Environmental Protection Authority
Te Mana Rauhī Taiao

Secondary Containment Systems

HSNOCOP 47

April 2012

APPROVED CODE OF PRACTICE

UNDER THE HAZARDOUS SUBSTANCES AND NEW ORGANISMS (HSNO) ACT 1996

New Zealand Government

Preface

This Code of Practice HSNOCOP 47 Secondary Containment Systems is approved pursuant to Sections 78 and 79 of the Hazardous Substances and New Organisms Act 1996 (HSNO Act).

It is confirmed that the requirements of Sections 78 and 79 have been met.

This publication is approved as a means of compliance with:

- Hazardous Substances (Emergency Management) Regulations; regulations 35, 36, 37, 38, 39 and 41, and,
- Schedule 7 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended); Variations to control – Hazardous Substances (Emergency Management) Regulations 2001 – Regulations 37 and 38: and,
- Schedule 9 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) clause 1; and,
- Site and Storage Conditions for Class 3.1 Flammable Liquids; clauses 59 to 62, 64 and 65; and,
- Site and Storage Conditions for Class 4 Substances; clauses 29 to 32 and 34; and,
- Site and Storage Conditions for Class 5.1.1 Oxidising Substances and Class 5.2 Organic Peroxides; clauses 44 to 47 and 49; and,
- Site and Storage Conditions for Toxic, Corrosive and Ecotoxic Substances; clauses 10 to 13 and 15.

Approval of the code is limited to those matters in the code that relate to legislative requirements under the HSNO Act and its regulations.

The intended publication date in the Gazette for the notice of approval is 10th May 2012.

Pursuant to s 80(1) of the HSNO Act, this Code may be inspected on request at the Wellington office of the EPA, BP House (Level 1), 20 Customhouse Quay, Wellington.

Pursuant to section 80(1)(b) of the HSNO Act, a copy of this Code is available from the EPA website: www.epa.govt.nz.

Approved this 24th day of April 2012

Rob Forlong
Chief Executive, Environmental Protection Authority

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1. Purpose and Scope

1.1. Purpose

The controls for hazardous substances that are liquids, or are likely to liquefy in a fire, include a requirement to be able to capture the substances in the event they are released from their primary container. This is achieved by means of a secondary containment system.

The purpose of this approved Code is to provide a practical means of meeting the controls for secondary containment systems. The Code seeks to address the range of secondary containment options a person in charge is likely to face when developing a new site or making significant changes to an existing site.

1.2. Scope

Secondary containment is one aspect of wider emergency management provisions for hazardous substances. This Code provides options for meeting the requirements of secondary containment systems for sites having pooling hazardous substances in above ground containers including bulk tanks, transportable containers and packages.

Compliance with this Code does not obviate the requirement to comply with other sections of the Hazardous Substances and New Organisms (HSNO) Act and regulations, and with other legislation such as the Health and Safety in Employment (HSE) Act 1992, the Resource Management Act 1991 (RMA) and the Building Act 2004.

This Code is applicable to sites designed and constructed subsequent to the date of approval. Notwithstanding this, persons in charge of sites constructed prior to this date may elect to use elements of this code or the code in its entirety.

It is not possible in a code of this nature to provide detailed requirements. Persons in charge should obtain specialist advice for their sites.

This publication is a means of compliance with:

- Hazardous Substances (Emergency Management) Regulations; regulations 35, 36, 37, 38, 39 and 41
- Schedule 7 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended); Variations to control – Hazardous Substances (Emergency Management) Regulations 2001 – Regulations 37 and 38
- Schedule 9 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) clause 1
- Site and Storage Conditions for Class 3.1 Flammable Liquids; clauses 59 to 62, 64 and 65
- Site and Storage Conditions for Class 4 Substances; clauses 29 to 32 and 34
- Site and Storage Conditions for Class 5.1.1 Oxidising Substances and Class 5.2 Organic Peroxides; clauses 44 to 47 and 49
- Site and Storage Conditions for Toxic, Corrosive and Ecotoxic Substances; clauses 10 to 13 and 15.

Approval of the code is limited to those matters in the code that relate to legislative requirements under the HSNO Act and its regulations.

1.3. Exclusions

The following situations are not specifically provided for in this Code:

- Stationary containers with integral secondary containment.
- Below ground stationary containers.
- Secondary containment systems for stationary containers within buildings.
- Secondary containment systems for sites in operation prior to the date of approval of this Code. This includes sites that are subject to a compliance plan (clause 5, Schedule 9 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended). This Code does not supersede these compliance plans but the person in charge may elect to use elements of this Code to assist in complying with the compliance plan.
- Small scale use of hazardous substances in research and development or teaching laboratories.
- Containment of explosives.

The examples provided in this Code are not intended to be used as technical specifications. The design and construction of each secondary containment system must be supported by technical documentation.

1.4. The HSNO Act and Codes of Practice

The HSNO Act enables codes of practice to be approved by the EPA:

1. To identify acceptable solutions to regulatory requirements. An approved code of practice of this nature provides users with a method of meeting the control requirements with a degree of prescription and assistance. Such codes are not mandatory, but act as a defence to prosecution in accordance with the provisions of section 117(3) of the HSNO Act.
2. In accordance with specific provisions of the HSNO regulations, gazetted transfer notices and Group Standards which permit codes of practice to be approved by the Authority as alternatives to other specified requirements, provided they can be shown to provide an equivalent level of safe management.

This Code is approved in accordance with the first of these of these options and is therefore a method of meeting the control requirements but is not mandatory.

1.5. Secondary containment systems

Containment of a liquid hazardous substance is provided by the primary container, e.g. a package, a drum, a bulk tank. It is expected that in everyday storage a substance will be contained in this primary container. To deal with a breach of the primary container, a secondary containment system is required. This must be designed to contain the substance, and enable the safe collection of it. The threshold quantities above which secondary containment is required depend on the hazard classification of the substance and the size of the container.

Secondary containment systems apply to pooling substances, that is, hazardous liquids and hazardous substances that may liquefy in a fire. By containing a spill and enabling its recovery, the secondary containment systems can prevent a potential emergency from escalating to a point where the staff at the site, the public, or the environment is at risk.

Fires at tank farms or earthquakes in the area of storage facilities are occurrences that might cause failure of primary containers and therefore need a secondary containment system. On a smaller scale, spills can result from handling incidents in package stores or failure of operational procedures, e.g. valve left open.

Secondary containment systems are required for the duration of storage on site. This includes the life time of tanks and the period of storage for packages and drums. In the event of deterioration of the secondary containment system, its integrity must be restored as soon as possible.

Secondary containment systems must be designed for their intended purpose. A small detail of design or a lack of maintenance can result in a cost that is out of proportion to the cause.

1.6. Terminology

For users of this Code, the terms “shall” and “must” have the meaning that the provision is mandatory for the application of this Code. These provisions must be in place for the code to be used as a defence to prosecution. The term “should” has the meaning that the provision is a recommendation and provides advice on good practice.

The terms “normative” and “informative” have been used in this Code to define the application of each appendix which they apply to. A “normative” appendix is an integral part of this Code whereas an “informative” appendix is for information and guidance.

In addition, readers are referred to section 9 for interpretation of terms used in this Code.

2. The HSNO Act

2.1. Purpose of Act

The purpose of the HSNO Act is to protect the environment as well as the health and safety of people and communities, by preventing or managing the adverse effects of hazardous substances and new organisms.

2.2. The control framework for hazardous substances

Controls on hazardous substances are made under the HSNO Act by:

- Regulations
- Transfer Notices
- Group standards
- Approvals of substances
- Reassessments of substances

2.3. Regulations

Regulations made under the HSNO Act specify generic controls for the hazardous substances. Some regulations encompass all hazard classes and some encompass specific hazard classes.

2.4. Transfer Notices

A transfer notice is a notice in the Gazette and is an approval for specific hazardous substances. Each transfer notice may vary the generic controls such that the controls are specific to the individual substances transferred.

Substances approved by transfer notice may have specific variations encompassed in that transfer notice. Substances transferred in the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 have variations associated with secondary containment systems are included in:

- Schedule 6 for petrol, aviation gasoline, racing gasoline, kerosene or diesel fuel stored on a farm, and
- Schedule 6 for petrol, aviation gasoline, racing gasoline, kerosene or diesel fuel stored for temporary use, and
- Schedule 6 for petrol, varying the 3.1A threshold quantity from 100 litres to 1000 litres, and
- Schedule 7 for substances which do not have a flammable hazard classification, and
- Schedule 9 clauses 1 and 2 for the storage of large quantities of flammable substances in bulk. This specifies maximum quantities within a secondary containment system, trigger for intermediate secondary containment and provisions for approval to modify aggregate quantities, and
- Schedule 9 clause 3 to enable the secondary containment system capacity to be less than 110% of the capacity of the largest stationary container, and
- Schedule 9 clauses 4, 5 and 6 enable transitional provisions including compliance plans.

Individual substances are subject to reassessment so the information in the Gazette Notices may not now be applicable. The EPA maintains a controls register and this should be referred to. This register is at:
http://www.epa.govt.nz/search-databases/Pages/controls-search.aspx

2.5. Group standards

A group standard is an approval for a group of hazardous substances which have a similar nature or type or which have similar circumstances of use. The HSNO controls are consolidated into the group standard and the applicable site and storage conditions. If a hazardous substance is nominated to a group standard then the controls of that group standard and the applicable site and storage conditions are required to be followed.

2.6. Hazard Classes

Hazardous substances are classified in accordance with their inherent properties and the Hazardous Substances (Classification) Regulations 2001. The hazard classes are:

- Class 1 – explosiveness;
- Class 2 – flammability, gases;
- Class 3 – flammability, liquids;
- Class 4 - flammability, solids;
- Class 5 - capacity to oxidize;
- Class 6 - toxicity;
- Class 8 - corrosiveness;
- Class 9 - ecotoxicity.
- (Class 7 is unallocated; radioactivity is subject to separate legislation)).

Each class is then split into sub classes and is also assigned a character in accordance with the degree of hazard. Each hazardous substance is given a series of hazard classes in accordance with the properties of the substance, for example petrol has hazard classifications 3.1A, 6.1E, 6,3B, 6.7B, 9.1B. Refer to Appendix 20 for further details of hazard classes.

Each hazardous substance is required to have safety data sheets available. The safety data sheets, available from substance suppliers, are required to have the hazard classifications included on them.

2.7. Requirement for Secondary Containment Systems

The default generic requirements for secondary containment systems for above ground containers are specified in:

- Regulations 35, 36, 37, 38, 39 and 41 of the Hazardous Substances (Emergency Management) Regulations for substances that were approved by transfer notice, and
- Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004, Schedule 9 clause 1, and
- Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004, Schedule 7 clause Control - Hazardous Substances (Emergency Management) Regulations 2001, and
- Group standards site and storage conditions..

The controls specified in the group standard site and storage conditions reflect the controls that are specified in the regulations.

Each site must be assessed for secondary containment requirements. Appendix 16 and Appendix 17 of this Code provide template registers for assessing secondary containment system requirements based on the substances held at the site.

2.8. Other Regulatory Requirements

Further requirements may also be specified in other legislation such as rules in district and regional plans under the RMA. These requirements are not included in this Code and readers of this Code should become familiar with the requirements of the RMA.

2.9. Duties of Person in Charge

The Person in Charge is an individual who is in control or possession of the relevant part of the site where the hazardous substances are present. This could be the owner, lessee, sub-lessee or occupier of the place, location or depot.

The Person in Charge is responsible for ensuring that the specified controls are in place and are being followed. This includes a secondary containment system. The following extract from regulation 25 of the Hazardous Substances (Emergency Management) Regulations 2001 indicates the obligation on the person in charge.

25 Duties of persons in charge of places under this Part;

(1) This Regulation applies to a place if-

there is held in it, or reasonably likely to be held in it on occasion, an aggregate quantity of hazardous substances of a particular hazard classification greater than the quantity specified in Schedule 4; and it is not an aircraft subject to the Civil Aviation Act 1990 or a ship subject to the Maritime Transport Act 1994.

(2) Subject to regulations 36(3) and 42(2), a person in charge of a place to which this regulation applies must ensure that the requirements of this part are complied with…."

3. Major Principles

The intent of a secondary containment system is to contain the hazardous substance that may be spilled from a container. It may also form part of the emergency response plan to cope with response operations.

Typical containers that require secondary containment systems are stationary tanks, process containers and packages such as drums and small packs. The secondary containment system around a tank is typically a compound with walls.

3.1. Business Activity

The requirement for secondary containment systems is applicable regardless of the nature of the business activities at the place. For example, secondary containment systems are required for commercial premises, retail outlets, industrial factories and distribution centres.

