containers Store acids and alkalis separately
Radioactive – toxic	Low level radioactive substances	Container failure	3 / 1/ Low	Use intermediate container
Reactive	Oxidising agents e.g. pool chlorine	Container failure Container dropped Vehicle collision Mixing of incompatible substances	3 / 3 / Medium 3 / 3 / Medium 2 / 4 / Medium 3 / 4 / High	Use separate cabinet with internal bunding As above Separate store from traffic Use separate cabinet, operating procedures

Reactive / flammable	Organic peroxides	Container failure Container dropped Vehicle collision Mixing of incompatible substances Ignition of materials Adjacent fire	3 / 3 / Medium 3 / 3 / Medium 2 / 4 / Medium 3 / 4 / High 2 / 4 / Medium 1 / 4 / Medium	Use separate cabinet with internal bunding As above Separate store from traffic Use separate cabinet, operating procedures Isolate from ignition Separation / fire suppression / emergency response
Toxic	Arsenic based products Cyanide Fluorescent tubes and light fittings Heavy metal compounds / Mercury – elemental Paint – metal based PCB materials Solvents – halogenated	Container failure Container dropped Vehicle collision Shelving collapse	3 / 3 / Medium 2 / 3 / Medium 2 / 4 / Medium 2 / 3 / Medium	Use intermediate containers / spill containment Use intermediate container Store separate from traffic Ensure adequate shelving design
Toxic / flammable	Pesticides – non Schedule X (non-organochlorine)	Container failure Container dropped Vehicle collision Shelving collapse Ignition of atmosphere Adjacent fire	3 / 3 / Medium 2 / 3 / Medium 2 / 4 / Medium 2 / 3 / Medium 2 / 4 / Medium 1 / 4 / Medium	Use intermediate containers / spill containment Use intermediate container Store separate from traffic Ensure adequate shelving design Isolate from ignition / ventilate store Separation / fire suppression / emergency response
Toxic / flammable / ecotoxic	Pesticides – Schedule X (organochlorine)	Container failure Container dropped Vehicle collision Shelving collapse Ignition of atmosphere Adjacent fire	3 / 3 / Medium 2 / 3 / Medium 2 / 4 / Medium 2 / 3 / Medium 2 / 4 / Medium 1 / 4 / Medium	Use intermediate containers / spill containment Use intermediate container Store separate from traffic, environment Ensure adequate shelving design Isolate from ignition / ventilate store Separation / fire suppression / emergency response

Appendix 3 Material categories

HHW storage facility categories

Facilities participating in the HHW Program should segregate materials into at least the following categories for storage and reporting purposes:

P1: Toxics

P2: Flammable liquids

P3: Corrosive – acids

P4: Corrosive – alkalis

P5: Flammable solids

P6: Oxidisers

P7: Miscellaneous DG

P8: Miscellaneous non-DG

P9: Unknowns

These categories replace the Groups formerly used:

Group A: Garden chemicals, pesticides and poisons

Group B: Flammable liquids and ethylene glycols

Group C: Corrosive 8 (acids and alkalis) and flammable solids

Group D: Dangerous goods and sanitisers

Group E: Miscellaneous

Group F: Unknowns

Categorising materials accepted through the HHW Program

The table below lists all of the materials accepted through the HHW Program, and outlines the relationship between HHW material type, dangerous goods class , storage categories (used by HHW storage facilities), and the older HHW group classification formerly used by some HHW storage facilities (A-F).

Materials accepted through the HHW Program	DG Class (as per the ADG Code)	Storage Facility Category (Used by HHW storage facility to sort and store HHW)	Older HHW Group Classification System (A-F)
Cyanides	6 Toxics	P1: Toxics	Not covered
Heavy metal compounds	6 Toxics		Not covered
Mercury – elemental	6 Toxics		Not covered
Paint – metal based	6 Toxics		Not covered
Paint – other, including isocyanates and amines	6 Toxics		Not covered
PCB materials	6 Toxics		Not covered
Pesticides – non Schedule X	6 Toxics		A
Pesticides – Schedule X	6 Toxics		A
Solvents – halogenated	6 Toxics		Not covered
Toxics	6 Toxics		Not covered
Arsenic based products	6 Toxics		A
Flammable liquids – hydrocarbons, fuels and solvents	3 Flammable liquids	P2: Flammable liquids	B
Paint – solvent based, including resins and adhesives	3 Flammable liquids		B
Acids	8 Corrosives	P3: Corrosive – acids	C
Batteries – lead acid	8 Corrosives		C
Alkali	8 Corrosives	P4: Corrosive – alkalis	C
Flammable solids (e.g. Phosphorus)	4 Flammable solids	P5: Flammable solids	C