3.2. Threshold Quantities

The threshold quantities for substances requiring a secondary containment system are reproduced in Appendix 1 of this Code. Storage above these quantities requires a secondary containment system, irrespective of the type of storage, e.g. stationary tanks, drums or packages.

When applying Appendix 1, each of the hazard classes assigned to the substances must be individually considered. For example diesel fuel has hazard classifications 3.1D, 6.1E, 6,3B, 6.7B, 9.1B. It is hazard classification 9.1B that triggers a requirement for secondary containment, i.e. secondary containment is triggered at 1000 litres (see special case in Section 5.1 below for farm tanks installed prior to April 2004).

Some substances have had specific variations made to the secondary containment thresholds, for example petrol has hazard classifications 3.1A, 6.1E, 6,3B, 6.7B, 9.1B. However, the variation for petrol in Schedule 6 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 varies the secondary containment threshold quantity for petrol to 1000 litres.

Variations to threshold quantities for substances are listed on the EPA database at:
http://www.epa.govt.nz/search-databases/Pages/controls-search.aspx

The threshold quantity for a secondary containment system is the same as the threshold quantity for Level 3 emergency procedures, including preparing emergency response plans. These response plans should provide for recovering hazardous substances from the secondary containment system, and where necessary, for treating the hazardous substance to enable disposal of it.

Workrooms[1] require secondary containment at 100% of the total pooling potential. This is irrespective of the quantity of substances held in the room i.e. there is no minimum threshold quantity

[1] Type 1, Type 2 and Type 3 buildings as defined in Schedule 10 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 and also in the Site and Storage Conditions.

3.3. Capacity of Secondary Containment System

The minimum required capacities of secondary containment systems are specified in the Hazardous Substances (Emergency Management) Regulations, Schedule 7 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 and group standards. The following table is a summary of these.

Minimum secondary containment capacity for hazardous substances with flammable classification.

Container Size Categories	**Quantity – Total Pooling Potential (TPP)**	
	Less than 5,000 litres	**Greater than or equal to 5,000 litres**
≤ 60 litres	At least 50% TPP	2,500 L or 25% TPP whichever is the greater
> 60 and up to 450 litres	At least 100% TPP	5,000 L or 50% TPP whichever is the greater
> 450 litres	At least 110% of the capacity of the largest container	
Workrooms[2] require secondary containment at 100% of the TPP.		

Minimum secondary containment capacity for classes 6, 8 and 9 substances that are not also flammable.

Container Size Categories	**Quantity – Total Pooling Potential (TPP)**	
	Less than 20,000 litres	**Greater than or equal to 20,000 litres**
≤ 60 litres	At least 25% TPP	5000 L or 5% TPP whichever is the greater
> 60 and up to 450 litres	At least 25% TPP or 110% of the largest container whichever is greater	5,000 L or 5% TPP whichever is the greater
> 450 litres[2]	At least 110% of the capacity of the largest container	

The following shall apply:

3. Where two or more containers of differing container size categories are located in the same secondary containment system, the capacity of the secondary containment system shall be at least the sum of each required secondary containment capacity of container category.

   An example of this is a situation whereby 20x209 litres of a class 3.1 C substance are located in a compound with 2x1000 litre IBCs of the same substance.

   Using the table above the secondary containment capacity required for each of the categories is:

   · 20x209 litre drums - 100% of the TPP, that is 4180 litres.

   · 2x 1000 litre IBCs - 110% of the largest container, 1100 litres.

   The sum of these two categories is 4180 + 1100 = 5280 litres.

[2] Type 1, Type 2 and Type 3 buildings as defined in Schedule 10 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 and also in the Site and Storage Conditions.

4. The capacity of a container is:
   a. For process vessels – the overflow point capacity.
   b. For vertical stationary tanks - the capacity up to the roof to shell joint.
   c. for horizontal tanks - the total enclosed volume.
5. The volume of isolatable piping connecting stationary containers or process containers is not considered in the secondary containment system capacity requirement.
6. In situations that rely on achieving a water bottom in the compound e.g. some clay lined compounds that require moisture for the clay to form a seal, the volume of water that is necessary to achieve this is in addition to the 110% containment capacity that is required.
7. Where stationary containers are interconnected and a spillage will entail the release of the contents of both or all of the containers, e.g. by a pipeline that is open, they are considered as one container.
8. A reduction in the capacity of the secondary containment system for containers greater than 450 litres capacity can be approved upon application to the EPA or permitted if the secondary containment system is designed in accordance with an approved code of practice. This reduced capacity must not be less than 100% of the capacity of the largest container located within the secondary containment system.
9. Consideration should be given to the management of fire fighting water in accordance with the provisions of the response plan. The compound should have a minimum containment volume of 20 minutes fire fighting water/foam at the design rate of application in addition to containing a spill from the largest container.

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3.4. Maximum Capacity of Secondary Containment System - Class 3.1 substances

The maximum aggregate quantity of flammable substances that are able to be located in a secondary containment system is specified in Schedule 9 of The Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) and the Site and Storage Conditions.

The aggregate quantity of flammable hazardous substances that may be held in a secondary containment system must not exceed 75,000,000 litres. This may be increased up to a maximum of 120,000,000 litres upon application to the EPA.

If the aggregate quantity of flammable liquid which is to be held within a secondary containment system is greater than 25,000,000 litres and the storage is in more than one stationary container, the stationary containers must be divided into groups. This quantity may be increased up to 40,000,000 litres upon application to the EPA. Each group must be separated from all other stationary containers within the secondary containment system by an intermediate secondary containment system (compound).

The capacity of the intermediate secondary containment system shall be at least 50% of the capacity of the largest stationary container within that group. The walls that form the subdivision of the secondary containment system shall be at least 250mm below the top of the lowest compound wall of the secondary containment system in which it is located.

The intermediate secondary containment system shall limit the impact of a minor spill from a single container. These spills are contained around the container that failed, thereby reducing the impact from allowing the spill to spread over a wider containment area. If the spill cannot be stopped and the quantity in the container is greater than the capacity of the intermediate secondary containment system, then the spillage will cascade into the major compound, that is, the adjacent intermediate compound.

3.5. Design

Design considerations of secondary containment systems include:

- The released substance shall be contained. This can include compliance with section 4.11 of this Code.
- Materials used to construct the secondary containment system shall be compatible with the substance stored i.e. have adequate corrosion resistance.
- The strength of the secondary containment system shall be adequate to retain the substance when the secondary containment system is full. The compound walls shall be able to withstand the hydrostatic pressure from the contained liquids. Consideration should be given to shock forces that may result from sudden container failure together with any waves that may be generated.
- Stationary tanks require secondary containment systems for the life of the storage tank. If the initial secondary containment system is not designed for the lifetime of the tank, it shall be repaired or replaced prior to its failure.
- Connections from a compound wall to the base of the compound shall be adequately sealed. This could include (non exclusive):
  - continuous pour from base to wall or
  - inserted leak stop barriers or
  - if earthen, following the intent of the examples in Appendix 4
- Incompatible substances shall be prevented from adversely affecting each other. Incompatible substances stored in stationary tanks shall have separate secondary containment systems. This shall not prevent dilute substances whose only action is to neutralise each other with minimal rise in temperature from being located in the same compound.
- For secondary containment systems about stationary tanks, the capacity requirements of clause 3.2 shall be complied with.
- Drainage from the secondary containment system shall be controlled.
- Consideration should be given to avoiding penetrations through compound walls and floors. Where penetrations are necessary, the provisions of clause 4.12 shall be complied with.
- A plan should be available to recover the substance released into the secondary containment system. All necessary equipment to achieve this should also be available.
- The compound walls shall be able to withstand the hydrostatic pressure from the contained liquids. Consideration should be given to shock forces that may result from sudden container failure together with any waves that may be generated.
- Where packages are stored, it may be necessary for the compound to have sloping ramps to allow vehicle access such as fork lift trucks.

3.6. Capture of Spillage

The secondary containment system shall be located so as to be able to capture a spillage from the primary container for all credible failure modes. Options to achieve this can include (amongst others):

- Locate the storage container, such that the top inside edge of the compound perimeter is inside the crest locus specified in Appendix 12, unless it can be demonstrated that a reduced distance would be suitable due to viscosity or other factors.
- Whilst the previous bullet point is preferred, in circumstances where:
    - only non flammable substances are stored in the storage container and in other containers in the same compound, and
    - it is not possible to ensure that a leak will fall into the compound, and
    - there are no circumstances whereby the tank may require water cooling,

    splash shields may be fitted about the tank. Appendix 13 provides an example of this.

A failure mode that results in jetting could result in sufficient force such that the contained substance is projected over the compound wall. Hence for sensitive sites jetting should be considered. Refer to Appendix 12 for a methodology. In this context, sensitive sites are those which will result in consequences such as environmental damage or human harm if the contained substance escapes outside the secondary containment system.

In circumstances where maintenance about the tank or water cooling of the tank is required, sufficient clearance must be available between the tank and the inside of the compound perimeter.

4. Further Principles

4.1. Compounds

Compounds are a common form of secondary containment system. Examples of compounds are included in the Appendices of this Code.

The publications CIRIA C598, CIRIA R163 and CIRIA R164 provide further information on compounds.

4.2. Containment below stationary tanks

Consideration shall be given to the ground and details underneath above ground tanks to detect leaks and capture any substance that may leak through the bottom of the tank. This is a particular requirement for vertical cylindrical above ground tanks.

The standard API 650 in Appendix 1 – *Underground Leak Detection and Subgrade Protection* provides acceptable construction methods for the detection of leaks through the bottoms of above ground stationary tanks and Appendix 11 of this Code provides an example.

4.3. Impounding Basin

Where site restrictions make it impossible to construct a secondary containment system directly around a stationary tank, the compound may be piped or ducted to an impounding basin. The impounding basin shall be constructed with the same degree of integrity as the initial compound. Refer to Appendix 7 of this Code for an example.

4.4. Flammable and oxidising substances

Secondary containment systems for flammable substances should be designed to minimise the surface area of the spill/fire size as far as is practicable. This must be considered with clause 4.6.

A fire in the compound containing flammable substances is a foreseeable event and the compound shall be designed on this basis. The compound and walls shall be designed to retain their structural integrity and withstand such a fire. Furthermore, the design shall ensure that a fire occurrence in either the tank compound, the transfer route or impounding basin shall not endanger neighbouring facilities, i.e. areas of high intensity land use.

Flammable substances can create hazardous atmosphere zones. Such zones can be present in compounds for flammable substances. These zones must be delineated and controls in place. Refer to AS/NZS 60079.10 for the classification of hazardous atmosphere zones. Also ensure that:

- buildings are adequately vented, and
- where possible, spillages in buildings are piped via a trap to an outside sump.

Where there are secondary containment systems for flammable and oxidising substances or organic peroxides, energy sources capable of igniting the substances or causing them to thermally decompose must be excluded.

4.4.1. Buncefield Report Recommendations

The fire at the fuel storage depot at Buncefield, England in December 2005 initiated a review of specific factors related to the storage of flammable substances. Whilst some of these have been incorporated in this Code, persons designing or constructing large facilities for the storage and distribution of flammable substances should source the Buncefield Report and adopt its recommendations. Refer to Section 8 of this Code for references.

The Buncefield Report includes the physical aspects of tank storage of flammable substances, as well as the managerial and operational aspects. Refer to the references in section 8.

4.5. Compatibility

4.5.1. Compatibility of substances

Hazardous substances that react with other substances must be controlled to avoid the substances coming into contact with each other. Incompatible materials must also be prevented from coming into contact with the hazardous substance. This includes any spillage route within the secondary containment system. The preferred method is to have separate secondary containment systems. The site inventory should identify the incompatible substances on the site.

Refer also to clause 3.5 of this code of practice.

When substances are classified as incompatible, they shall not be stored in the same compound, and separation distances shall be applied. Furthermore, water reactive substances shall be protected from water. This extends to reaction with fire fighting methods.

The Hazardous Substances (Classes 1 to 5 Controls) Regulations, Schedule 3 Table 1 specifies substances that are incompatible with class 2, 3 and 4 substances and Schedule 4 Table 4 has a table of separation distances for substances that are incompatible with 5.1.1A; 5.1.1B; 5.1.1C and 5.1.2A hazard classifications. AS/NZS 3833:2007 Figure 6.1 has a useful segregation matrix for storage areas.

Appendix 15 of this Code includes further detail for incompatible hazardous substances.

4.5.2. Compatibility of secondary containment system

The material which the secondary containment system is constructed from must not be adversely affected by the substance stored inside it. It may be necessary to coat the secondary containment system to achieve this, for example, coating it with fibreglass to achieve corrosion resistance.