Materials accepted through the HHW Program	DG Class (as per the ADG Code)	Storage Facility Category (Used by HHW storage facility to sort and store HHW)	Older HHW Group Classification System (A-F)
Inorganic oxidising agents e.g. pool chlorine	5 Oxidisers	P6: Oxidisers	D
Organic peroxides (MUST BE KEPT SEPARATE)	5 Oxidisers		D
Aerosols – CFC based	2 Gases	P7: Miscellaneous DG	Not covered
Aerosols – flammable - paint and lacquers	2 Gases		Not covered
Aerosols – flammable - pesticide	2 Gases		Not covered
Batteries – nickel cadmium	9 Miscellaneous		Not covered
Batteries – other	9 Miscellaneous		Not covered
Batteries – lithium			
Batteries – lead acid			
Fire extinguishers – non-halon	2 Gases		Not covered
Flares	1 Explosives		E
Fluorescent tubes and light fittings	9 Miscellaneous		E
Gas Cylinders – other	2 Gases		E
Gas Cylinders – propane	2 Gases		E
General household chemical e.g. cleaners	9 Miscellaneous		C
Other (not in any of the above)	9 Miscellaneous		E
Low level radioactive substances e.g. smoke detectors	7 Radioactive Material		E
Paint – recyclable	Non DG	P8: Miscellaneous non-DG	Not covered
Paint – water based	Non DG		Not covered
Engine coolants and glycols	Non DG		E
Unknown liquids	9 Miscellaneous	P9: Unknowns	F
Unknown solids	9 Miscellaneous		F

Appendix 4 Materials guide (classification, hazards and examples)

Site Storage Category	HHW Material	DG Class	Hazard	Examples
NOT INCLUDED IN THE HOUSEHOLD HAZARDOUS WASTE PROGRAM –Contact your local council	Asbestos	9 Miscellaneous	Inhalation of asbestos dust or fibres is dangerous and therefore exposure to the dust must be avoided at all times	
NOT INCLUDED IN THE HOUSEHOLD HAZARDOUS WASTE PROGRAM –Contact your local council	Fire extinguishers – halon	2.2 Non-flammable non-toxic gas	Halon is not toxic to humans, but is a powerful ozone-depleting agent and thus an environmental pollutant. It should not be released to the atmosphere, but disposed of by appropriate methods	
NOT INCLUDED IN THE HOUSEHOLD HAZARDOUS WASTE PROGRAM –Contact your local council	Used oil	Combustible	**Other** Substances that may have the potential to cause harm to human health and the environment	Motor oil
NOT INCLUDED IN THE HOUSEHOLD HAZARDOUS WASTE PROGRAM –Contact your local council	Pharmaceuticals	6 Toxic (Some)	**Toxic** Any substance that has the ability to cause harm to human health and/or the environment	A wide variety of unwanted medicines or pharmaceuticals
NOT INCLUDED IN THE HOUSEHOLD HAZARDOUS WASTE PROGRAM –Contact your local council	Photographic chemicals	6 Toxic	**Toxic** Any substance that has the ability to cause harm to human health and/or the environment	Fixers, bleaches, neutralisers or developers
P1: Toxic	Arsenic based products	6 Toxic	**Toxic** Any substance that has the ability to cause harm to human health and/or the environment	Arsenic pesticides – solid or liquid Laboratory chemicals containing arsenic eg. arsenate of lead