Substances with a 3.1 hazard classification are susceptible to ignition when spilled into a compound and consideration shall be given to the materials of construction to withstand this scenario. This applies particularly to substances with 3.1A, 3.1B or 3.1C flammable classification which by their very nature have relatively low flash points. The secondary containment systems for these substances with 3.1A, 3.1B or 3.1C flammable classification shall be constructed from materials that maintain their structural integrity in a fire scenario. Metals such as steel, stainless steel and aluminium should not be used as a means of compliance with this Code where substances with these hazard classes are present.

Some hazardous substances are stored at elevated temperatures. In these scenarios consideration shall be given to the materials of construction of the secondary containment system to ensure it retains it characteristics at these elevated temperatures.

4.6. Compound wall height

Compounds should have safe exit routes. Where access is required into a compound area for maintenance or operational work, there should be uncomplicated access and egress. Where the walls of compounds cannot be stepped over, egress routes shall be provided e.g. steps or stairs.

4.7. Drainage

4.7.1. Slope away from container.

The floor of a compound about a stationary tank shall be sloped away from the storage container. This does not imply that it must be sloped away from the container in all directions for example, other sections of the compound floor may slope towards the tank in question and this may then flow to a lower section of the compound. Tank bases should be constructed at an elevation above the compound floor.

4.7.2. Compound drains

Persons in charge must ensure that water does not accumulate in the compound. The compounds must be periodically drained to minimise this accumulation and the compound must include a method for draining this water when needed e.g. a normally closed valve at the lowest point.

Compounds storing highly toxic substances, that is with 6.1A, 6.1B and 6.1C hazard classifications, shall not have drains to open areas unless there is certainty that the discharged water is not contaminated with the hazardous substance. Drains to sump systems must be compatible with the chemical being stored.

The piping should be subjected to an integrity test at the time of construction. Any seals where piping is joined, for example to sumps etc., must also be compatible with the substances involved.

4.7.3. Site Drains

Consideration should be given to drainage systems through the site. This may mean providing separate drainage from the site for:

- areas continuously contaminated
- areas able to be accidentally contaminated
- storm water.

The division of areas of the site and the drainage systems on this basis, can optimise the focus on areas which may be contaminated with the hazardous substance, thereby avoiding having to treat large volumes of rainwater that have become contaminated.

Drainage from secondary containment systems, whether by gravity or pumping, shall be controlled. The quality of the material being drained shall be monitored and only released to public drain systems when it is compliant with

the requirements of the territorial authority, otherwise the drained material requires collection for treatment and disposal or re-use. Manual control may be necessary, especially for water –miscible substances such as alcohols, aldehydes and ketones.

Care should be taken with concentrated acids as they may result in an exothermic reaction when coming into contact with water.

The drainage system, if accessible to unauthorised persons, shall be kept locked. This requirement can be met by locking the outlet valve in the closed position. Where gravity draining is used, the status of the valve position shall be clearly obvious. It is good practice to place a sign at each drain position stating that the valve/s shall be kept closed unless under supervision.

Site operation procedures should define disposal routes for contaminated content.

4.7.4. Rain Proofing

Where it is practicable, persons in charge of sites that utilise compounds as a means of secondary containment should consider rain proofing the compound. This will minimise the requirements for draining it.

4.7.5. Water

If it is not possible to establish whether the water in the compound is contaminated by looking at it, the water should be tested prior to being discharged. If the water is polluted it should be disposed of in a manner that does not affect the environment.

4.8. Unavoidable wastage

Where wastage is unavoidable, the disposal of the unrecoverable material must comply with the Hazardous Substances (Disposal Regulations) 2001. There may also be a requirement to comply with the RMA and any resource consent.

4.9. Substances that are toxic, corrosive or ecotoxic

Compounds for substances that are acutely toxic or very ecotoxic shall be impermeable, that is, clause 4.11 of this Code is not applicable. For the purposes of this clause, acutely toxic substances are those with a 6.1A or 6.1B classification and very ecotoxic are those with a 9.1A classification.

For concrete compounds this may mean the application of a suitable surface coating resistant to the hazardous substance. Consideration should be given to treating the concrete with penetrating synthetic resin or a similar suitable system that is compatible to the final surface coating, before that surface coating is applied.

Where toxic or biologically corrosive substances are to be contained, people must be prevented from being directly exposed to them.

4.10. Use of Secondary Containment Systems for other Purposes

The interior of a secondary containment system that is occupied by tanks shall be limited to the tanks and the necessary related equipment, such as piping, valves, dewatering tanks equipment etc. Substances in packages shall not be located in secondary containment systems for stationary tanks. Similarly, the compound shall not be used for the storage of gas cylinders full or empty.

4.11. Permeability rates for flammable liquids

Materials used in the construction of compounds for the storage of flammable liquids including hydrocarbon fuels that are not water miscible may include low permeability materials such as clay or bentonite geotextile membranes. The barrier shall be sufficiently thick to:

- prevent the passage of the flammable liquids from passing through the membrane until such time as the substance is removed from the compound or an alternative action is initiated to inhibit the passage of the substance, for example implementing a water bottom, and
- restrict the seepage rate while under full hydrostatic head. The water seepage rate at full head shall be no greater than 1 mm/hour, and
- avoid localised seepage. In particular, localised seepage into an earthen compound wall shall be avoided as this may fluidise the wall mass and result in sudden rupture

The water seepage rate may be calculated from the Darcy equation. See Appendix 6 for details on the Darcy equation and permeability rates of hydrocarbons through compound floors of high clay index layers

When constructed of low permeability materials, the top of the compound wall shall be at least 300 mm wide and if the wall height is greater than 750 mm, the top width must be not less than 600 mm. Where earth is placed to form the compound wall, it should not have a slope greater than 1 m in 1 m.

Sites in use prior to 1 April 2004 are able to have approved compliance plans which may accept seepage rates different from those above.

Some hazardous substances e.g. cut back bitumen have a viscosity that is sufficiently high so that a specifically engineered geotextile membrane is not required.

4.12. Penetrations through Compounds

Consideration should be given to avoiding penetrations through compound walls and floors. Where a penetration is necessary, it shall not threaten the structural integrity of the compound or its impermeability. Where pipe work is required to penetrate the compound wall it shall be sealed and supported. Pipe work that penetrates through the compound floor shall also be adequately sealed. Where flammable substances are stored, the seals shall be fire resistant. Earth rods, pipe sleepers and other support footings shall be sealed through the compound floor. Setting into a poured bentonite clay mix may suffice for clay compounds.

Examples of penetrations are included in Appendix 10 of this Code.

4.13. Substances that degrade with age

Some substances can change their hazard characteristics with age, or can lose their desensitising or inerting carrier. These require careful documentation and management and the secondary containment system must be compatible with all phases of the substances. This is especially so for desensitised explosives or substances that degrade to oxidisers over time.

4.14. Storage inside buildings

When planning the use of a building for the storage or retail sale of hazardous substances that require a secondary containment system, each substance should be catalogued in an inventory list. The HSNO requirements, including the secondary containment requirements, for the aggregate of the substances in the building is then able to be determined.

The inventory of hazardous substance should be maintained on an ongoing basis.

4.14.1. Buildings that store hazardous flammable liquid

When flammable liquids are stored or used inside buildings, the building must be constructed of specified materials, must be sited to comply with specified separation distances, must have controlled zones, and must have secondary containment systems.

The secondary containment system capacity for workrooms e.g. Type 1, Type 2 and Type 3 buildings must be at least 100% of the total pooling potential. This is applicable irrespective of the quantity contained i.e. there is no minimum threshold quantity.

The building types, separation distances and secondary containment requirements are specified in:

- Site and Storage Conditions for those substances that are encompassed by a Group Standard.
- Schedule 10 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) (Gazette Notice 35) and the Hazardous Substances (Emergency Management) Regulations 2001, for those substances encompassed by Transfer Notices.

The requirements of the Site and Storage Conditions reflect those of Schedule 10.

Where flammable storage inside a building is required to be vented, this shall be vented outside the building.

4.14.2. Example of a typical internal store

This store has a surrounding nib wall with entrance ramps and contoured floor. The centre drain slopes to an internal sump where it can be pumped out. The store is attached to a retail shop and has electronic keyed entrance.

4.14.3. Buildings that store incompatible substances

Incompatible substances must be segregated in accordance with the provisions of section 4.5 of this Code. One form of secondary containment is for incompatible material to be stored on separate racks with 'grate-over channel" drains all around the rack. The total volume of the drain is to meet the secondary containment capacity requirement for the maximum amount of stored liquid and substances that liquefy in a fire, for each storage rack. Each drain system must be kept segregated from each other for this type of control.

Another form of secondary containment is to install berms around the segregated storage areas.

4.14.4. Fire fighting design for buildings

When designing the layout of a secondary containment system within a building, consideration should be given as to how a fire is to be combated. For example if using water fog nozzles to push the fire towards a corner is the intended method, an aerosol display stand that would be engulfed should not be located in this area. A competent person[3] should be consulted prior to the design and establishment of hazardous storage areas within buildings.

NFPA 30 provides an extensive guideline for fire fighting considerations when storing flammable substances inside buildings. It includes drainage through traps to remote secondary containment, containment sills or ramps, as well as guidelines for heights of racks and stacked storage.

[3] In this context a competent person means a person who is skilled and experienced in this activity, such as a fire engineer, or the fire Engineering Section of the New Zealand Fire Service.

Consideration should be given to the management of fire fighting water. The compound should have a minimum containment volume of 20 minutes fire fighting water/foam at the design rate of application in addition to containing a spill from the largest container.

4.14.5. Buildings holding substances that are required to be kept cool.

Hazardous substances that are required to be kept cool must be located where that requirement is met.

4.14.6. Harmful or flammable vapours;

Where practicable, the drainage from indoor secondary containment systems of substances with flammable or toxic vapours should be piped via traps to holding vessel/s or sump/s in a safe location. The sump may form part of the volume calculation of the required secondary containment capacity. Incompatible substances must not share the same secondary containment system.

4.15. Outdoor storage for packages

Outdoor storage facilities for packages of liquid hazardous substances, e.g. drums, must meet the requirements for secondary containment. If they are flammable the facilities must also be installed in compliance with the location requirements of Schedule 10 of the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended) or the Group Standards Site and Storage Conditions, whichever is applicable.

4.15.1. Outdoor storage under shelter

Consideration should be given to covering outdoor package stores, e.g. roofing over, to minimise rainfall into the secondary containment system. This has the benefits of

- minimising contamination of rain water from localised spills, thereby reducing the cost and effort to maintain the secondary containment system and the drainage from it, and
- preventing the pooling of rain water and thus maintaining the capacity of the secondary containment system.

4.16. Transportable bulk containers – Including IBCs

These containers are designed for transporting substances in bulk. They may be stored for the purpose of discharging their contents. The location of these containers shall meet the requirements for secondary containment.

Some transportable bulk containers have an integrated secondary containment system e.g. a double skin containment system, which may be utilised while the container is being held and discharged. The design and construction of the integral containment system is required to support the total load of the transportable bulk container and shall not be subject to weakening from being contacted by the hazardous substance that is contained.

4.17. Tertiary containment systems

Catastrophic multiple container failures or the use of water for fire protection purposes may result in overwhelming the secondary containment system. Where this is a possibility, consideration should be given to providing tertiary containment to prevent harm to the public or the environment. This can be provided by raised earthen mounds, depressions, or hard paved areas with nib walls. Portable deployment systems may also be used such as inflatable pools and tubes, or sand bags to create compounds on hard paved areas.

Tertiary containment systems can be used to:

- minimise the consequences of a major incident that overwhelms the secondary containment system, and
- contain fire fighting water that is contaminated with hazardous substances. There should be allowance for controlling run-off of fire fighting water where contamination is likely from oil, chemicals, fire fighting foams and combustion sediments, etc. In these circumstances the run-off may be contaminated with fire fighting foam where otherwise immiscible liquids are entrained and solubilised to the point they may flow through an interceptor. The run-off should be controlled until it can be rendered safe for discharge or is recovered.
- Increase the time available for response. This is particularly useful for remote and/or unmanned locations.

The arrangements of a tertiary containment system must not frustrate access for emergency services to the site.

Appendix 14 provides examples of tertiary containment systems.

4.17.1. Types of Tertiary Containment

Types of tertiary containment can include:

- Storage tanks where the size is practical.
- Car parks and similar areas designed with ramps, portable deployment boom or barriers to provide a ponding area.
- Permanent lagoons (Storm Basins).
- Perimeter drainage systems controlled via a shut-off valve – an example of this is depicted in Appendix 22.