Site Storage Category	HHW Material	DG Class	Hazard	Examples
P1: Toxic	Cyanide	6 Toxic	**Toxic** Any substance that has the ability to cause harm to human health and/or the environment	Sodium cyanide, potassium cyanide Laboratory chemicals containing cyanides
P1: Toxic	Heavy metal compounds Mercury	6 Toxic	**Toxic** Any substance that has the ability to cause harm to human health and/or the environment	'Heavy metals' is an ill-defined term but generally includes elements that have metallic properties, such as zinc, lead, mercury, copper, chromium, cadmium, etc, whose compounds are frequently toxic to humans. Laboratory chemicals, copper sulfate, iron sulfate, zinc chloride (soldering flux), arsenate of lead, red lead, mercury, copper based algaecides, arsenicals etc
P1: Toxics	Paint – metal based	6 Toxic	**Toxic** Any substance that has the ability to cause harm to human health and/or the environment	Lead-based paint
P1: Toxics	Paint – other, including isocyanates and amines	3 Flammable 6 Toxic	**Flammable** Any substance that will ignite when exposed to spark or flame **Toxic** Any substance that has the ability to cause harm to human health and/or the environment	Paints containing isocyanates are frequently used in the automotive industry. Amines are sometimes used as cure retardants in automotive paints
P1: Toxics	PCB materials	6 Toxic	**Toxic** Any substance that has the ability to cause harm to human health and/or the environment	Capacitors, transformer oils

Site Storage Category	HHW Material	DG Class	Hazard	Examples
P1: Toxics	Pesticides – non Schedule X (non-organochlorine)	6 Toxic 3 Flammable	**Toxic** **Any substance that has the ability to cause harm to human health and/or the environment** **Flammable** **Any substance that will ignite when exposed to spark or flame**	Insecticides, herbicides, miticides, fungicides, fumigants and chemicals for destroying weeds, insects and fungus. Includes a wide range of organic chemicals such as carbamates, pyrethroids, organophosphates, etc. Organic laboratory chemicals
P1: Toxics	Pesticides – Schedule X (organochlorine)	6 Toxic 3 Flammable Liquid	**Toxic** **Any substance that has the ability to cause harm to human health and/or the environment** **Flammable** **Any substance that will ignite when exposed to spark or flame** **Organochlorine pesticides are persistent in the environment, and are specially regulated in all Australian States as 'Schedule X' chemicals**	Lindane, Dieldrin, Aldrin, Chlordane, Heptachlor, DDT
P1: Toxics	Solvents – halogenated	6 Toxic	**Toxic** **Any substance that has the ability to cause harm to human health and/or the environment**	Carbon tetrachloride, trichloroethylene, perchloroethylene, dichloromethane (methylene dichloride)
P1: Toxics	Toxics	6 Toxic	**Toxic** **Any substance that has the ability to cause harm to human health and/or the environment**	A wide variety of materials – eg strychnine, rat poison, etc
P2: Flammable Liquids	Flammable liquids – hydrocarbons, fuels and solvents	3 Flammable liquid	**Flammable** **Any substance that will ignite when exposed to spark or flame**	Petrol, kerosene, white spirits, brake fluids, thinners, mineral turpentine (turps), , degreasers, decarbonisers,

Site Storage Category	HHW Material	DG Class	Hazard	Examples
P2: Flammable liquids	Paint – solvent based	3 Flammable liquid	**Flammable** **Any substance that will ignite when exposed to spark or flame**	Enamels, lacquers
P3: Corrosive – acids	Batteries – lead acid	8 Corrosive	**Corrosive** **Any substance that burns, irritates or attacks tissue, skin, eyes and/or metals**	Automotive batteries, ferric chloride
P3: Corrosive – acids	Acids	8 Corrosive	**Corrosive** **Any substance that burns, irritates or attacks tissue, skin, eyes and/or metals**	Hydrochloric (muriatic), sulfuric, nitric#, hydrofluoric, phosphoric, , acetic acids, pH decreasers (pool acids) and cyanuric acid (pool stabilisers) #Nitric acid can also be a powerful oxidising agent (Subsidiary Risk Class 5.1)
P4: Corrosive – alkalis	Alkalis	8 Corrosive	**Corrosive** **Any substance that burns, irritates or attacks tissue, skin, eyes and/or metals**	Caustic soda (sodium hydroxide or NaOH), drain cleaner, oven cleaners, chemicals listed as buffers, caustic cleaners and pH increases (pool alkalis) , water solutions of ammonia, 'cloudy ammonia' and ammonia based cleaners, sodium hyperclorite solution (i.e. pool cleaner, bleach)
P5: Flammable solids	Flammable solids	4 Flammable solids	**Flammable** **Any substance that will ignite when exposed to spark or flame**	Phosphorus, sulfur, nathalene (moth balls) hexaline (fuel tablets for camping stoves), fire lighters
P6: Oxidisers	Organic peroxides	5.2 Organic peroxides	**Organic peroxides** **Can be explosive, can react violently with other substances, are highly flammable**	MEK peroxide. Benzyl peroxide