Where a site or building has an impermeable mound or ramp built around it for tertiary containment, care should be taken to ensure this does not become a hazard for use of other buildings or equipment.

4.17.2. Tertiary containment as auxiliary fire fighting water supply

Where tertiary containment is provided to capture fire fighting water run-off, e.g. storm basins, the potential may exist for fire pumps to take water from this containment area thereby reducing the overall volume of liquid to contain.

4.17.3. Fire fighting runoff pollutants

The polluting effects of fire fighting water run-off, related to both surface water and groundwater, can be due to one or more of the following (amongst others):

- direct toxicity and ecotoxicity including metals
- a change in Biological Oxygen Demand (BOD)
- a change in Chemical Oxygen Demand (COD)
- suspended solids lowering water quality and disrupting waterway ecology
- a change in pH

Diluting the fire fighting water run-off does not remove contamination and the makeup of the contamination may not be able to be treated by standard waste water bio-treatment or interceptors.

Persons in charge should consider the amount of contaminated fire fighting water that will be generated in accordance with the emergency response procedures to the fire, how much containment is required and what can be used as containment.

4.18. Compounds and Fire Controls

Compounds for flammable substances shall:

- Have fire resistant structural integrity, including joints and pipe work penetrations.
- Have a plan which specifies the management of fire fighting water e.g. have a means of removing fire fighting water from below the surface of the liquid in the compound for substances that are not miscible with water and which have a lower density than water. This may be via a permanent structure (preferable) or the plan may specify how to form it.
- Have traps on below ground drains.
- Where flammable substances are stored have adequate access around the perimeter of the compound for fire appliances.

In addition to these, consideration should be given to the management of fire fighting water. The compound should have the capacity to contain 20 minutes of fire fighting water/foam at the design rate of application in addition to containing a spill from the largest container.

4.19. Secondary Containment for Pipework

Where a hazardous substance is contained in pipework that is installed and operated so as to manage any loss of containment in the pipework, that hazardous substance is:

- not required to be taken into account in determining whether a place is required to have secondary containment, and
- not required to be located in a secondary containment system.

4.20. Housekeeping

Secondary containment systems should be maintained in a tidy state. Compounds should be regularly cleared of rubbish and other extraneous material. No combustible material, such as vegetation, litter or rubbish, should be allowed to accumulate in the bund.

Spillages of material within the compound should be cleaned up immediately.

After rainfall, the compound should be emptied as soon as possible to maintain full capacity.

Secondary containment systems for tanks should not be used for the storage of packages, gas cylinders (full or empty) or other hazardous substances.

4.21. Housekeeping

There must be instituted or capable of being instituted in respect of a secondary containment system, controls that—

- (a) if flammable liquids must be contained, exclude any energy source capable of igniting them or causing them to decompose thermally; and
- (b) if toxic or biological corrosive substances must be contained, prevent people from being directly exposed to them; and
- (c) prevent the substances retained from being contaminated by incompatible substances and materials.

5. Specific Sites

5.1. Farm Tanks

5.1.1. General Provisions:

Where petrol, aviation gasoline, racing gasoline, kerosene or diesel fuel is stored:

- in a total quantity of less than 2000 litres, and
- on a farm of not less than 4 ha in area,
- with containers separated by more than 6 metres from other fuels, and
- with tanks separated from an area of high intensity land use or area of regular habitation by not less than 20 metres and packages separated from an area of high intensity land use or area of regular habitation by not less than 15 metres, and
- with tanks located in an open area or packages located in either an open area or well ventilated building,

the requirements for secondary containment are complied with if the fuel is located so that any spillage will not endanger any building, or flow into, seep into or otherwise reach any water body including streams, lakes, or natural water.

In order to comply with this requirement:

- all tanks should be maintained so that valves, hoses and dispensers do not leak, and
- in areas with light, free draining soils, for example pumice or sandy soils, the ground may need to be lined with an additional barrier that will prevent soakage into the soil.

Further details for the above ground storage of fuels on farms can be found in the *Guide for Above-Ground Fuel Storage on Farms available* from the EPA website at:
http://www.epa.govt.nz/Publications/Guide-Above-ground-fue-storage-on-farms.pdf

5.1.2. Diesel Tanks installed prior to April 2004:

Where diesel fuel is:

- stored in tanks up to 2500 litres capacity, and
- stored on a farm of not less than 4 ha in area, and
- the tanks are separated by more than 6 metres from other fuels, and
- that tanks are separated from an area of high intensity land use by not less than 20 metres and
- the tanks were in use before April 2004,

the requirements for secondary containment are sufficed if the fuel is located so that any spillage will not endanger any building, or flow into, seep into or otherwise reach any water body including streams, lakes, or natural water.

In order to comply with this requirement:

- all tanks should be maintained so that valves, hoses and dispensers do not leak, and
- in areas with light, free draining soils for example pumice or sandy soils, the ground may need to be lined with an additional barrier that will prevent soakage into the soil.

Refer to HSNOCOP 13 *Management of Existing Stationary Container Systems up to 60,000 litres* for further information on tanks installed prior to April 2004.

5.2. Short Duration Storage

5.2.1. General Provisions:

Where petrol, aviation gasoline, racing gasoline, kerosene or diesel fuel is:

- stored in a total quantity of less than 2000 litres, and
- is containers in a tank wagon or in secure containers, each individual container with a capacity of less than 250 litres, and
- the duration of the storage is for a continuous period of less than 14 days,

the requirements for secondary containment are sufficed if the fuel is located so that any spillage will not endanger any building, or flow into, seep into or otherwise reach any water body including streams, lakes, or natural water any natural water body.

In order to comply with this requirement all tanks must be maintained so that valves, hoses and dispensers do not leak, and in areas with light, free draining soils, for example pumice or sandy soils, the ground must be lined with an additional barrier that will prevent soakage into the soil.

5.3. Movable Stationary Tanks

5.3.1. General Provisions:

Movable stationary tanks that do not have integral secondary containment are required to have compliant secondary containment systems. Where this secondary containment system is not attached to the frame of the stationary tank, the following principles may be applied to a compound:

- The capacity of the compound shall be at least 110% of the capacity of the largest stationary tank within it.
- The material used to form the compound shall be compatible with the substance being stored.
- Where earth is used to form any compound wall, the wall shall have a minimum top width of 300 mm and if the wall height is greater than 750 mm, the top width shall be not less than 600 mm. Where earth is placed to form the bund it shall have a slope not greater than 1m in 1m.
- Where earth is placed to form a compound or bund, it is not suitable to use loose or sandy loam in this circumstance – the earth shall be selected and appropriately compacted to form a layer that is impermeable to the substance being stored.
- The interior of any compound shall be occupied only by the stationary tank or tanks, and such settling and measuring tanks, piping, valves and other necessary appliances. These additional facilities must be included in the volume calculations of the secondary containment system.
- No person shall allow water to accumulate in the compound. Compounds shall be periodically drained to minimise the accumulation of water e.g. by means of an oil stop valve, by means of pumping or by means of a pipe carried through the wall of the compound at the lowest practicable point. For compounds that are manually drained, the pipe shall be fitted with either a screw-in bung or a lockable valve which shall be kept in the closed position at all times except when draining off accumulated water.

6. Evaluation and Operation

6.1. Process Safety

A finding from evaluations of large scale incidents is the lack of process safety leadership that reduced the effectiveness of installed safety principles and mechanisms. Consideration should be given to evaluating risks at the design phase of a project. Refer to Appendix 21 for further details.

7. Certification and Testing

7.1. Compound Testing

7.1.1. New Compounds

The construction of permanent new /upgraded secondary containment systems for above ground storage shall be verified by post-construction integrity testing. For compounds, the preferred method is a hydro test at full head. In this context;

- hydro test means testing with water, and
- full head means 100% of the capacity of the largest stationary tank within the compound,

Where:

- this is not practicable e.g. within a building, tank in a chamber etc, or
- there are new/upgraded secondary containment systems for above ground storage which are not permanent,

these may be assessed by a competent person[4] as an alternative option to this requirement..

In the context of this clause a permanent facility is one that is intended to be in place for a period greater than 6 months.

Because large primary containers require a full hydro test for foundation compression stability and tank integrity prior to service, the testing for the new compound can often be combined with the primary container hydro test.

The criteria for the test are:

- No measurable loss except for
- Earthen type compounds for hydrocarbons which shall not exceed 1mm / hr level drop at full hydrostatic head. The testing shall be done after initial soaking into the membrane has occurred and the system has stabilised. Accordingly, a duration of 24 to 48 hours subsequent to filling and initial ground wetting is a typical test period.

Compound walls that become damp on the external face or toe of the compound during the test shall be investigated and the significance of the dampness determined. Where the cause of the dampness may result in structural failure, it shall be remedied.

If there is a failure, the compound shall be repaired and a hydrostatic test repeated. It is not necessary to repeat the test for the complete compound if the repaired section can be isolated.

One method to undertake measurements is to:

- use a stilling well arrangement to take height measurements, e.g. a pipe with slots at the bottom, to avoid inaccurate measurements from waves and ripples that may occur.
- determine the evaporation loss/rainfall gain through a parallel measurement adjacent to the compound being tested using an open top vessel of known leak free integrity. This loss/gain is subtracted from/added to the liquid seepage loss to provide actual seepage rates.

[4] In this context, a competent person is a person who is skilled and experienced in assessing the natural characteristics of the secondary containment system e.g. a Chartered Professional Engineer.

A water level data logger is a useful instrument for monitoring the levels.

The results of the tests should be recorded and signed by a competent person[5]. A suitable form is included in Appendix 18 of this Code. The full results of the loss rate should be made available to the HSNO test certifier.

7.1.2. Periodic Compound Testing

It is necessary to undertake periodic inspections and testing of the compounds to ensure their integrity.

Compounds should be flood tested at 10 year intervals and have a technical inspection undertaken at 5 year intervals. A suitable process is:

- Flood the compound floor to within 50 mm of the floor of the primary container. This can be water retained during heavy rain or water introduced into the compound. (Tank bases should be constructed to an elevation above the compound floor.) Monitor and record the results and scale them to the full compound head. The criteria are the same as in section 4.11 for new compounds.
- The technical inspection shall include seals and joints.

In some circumstances it may be impractical to undertake a periodic hydro test. In these circumstances an alternative test that is at least equivalent should be undertaken.

For large sites with multiple large compounds that have consistent design and construction, it is acceptable to conduct the periodic flood tests in representative compounds with verification checks and inspections in the other compounds. In this context, large compounds are those with a capacity in excess of 1,000,000 litres.

7.2. Test Certificates

The test certification process, which is a requisite of the HSNO Act, encompasses secondary containment systems. The secondary containment system is required to be verified for:

- a location test certificate, and
- a stationary container system test certificate in circumstances where a location test certificate is not required.

A performance standard has been prepared for test certifiers to certify secondary containment systems. This performance standard has been included in Appendix 19 of this Code. A test certifier may be located from the EPA database of test certifiers:
http://www.epa.govt.nz/search-databases/Pages/testcertifiers-search.aspx

7.3. Compound Maintenance

Any works involving penetration of the permeability barrier shall ensure the containment integrity is maintained according to the performance criteria.

Where these are minor works and localised, e.g. localised pipe or earthing rod penetrations, the works shall use recognised detailing practices. The detail of the works shall be documented and this documentation can be augmented by localised testing.

[5] A Chartered Professional Engineer or equivalent with experience in this activity.

Where these works are significant, e.g. re-founding of a tank or reconfiguring the compound, the integrity of the containment shall be demonstrated upon completion of the works, e.g. by undertaking a compound hydro test. A test in accordance with clause 7.1.2 will normally suffice but in circumstances where this will not test the works that have been undertaken, a test in accordance with clause 7.1.1 may need to be considered. A consideration in determining whether a full head test is required is the impact on both the tanks in the compound and the long term under floor corrosion of tanks in the compound.

8. References and Further Information

API 650	Welded Tanks for Oil Storage
API RP 2350	Overfill Protection for Storage Tanks in Petroleum Facilities
AS 1940	The Storage and Handling of Flammable and Combustible Liquids
AS 3780	The Storage and Handling of Corrosive Substances
AS 4326	The Storage and Handling of Oxidizing Agents
AS/NZS 3833	The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers.
AS/NZS 4452	The Storage and Handling of Toxic Substances
AS/NZS 60079.10	Explosive atmospheres – Classification of areas – Explosive gas atmospheres (IEC 60079-10-1, Ed.1.0(2008)
BS EN 61511	Functional safety. Safety instrumented systems for the process industry sector
CIRIA C598	Chemical Storage Tank Systems – Good Practice http://www.ciria.org.uk/pdf/C598_summary(w002).pdf
CIRIA R163	Construction of Compounds for Oil Storage Tanks
CIRIA R164	Design of Containment Systems for the Prevention of Water Pollution from Industrial Incidents
NFPA 30	Flammable and Combustible Liquids Code.
Buncefield Report	Final report by the Buncefield Major Incident Investigation Board http://www.buncefieldinvestigation.gov.uk/reports/
HSNOCOP 13	Management of Existing Stationary Container Systems up to 60,000 litres http://www.epa.govt.nz/publications-resources/publications/codes-of-practice/Pages/Completed-codes-of-practice.aspx
HSNOCOP 16	Hazardous \substance Storage http://www.epa.govt.nz/publications-resources/publications/codes-of-practice/Pages/Completed-codes-of-practice.aspx
HSNOCOP 36	Preparing for a Chemical Emergency

9. Interpretation

BSTG	means the Buncefield Standards Task Group; made up of members from COMAH to report and recommend on the causes and failings of the Buncefield Petroleum Storage complex major incident.
Bentonite	means an absorbent aluminium phyllosilicate, generally impure clay that's absorbent swelling properties make it an excellent sealant.
Compound wall	means an impermeable wall surrounding above-ground (or partially depressed) bulk storage tanks, or containers that form the initial boundary of a secondary containment system
COMAH	means Control of Major Accident Hazards Regulations 1999 and their amendments 2005 (United Kingdom)
Compound	means a secondary containment system that has walled areas surrounding above-ground (or partially depressed) bulk storage tanks, or containers. This is also commonly known as a "dyke" or bund. A compound may also provide physical protection about a storage container
Containment	means prevention of a sites hazardous substance endangering the environment, or public outside of a site's boundary.
Code	means this Secondary Containment Systems code of practice HSNOCOP 47.
EPA	means the Environmental Protection Authority
HDPE	means high density polyethylene
Hydrocarbon fuels	means liquid hydrocarbon fuels, crude oils and bitumens.
Informative	means an Appendix in this Code which is included for information and guidance
Intermediate secondary containment system	means a secondary containment system that is part of a larger secondary containment system
LoPA	means layers of protection assessment
Normative	means an Appendix of this Code which is an integral part of the Code
Pooling substance	has the definition given in the Hazardous Substance (Emergency Management) Regulations and the Group Standards, that is, a hazardous substance that- is a liquid; or is likely to liquefy in a fire.
Primary Container	means the fixed tank, process container, transportable container or package storing the hazardous substance being considered.
RMA	means the Resource Management Act 1991 and all amendments.
Secondary Containment System	means a secondary containment system with the definition in the Hazardous Substance (Emergency Management) Regulations and the Group Standards Site and Storage Conditions; that is, in relation to a place -

	Means a system or systems – In which pooling substances held in the place will be contained if they escape from the container or containers in which they are being held; and From which they can, subject to unavoidable wastage, be recovered, and Includes a system or systems that comply with a code of practice approved by the EPA under Section 78 of the Hazardous Substances and New Organisms Act 1996.
SIL	means Safety Integrity Level: a formal risk assessment process.
Tertiary containment	means a system that will prevent leak to the environment in the event of a simultaneous catastrophic failure of both the primary containment system and the secondary containment system.
Total pooling potential	has the definition given in the Hazardous Substance (Emergency Management) Regulations and the Group Standards, that is, in relation to a place, means the aggregate quantity of all pooling substances held in the place.
Unavoidable wastage	means the loss of a substance from a spill that a) is unrecoverable e.g. due to evaporation or seepage into the containment system surfaces or sealing membranes, or b) as a result of a spill has become contaminated such as to be unusable.

Appendix 1: Threshold Quantities for Secondary Containment

(Normative)

Reproduced from Schedule 4 of the Hazardous Substances (Emergency Management) Regulations

Hazard Classification	Description	Quantity (L=Litres, kg = kilograms)
2.1.1A or B	Non Permanent Gas	Note: class 2.1.1 liquefied gas must not be stored in a compound or ground depression.
2.1.2A	Aerosol	3,000 L aggregate water capacity
3.1A*	liquid	100 L
3.1B	liquid	1000 L
3.1C, 3.1D	liquid	10,000 L
3.2A, 3.2B, 3.2C	liquid	100 L
4.1.1A	solid	1,000 kg
4.1.1B	solid	10,000 kg
4.1.2A, 4.1.2B	liquid solid	50 L 50 kg
4.1.2C, 4.1.2D	liquid solid	100 L 100 kg
4.1.2E, 4.1.2F, 4.1.2G	liquid solid	100 L 200 kg
4.1.3A, 4.1.3B, 4.1.3C	liquid solid	100 L 100 kg
4.2A	liquid solid	100 L 100 kg
4.2B	solid	1,000 kg
4.2C	solid	10,000 kg
4.3A	liquid solid	100 L 100 kg
4.3B	liquid solid	1,000 L 1,000 kg
4.3C	liquid solid	10,000 L 10,000 kg
5.1.1A	liquid solid	50 L 50 kg
5.1.1B	liquid solid	500 L 500 kg

5.1.1C	liquid solid	5,000 L 5,000 kg
5.1.2A	non-permanent gas	100 kg
5.2A, 5.2B	liquid solid	10 L 10 kg
5.2C, 5.2D	liquid solid	25 L 25 kg
5.2E, 5.2F	liquid solid	100 L 100 kg
6.1A, 6.1B, 6.1C	non-permanent gas liquid solid	5 kg 100 L 100 kg
6.1D, 6.5A, 6.5B, 6.7A	non-permanent gas liquid solid	50 kg 1,000 L 1,000 kg
6.6A, 6.7B, 6.8A, 6.9A	liquid solid	10,000 L 10,000 kg

* Petrol has a hazard classification of 3.1A but the threshold quantity for petrol has been established at 1000 litres.

Hazard Classification	Description	Quantity (L=Litres, kg = kilograms)
8.2A	non-permanent gas liquid solid	5 kg 100 L 100 kg
8.2B	non-permanent gas liquid solid	50 kg 1,000 L 1000 kg
8.2C, 8.3A	liquid solid	10,000 L 10,000 kg
9.1A	liquid solid	100 L 100 kg
9.1B, 9.1C	liquid solid	1,000 L 1,000 kg
9.1D	liquid solid	10,000 L 10,000 kg

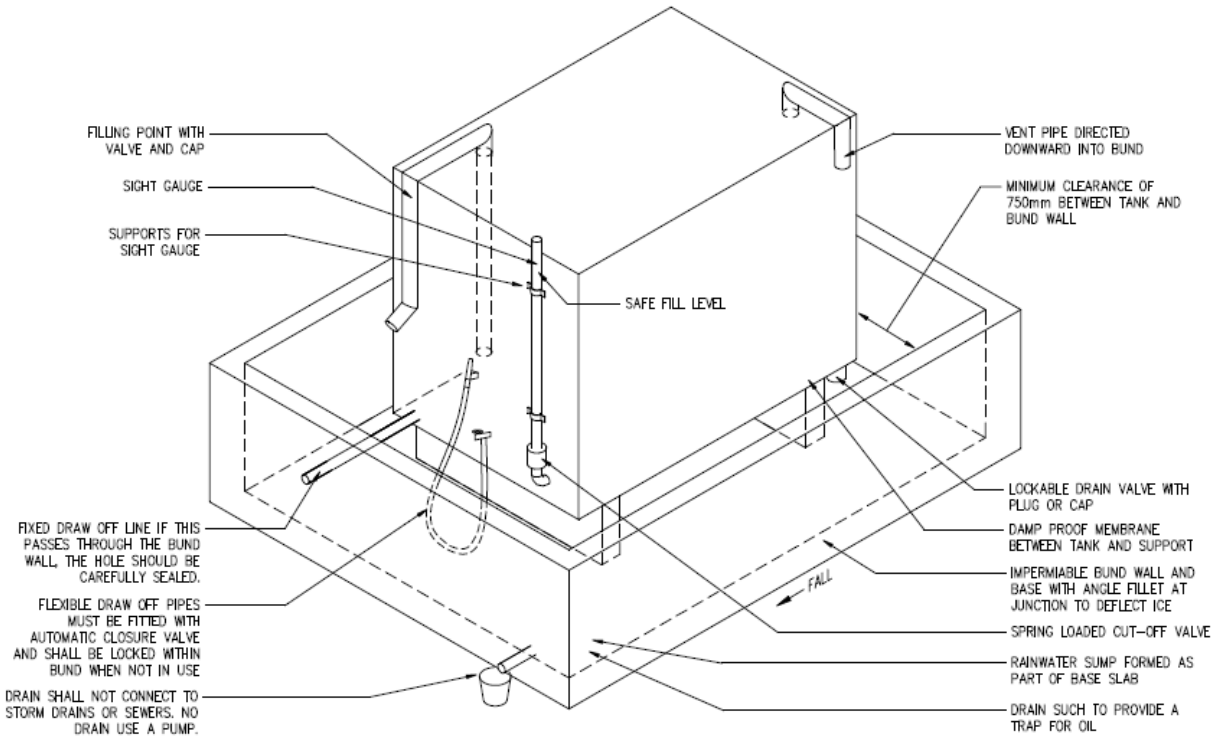
Notes to table:

1. Secondary containment is not required unless the substance is a liquid or will liquefy in a fire.
2. Liquefied gases (hazard classification 2.1.1) must not be stored in a compound or in a depression.

Appendix 2: Examples of Secondary containment Systems

(Informative)

Example of Small Tank



Notes to diagram:

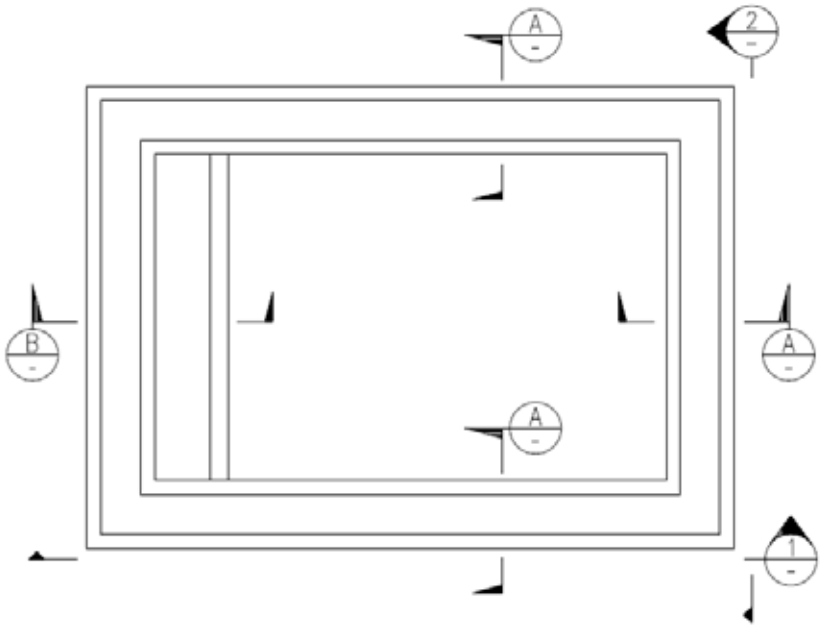
1. Tank side valves that are below flammable product level shall be fire safe.

2. When concrete is used it shall be reinforced to prevent cracking and to withstand loads expected during normal service.

Refer to Appendix 3 for examples of compounds constructed from concrete blocks and cast concrete.