Site Storage Category	HHW Material	DG Class	Hazard	Examples
P6: Oxidisers	Oxidising agents e.g. pool chlorine	5.1 Oxidising agent	**Oxidisers** **Donate oxygen or can oxidize substances. Particularly dangerous when involved in a fire as they are a fire accelerant. May cause damage to skin or eyes as they can oxidize flesh.**	Calcium hypochlorite, sodium hypochlorite, swimming pool chlorine and sanitisers, hydrogen peroxide and other peroxides, potassium permanganate
P7: Miscellaneous DG	Aerosols – CFC – based Aerosols – flammable	2 Flammable gas	**Flammable** **Any substance that will ignite when exposed to spark or flame**	Furniture polishes, spray paints
P7: Miscellaneous DG	Aerosols – flammable, pesticide	2 Flammable gas 6 Toxic	**Flammable** **Any substance that will ignite when exposed to spark or flame Toxic** **Any substance that has the ability to cause harm to human health and/or the environment.**	Insecticide sprays
P7: Miscellaneous DG	Batteries – nickel cadmium Batteries – other	8 Corrosive (some)	**Corrosive** **Any solid, liquid or gaseous substance that burns, irritates or attacks tissue, skin, eyes and/or metals**	Household dry cell batteries, nickel-cadmium batteries, nickel hydride batteries, lithium batteries
P7: Miscellaneous DG	Fire extinguishers – non-halon	2.2 Non-flammable non-toxic gas (some)	**Some fire extinguishers contain carbon dioxide or nitrogen under pressure. These are non-flammable non-toxic gases, but may act as asphyxiants in high concentrations**	
P7: Miscellaneous DG	Flares	1 Explosive		Marine safety flares
P7: Miscellaneous DG	Fluorescent tubes and light fittings	6 Toxic	**Toxic** **Any substance that has the ability to cause harm to human health and/or the environment**	Fluorescent tubes and light bulbs may contain hazardous levels of mercury and other toxic heavy metals.

Site Storage Category	HHW Material	DG Class	Hazard	Examples
P7: Miscellaneous DG	Gas cylinders – propane	2 Flammable gas	**Flammable** **Any substance that will ignite when exposed to spark or flame**	LPG cylinders (barbeque gas bottles)
P7: Miscellaneous DG	General household chemical	Non-hazardous, or 8 Corrosive, or 9 Miscellaneous	**Other** **Substances that may have the potential to cause harm to human health and the environment**	Domestic cleaners, polishes Detergents are generally non-hazardous, but may present an environmental nuisance
P7: Miscellaneous DG	Low level radioactive substances e.g. smoke detectors	7 Radioactive		Smoke detectors –ionization type
P8: Miscellaneous non-DG	Paint – recyclable	Only water-based paints are generally considered to be recyclable. Water-based (acrylic) paints are not classified as Dangerous Goods in the Australian Dangerous Goods Code	**Other** **Substances that may have the potential to cause harm to human health and the environment.** **Water-based paints can be an environmental nuisance if spilled into waterways**	Water-based (acrylic) paints considered to be in good enough condition to be re-used or recycled
P8: Miscellaneous non-DG	Paint –- water–based	Water-based (acrylic) paints are not classified as dangerous goods in the Australian Dangerous Goods Code	**Other** **Substances that may have the potential to cause harm to human health and the environment.** **Water-based paints can be an environmental nuisance if spilled into waterways**	Acrylic paint
P8: Miscellaneous non-DG	Engine coolants and glycols	Non DG or 3 Flammable (some)	**Ethylene glycol, which is a common automotive antifreeze agent, is a flammable liquid**	Antifreeze, engine coolants, radiator inhibitors

Appendix 5 Storage categories for materials[1]

Listed below are likely materials that may be brought in and the relevant categories in which they should be stored before disposal.