Appendix 3: Examples of Concrete Compound Walls

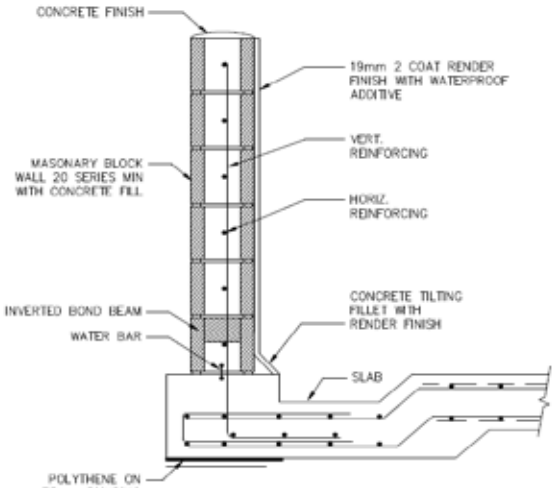
(Informative)



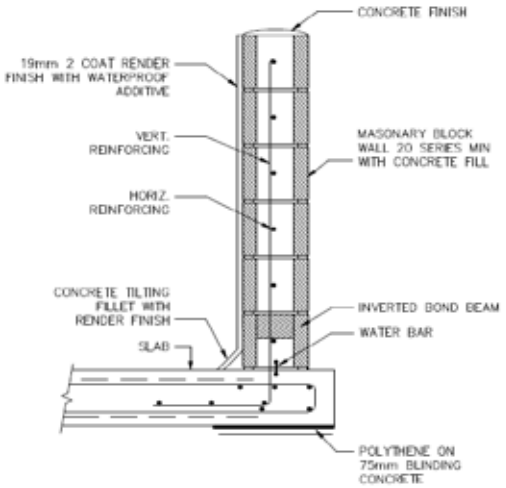
PLAN

ELEVATION 1

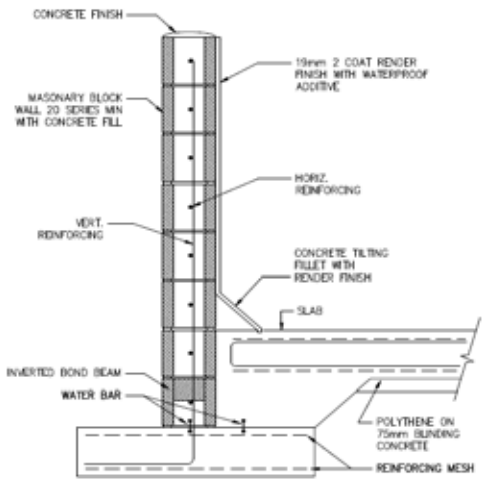
ELEVATION 2



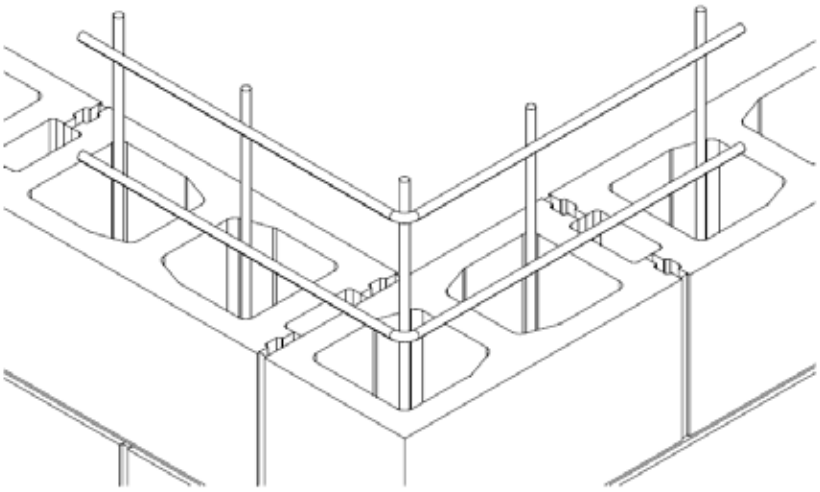
SECTION B



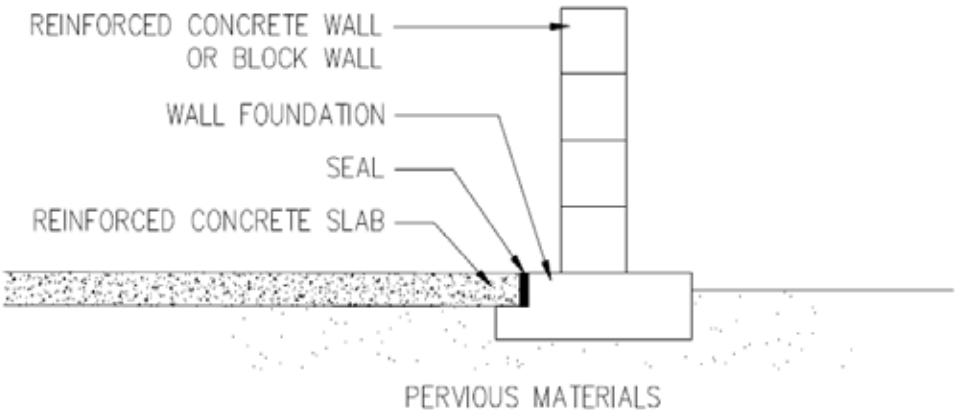
SECTION A



BLOCKWORK BUND WALL BUILT OFF STRIP FOUNDATION

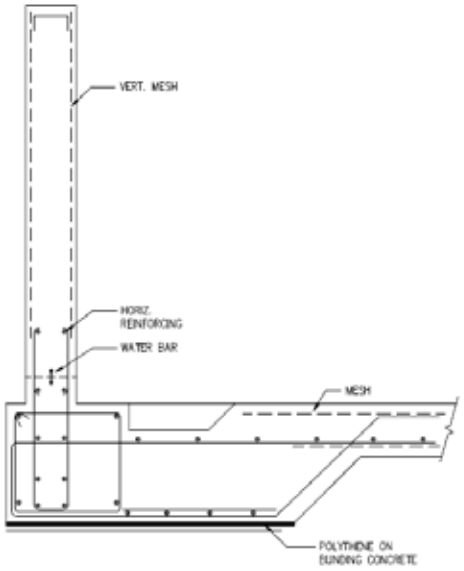


CORNER REINFORCEMENT DETAIL

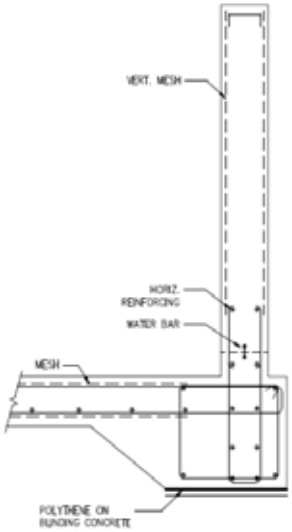


CONCRETE BUND WALL EXAMPLE

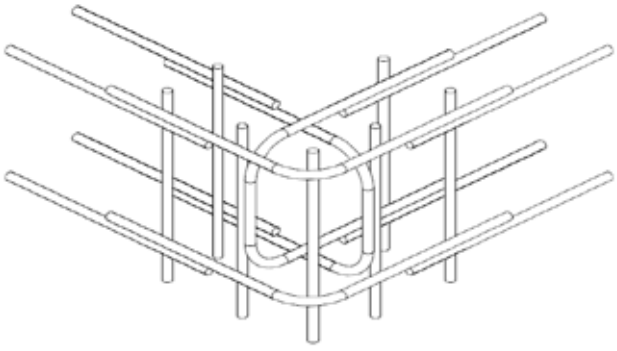
Cast reinforced concrete wall example



REINFORCED CONCRETE BUND

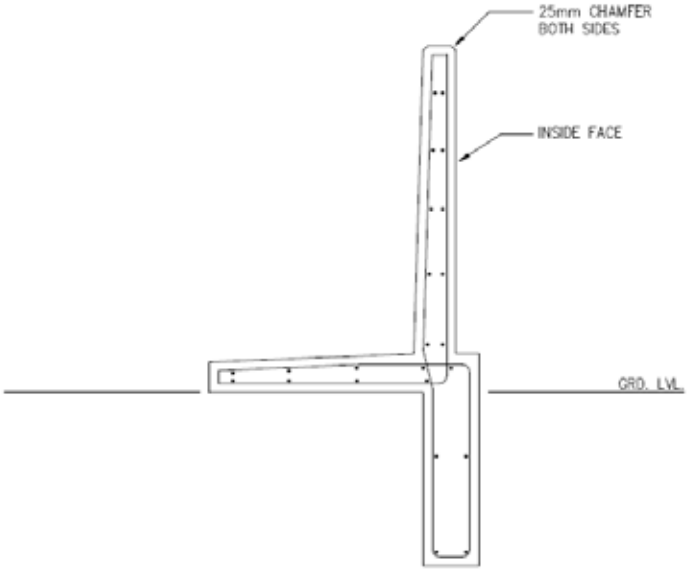


REINFORCED CONCRETE BUND



CORNER REINFORCEMENT DETAIL

Example of cast concrete wall for larger diameters where lateral loading is increased.

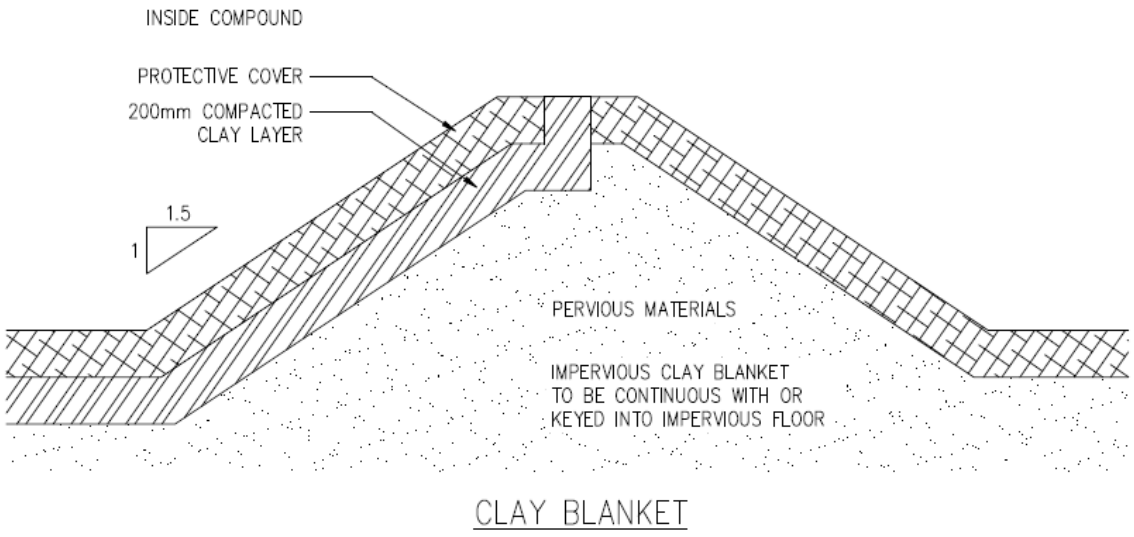


BUND WALL

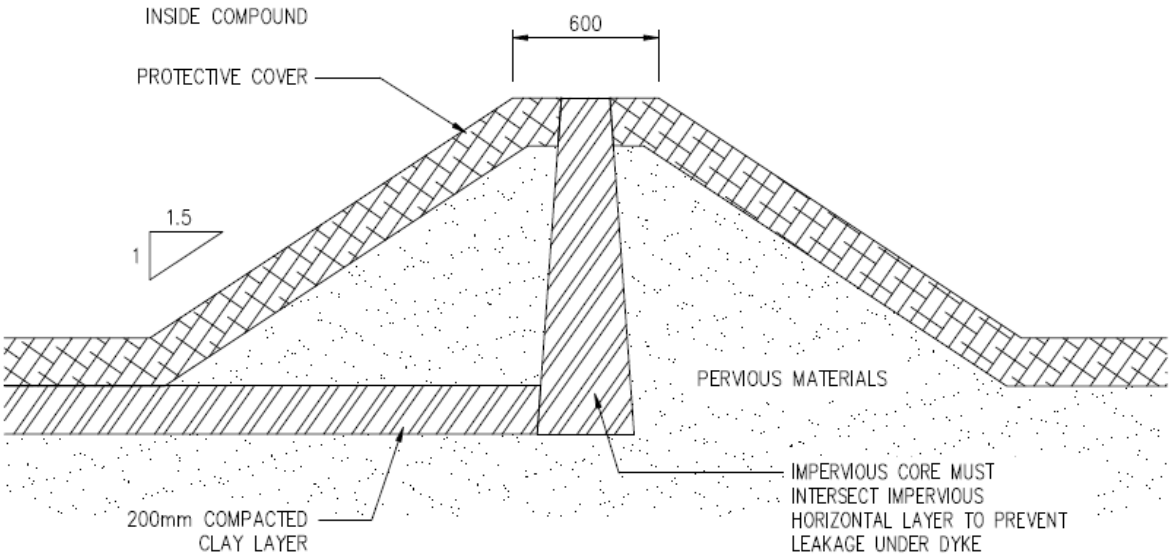
Appendix 4: Examples of Compound Walls – Bulk Flammable Liquids

(Informative)

Example of Wall Construction Using a Clay Blanket

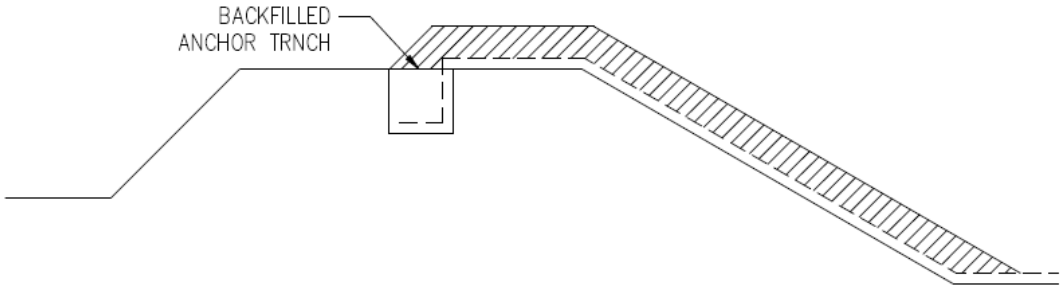


CLAY BLANKET



CLAY CORE

Example of Protecting and Anchoring a Liner

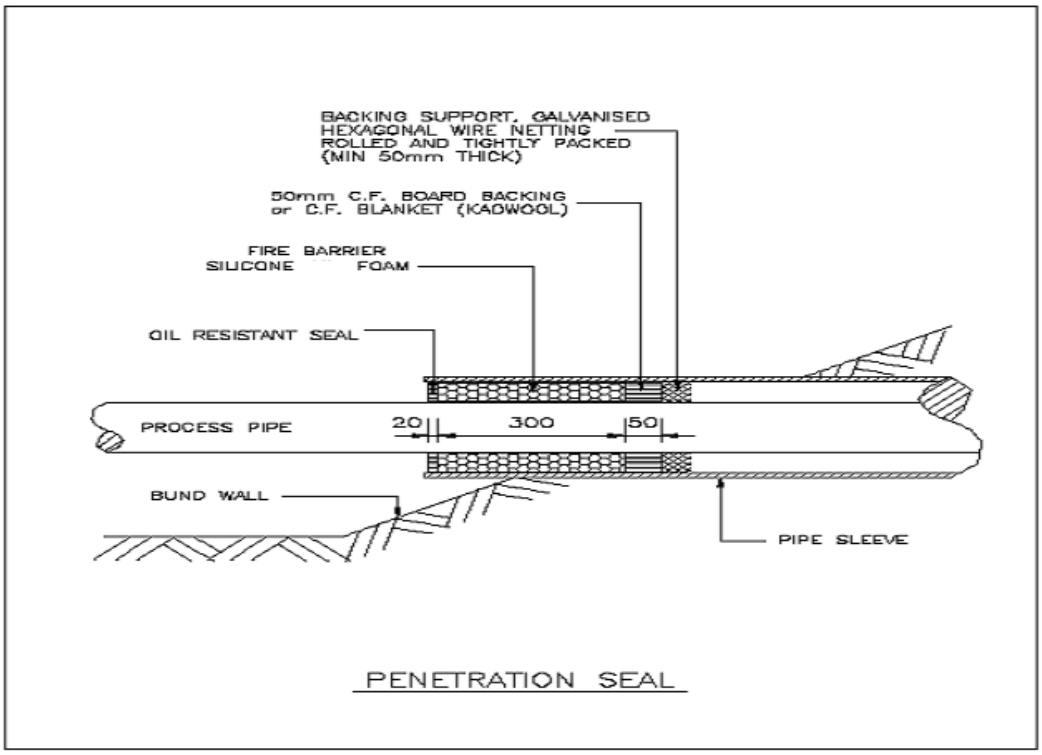


TYPICAL ARRANGEMENT FOR PROTECTING
AND ANCHORING A MEMBRANE LINER

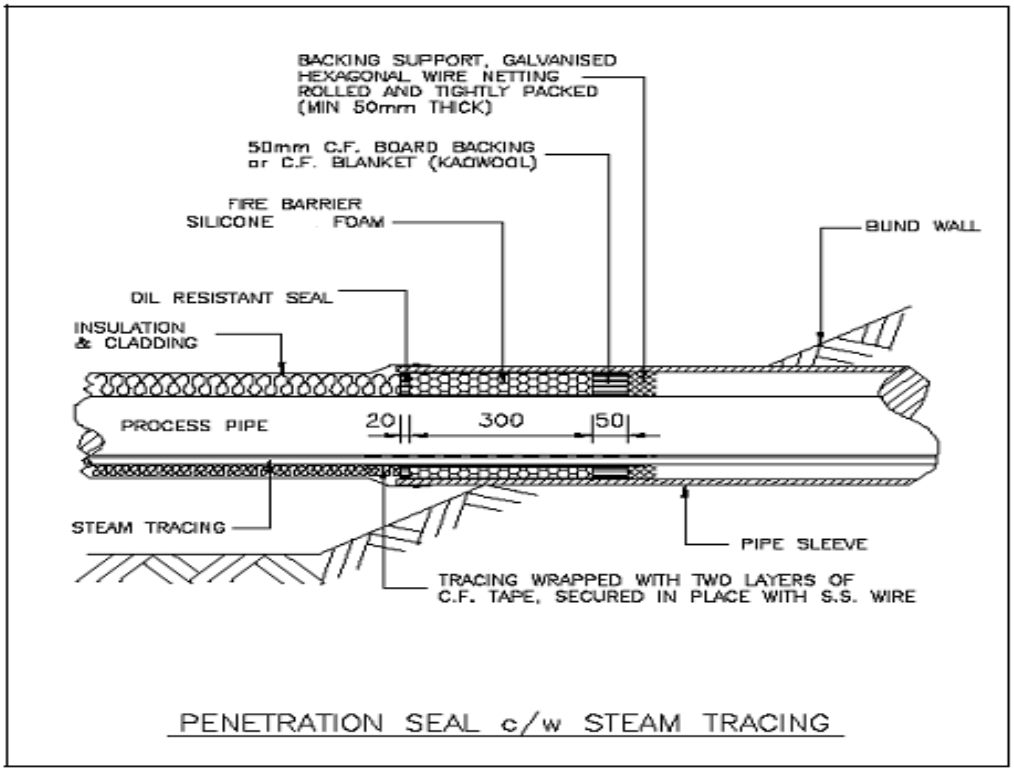
Appendix 5: Examples of Pipe Penetration through Walls

(Informative)

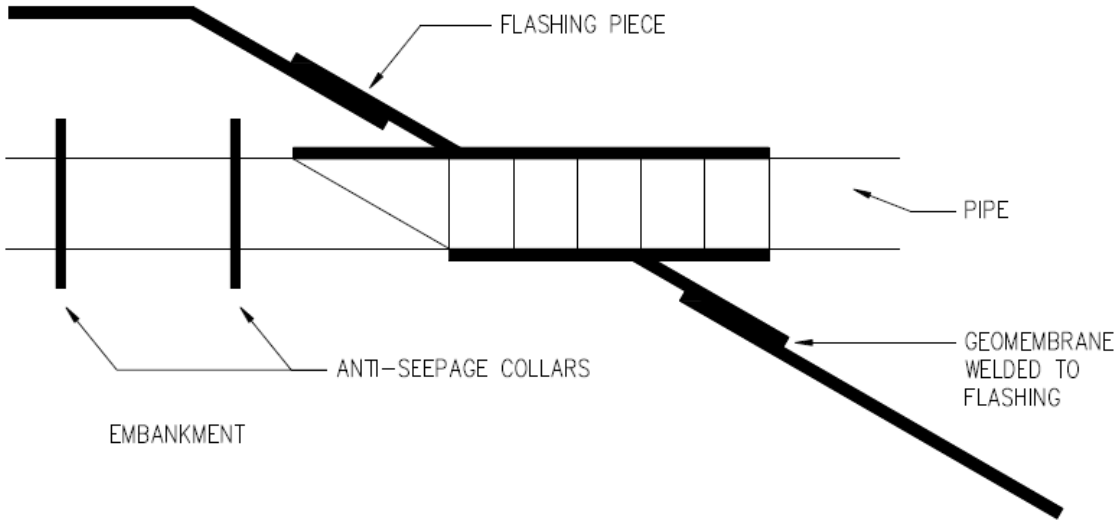
Earthen wall existing retrofit



Earthen wall existing retrofit with steam tracing



Example of a pipe penetration through earthen compound wall (existing retrofit)



ARRANGEMENT FOR SEALING PIPE
PENETRATING A GEOMEMBRANE LINER

Appendix 6: Relationship Between Seepage and Permeability

(Normative)

This appendix, applicable to flammable substances is in conjunction with section 4.11of this Code.

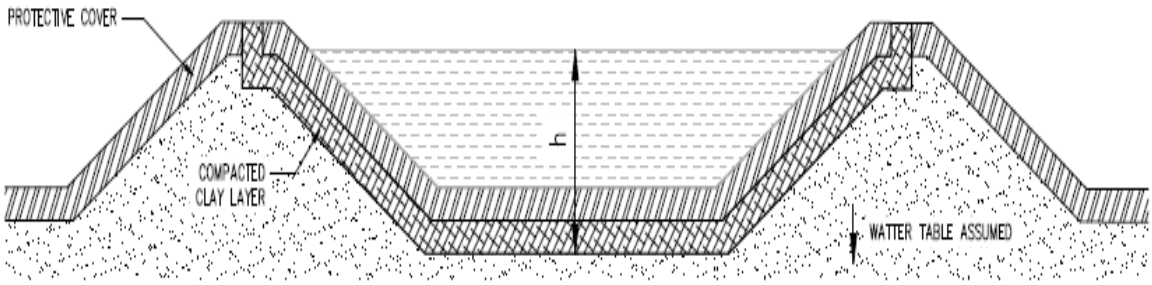
The Darcy Equation can be used to determine the required thickness of clay barrier to ensure the loss rate does not exceed 1 mm/hr:

Seepage, V = k x i

Where

- k = coefficient of permeability
- i = hydraulic gradient = z/l
- l = barrier thickness
- z = hydrostatic head = p x h
- p = liquid density and h = height shown below

EXAMPLE
Assume barrier ('clay') permeability coefficient of 0.0001 mm/sec (1 x E-7m/s)
Calculate seepage for compounded water (density = 1 kg/litre)



PERVIOUS SEEPAGE / PERMEABILITY: – CLAY BLANKET

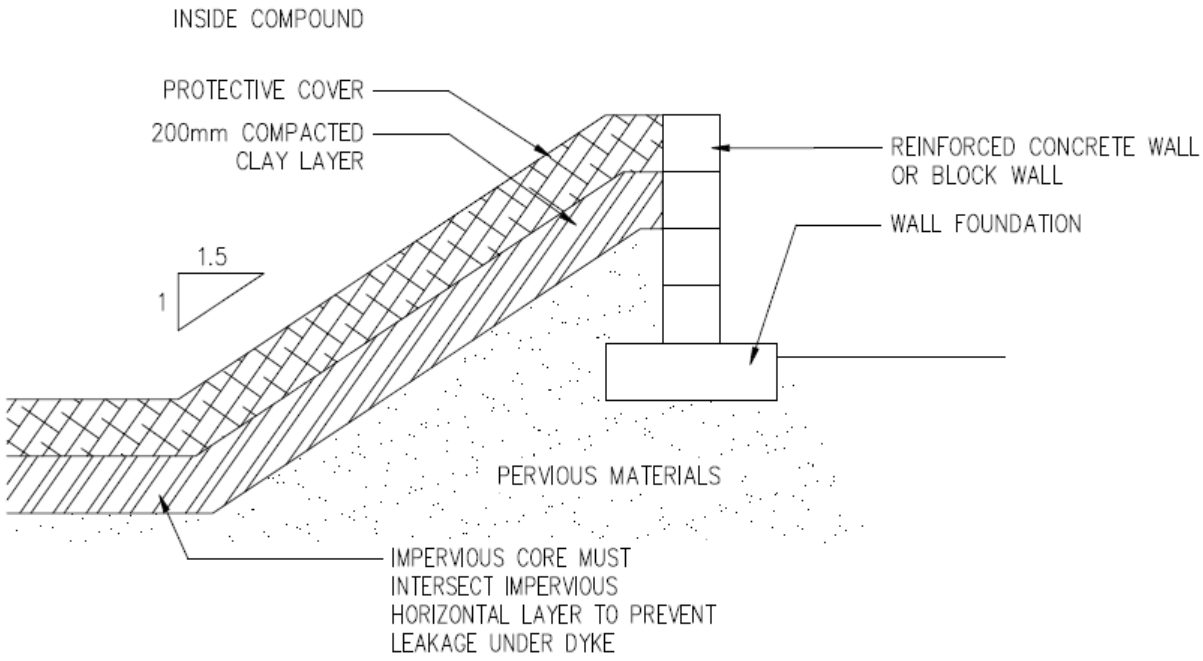
l (thickness)		z (head)		v (seepage)
250	mm	500	mm	0.72 mm/hr
250	mm	750	mm	1.08 mm/hr
250	mm	1000	mm	1.44 mm/hr
250	mm	1250	mm	1.80 mm/hr
250	mm	1500	mm	2.16 mm/hr
300	mm	500	mm	0.60 mm/hr
300	mm	750	mm	0.90 mm/hr
300	mm	1000	mm	1.2 mm/hr