MATERIAL	MATERIAL CATEGORY
Acetic acid	P3 Corrosives – acids
Aerosols	P7 Miscellaneous DG
Ammonia	P4 Corrosives – alkali
Ammonia based cleaners	P4 Corrosives – alkali
Antifreeze	P2 Flammable liquids
Arsenate of lead	P1 Toxics
Arsenicals	P1 Toxics
Batteries – lead acid	P3 Corrosives – acids
Batteries – nickel cadmium	P7 Miscellaneous DG
Batteries – other	P7 Miscellaneous DG
Benzene	P2 Flammable liquids
Bleach (liquid)	P4 Corrosives – alkali
Bleach–based cleaners	P4 Corrosives – alkali
Borax (sodium borate)	P8 Miscellaneous non DG
Brake fluid	P2 Flammable liquids
Bromine	P3 Corrosives – acids
Buffers	P4 Corrosives – alkali
Calcium hypochloirte	P6 Oxidisers
Caustic cleaners	P4 Corrosives – alkali
Caustic soda	P4 Corrosives – alkali
Cloudy ammonia	P4 Corrosives – alkali
Copper based algaecides	P1 Toxics
Copper sulphate	P1 Toxics
Creosote	P1 Toxics
Cyanides	P1 Toxics
Degreaser	P2 Flammable liquids
Drano	P4 Corrosives – alkali
Engine coolants	P8 Miscellaneous non DG
Ethylene glycol	P8 Miscellaneous non DG
Ferric chloride	P3 Corrosives – acids
Fire extinguishers – non-halon	P7 Miscellaneous DG
Flares	P7 Miscellaneous DG
Fluorescent tubes	P7 Miscellaneous DG

[1] Based on 'Operational Guidelines for the Safe Storage of Chemicals at Local Government Drop-off Centres', WA Dept of Environment, date unknown but prior to 1.7.2006, adapted to include reference to the new permanent facility storage categories P1 – P9

MATERIAL	MATERIAL CATEGORY
Fuel	P2 Flammable liquids
Fumigants	P1 Toxics
Fungicides	P1 Toxics
Gas cylinders – propane (LPG)	P7 Miscellaneous DG
Herbicides	P1 Toxics
Hydrochloric acid	P3 Corrosives – acids
Hydrofluoric acid	P3 Corrosives – acids
Hydrogen peroxide	P6 Oxidisers
Insecticides	P1 Toxics
Iron sulfate	P1 Toxics
Kerosene	P2 Flammable liquids
Lime (calcium oxide)	P4 Corrosives – alkali
Lime sulfur	P1 Toxics
Liquid hydrocarbons	P2 Flammable liquids
Low level radioactive substances (e.g. smoke detectors)	P7 Miscellaneous DG
Mercury	P1 Toxics
Methylated spirit	P2 Flammable liquids
Mineral turpentine (turps)	P2 Flammable liquids
Miticides	P1 Toxics
NaOH	P4 Corrosives – alkali
Naphthalene (mothballs)	P5 Flammable solids
Nitric acid	P3 Corrosives – acids
Organic peroxides	STORE SEPARATELY!
Oven cleaner	P4 Corrosives – alkali
Oxalic acid	P1 Toxic
Paint – metal based	P1 Toxics
Paint – other (including isocyanates and amines)	P1 Toxics
Paint – solvent–based	P2 Flammable liquids
Paint – water–based (acrylic)	P8 Miscellaneous non DG
PCB materials	P1 Toxics
Perchloroethylene	P1 Toxics
Peroxide	P6 Oxidisers
Pesticides	P1 Toxics
pH decreaser	P3 Corrosives – acids
pH increaser	P4 Corrosives – alkali
Phosphoric acid	P3 Corrosives – acids
Pool chlorine	see calcium hypochlorite and sodium hypochlorite
Potassium nitrate	P6 Oxidisers
Red lead	P1 Toxics

MATERIAL	MATERIAL CATEGORY
Rodenticides	P1 Toxics
Shellite	P2 Flammable liquids
Soda ash	P4 Corrosives – alkali
Sodium bicarbonate	P8 Miscellaneous non-DG
Sodium hydroxide	P4 Corrosives – alkali
Sodium hypochlorite	P4 Corrosives – alkali
Sodium metabisulphite	P1 Toxics
Solvents	P2 Flammable liquids
Strychnine	P1 Toxics
Sulfur	P5 Flammable solids
Sulfuric acid	P3 Corrosives – acids
Thinners	P2 Flammable liquids
Toluene	P2 Flammable liquids
Trichloroethylene	P1 Toxics
Unknown	P9: Unknowns
Unlabelled	P9: Unknowns
Welding flux	P8 Miscellaneous non-DG
White spirit	P2 Flammable liquids
Xylene	P2 Flammable liquids
Zinc chloride	P3 Corrosives – acids

Appendix 6 Examples of Packing Groups

Listed below are examples of Australian Dangerous Goods Code Packing Group I, II and III materials that might be brought into household hazardous waste storage facilities.

Packing Group I (these would be very rare, but **could** arise, particularly in rural areas)	• Aluminium phosphide (grain fumigant) • Arsenical pesticides (may be PG I or II) • Calcium cyanide (on contact with water produces highly toxic hydrogen cyanide gas) • Chloropicrin (used in the past as rabbit fumigant) • Hydrofluoric acid (>60% strength) • Diethyl ether • Hydrogen peroxide (>60% strength) • Strychnine • White phosphorus (used in the past as rabbit and crow poison)
Packing Group II	• Acetone (nail polish remover) • Petrol • Some arsenical pesticides • Calcium hypochlorite (‘solid pool chlorine’), with >39% available chlorine • Petrol • Methylated spirits • Methyl ethyl ketone (common solvent) • Hydrofluoric acid (<60% strength) • Hydrogen peroxide (>60% strength) • Isopropyl alcohol • Lithium batteries • Methanol • Concentrated hydrochloric acid • Potassium permanganate crystals or powder • Solid caustic soda (may be a component in drain cleaners) • Sulphuric acid (any concentration except fuming)
Packing Group III	• Solvent-based paint • Lead-acid batteries • Kerosene • Calcium hypochlorite (‘solid pool chlorine’) with 10-39% available chlorine • Ethyl alcohol (<70% strength) • Hydrogen peroxide (8-20% strength) • Metallic mercury • Naphthalene (old-style mothballs) • Dilute hydrochloric acid • Perchloroethylene (dry cleaning liquid) • Turpentine

Appendix 7 Australian Dangerous Goods Code Classes and Divisions

ADG Code Class/Division	Name	Examples
1	Explosives	Distress flares
2.1	Flammable gases	LP gas, butane
2.2	Non-flammable non-toxic gases	Oxygen, nitrogen, argon
2.3	Toxic gases	Ammonia, chlorine, methyl bromide
3	Flammable liquids	Petrol, kerosene, ethanol
4.1	Flammable solids	Sulfur, fire lighters
4.2	Spontaneously combustible substances	Phosphorous, steam activated carbon
4.3	Water reactive substances	Aluminum phosphide
5.1	Oxidising agents	Calcium hypochlorite, ammonium nitrate
5.2	Organic peroxides	Methyl ethyl ketone peroxide (MEKP)
6.1	Toxic substances	Sodium cyanide, pesticides, phenyl based cleaners
6.2	Infectious substances	Hospital waste (NOTE: this class of dangerous goods is not accepted through the HHW Program, and should not be stored in HHW storage facilities)
7	Radioactive substances	Luminous light sources, smoke detectors
8	Corrosive substances	Hydrochloric acid, sodium hydroxide
9	Miscellaneous dangerous goods	PCBs, dry ice