300	mm	1250	mm	1.50 mm/hr
300	mm	1500	mm	1.80 mm/hr
350	mm	500	mm	0.51 mm/hr
350	mm	750	mm	0.77 mm/hr
350	mm	1000	mm	1.03 mm/hr
350	mm	1250	mm	1.29 mm/hr
350	mm	1500	mm	1.54 mm/hr

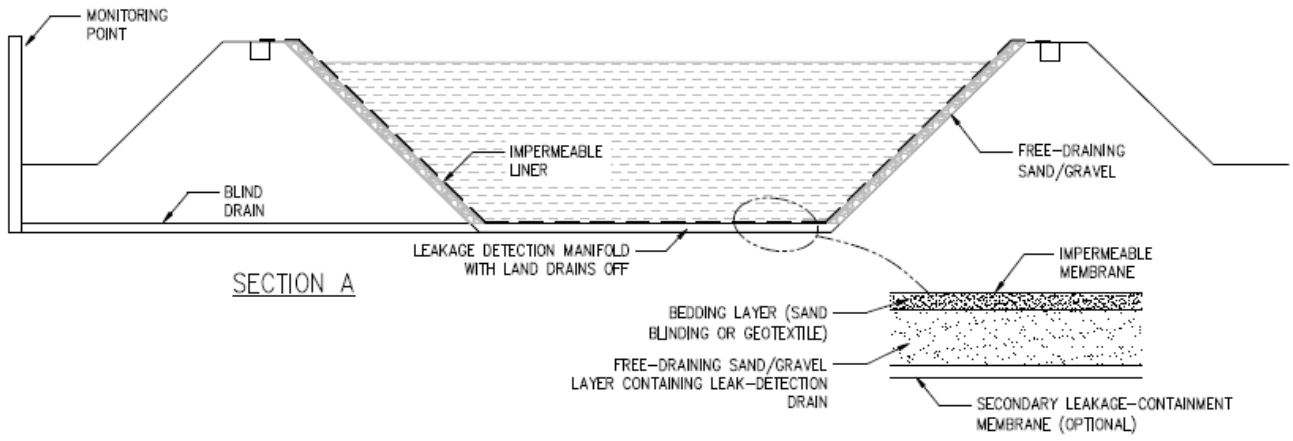
Required barrier thickness to achieve seepage criteria increases in proportion to the hydrostatic head requirement.

Appendix 7: Other Examples - Compound, Impounding basin, Lagoon

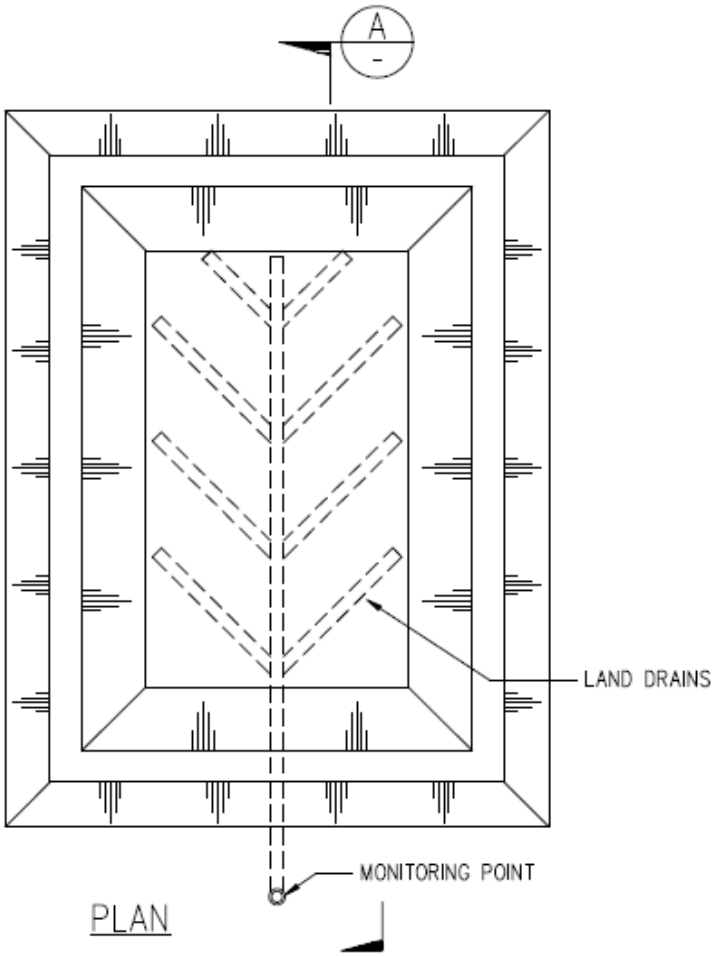
(Informative)



EARTH / CONCRETE BUND WALL EXAMPLE



IMPOUNDING BASIN



LEAKAGE DETECTION SYSTEM FOR A LINED LAGOON

Localised compound floor material test.

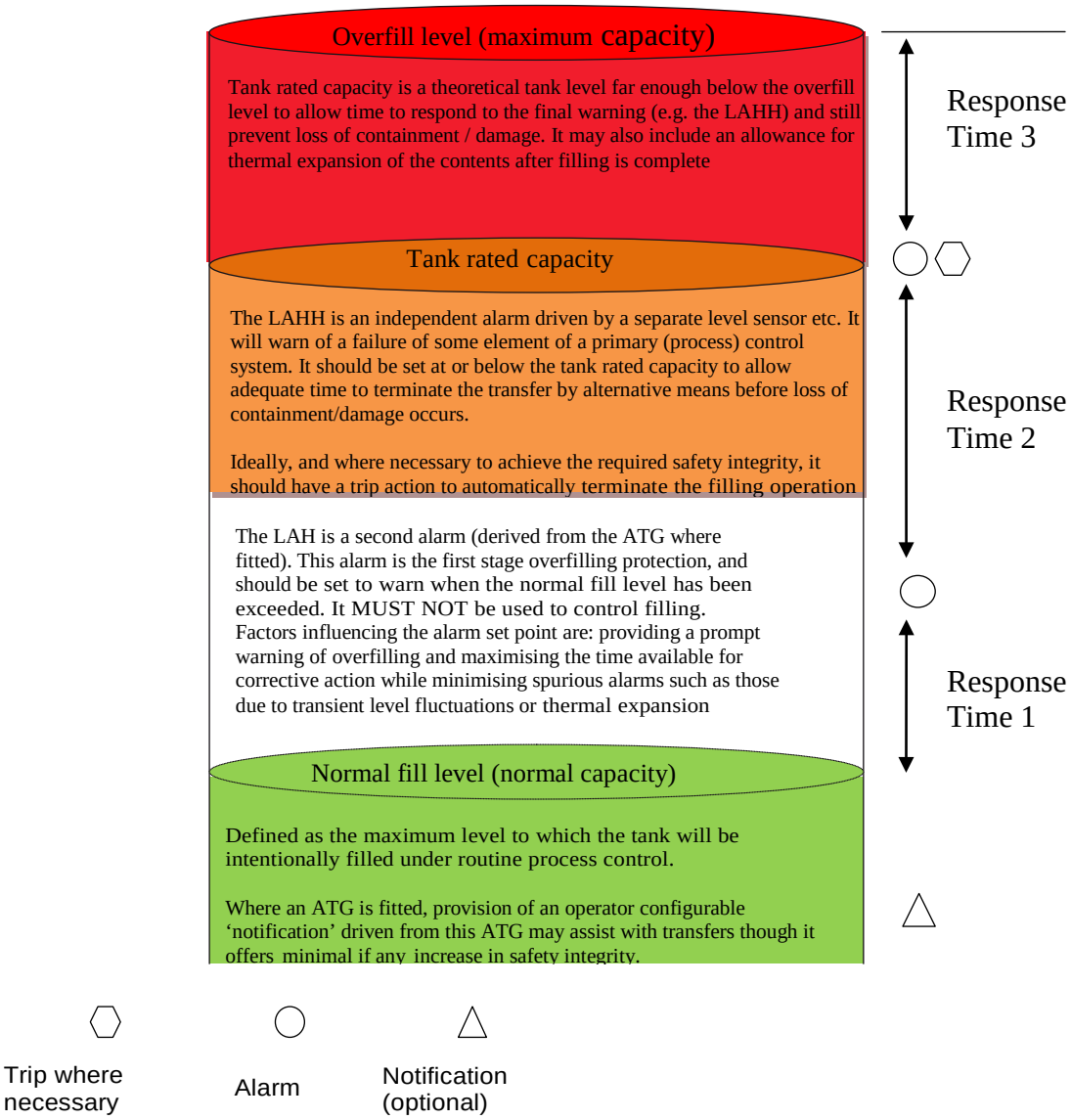
This was a simple “material at hand” existing brown rock compound floor test to gain knowledge of the suitability of the locally sourced material. The test tank was steel plate from a Tank floor replacement. It was simply made into a rough cylinder on site then welded.

The cylinder’s trench was marked out then excavated into the compacted high clay index brown rock floor. Bentonite was mixed in a concrete mixer and the trench filled, the cylinder lowered in and left to set. Three sites across the compound floor were tested. The transpiration tank was a 200L drum.

This type of test does not test the other areas such as pipe sleepers, earth rods, access step foundations or the heel of the wall to floor connection.

Appendix 8: Overfill Protection

(Informative)



LAH = Level alarm high

LAHH = Level alarm high high

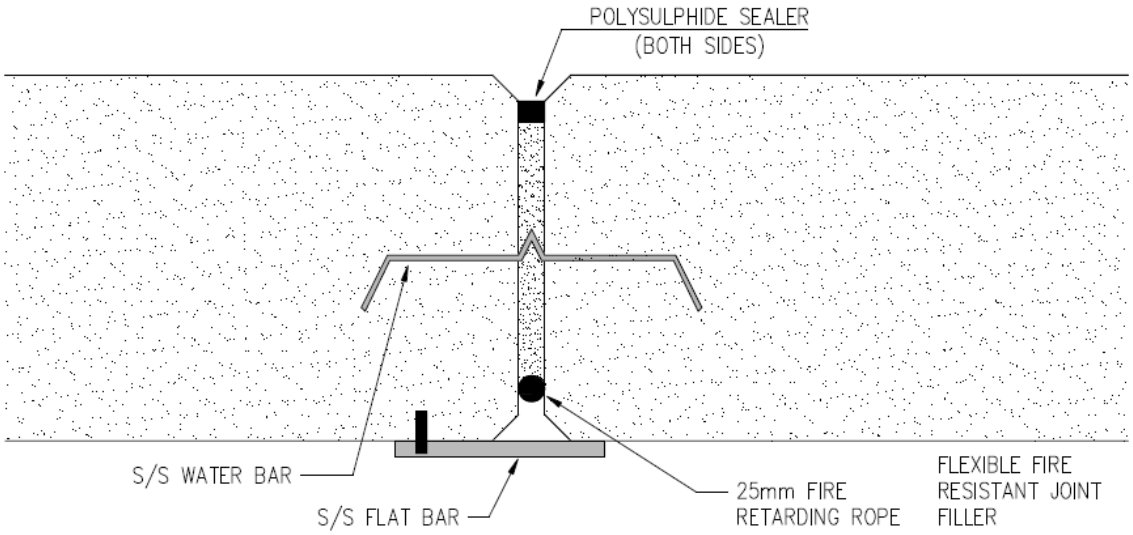
ATG = Automatic Tank Gauge

For further information refer to API RP 2350 Overfill Protection for Storage Tanks in Petroleum Facilities.

Where multiple tanks are blended into a single tank the blend management system should be capable of proving that the sum of the flows is equal to the volumetric rise in level of the receiving tank. Where this is in error, an alarm should be provided and as a minimum step, manual intervention is required to ratify the reason for the alarm condition.

Appendix 9: Example of Expansion Joints in Concrete Compound Walls

(Informative)



EXPANSION JOINTS IN CONCRETE WALLS

Fire retarding rope is to be placed on both sides of an internal compound wall and may be placed on the internal side only of an external wall.

Water bar, rope and polysulphide sealant to be omitted in compound wall footings

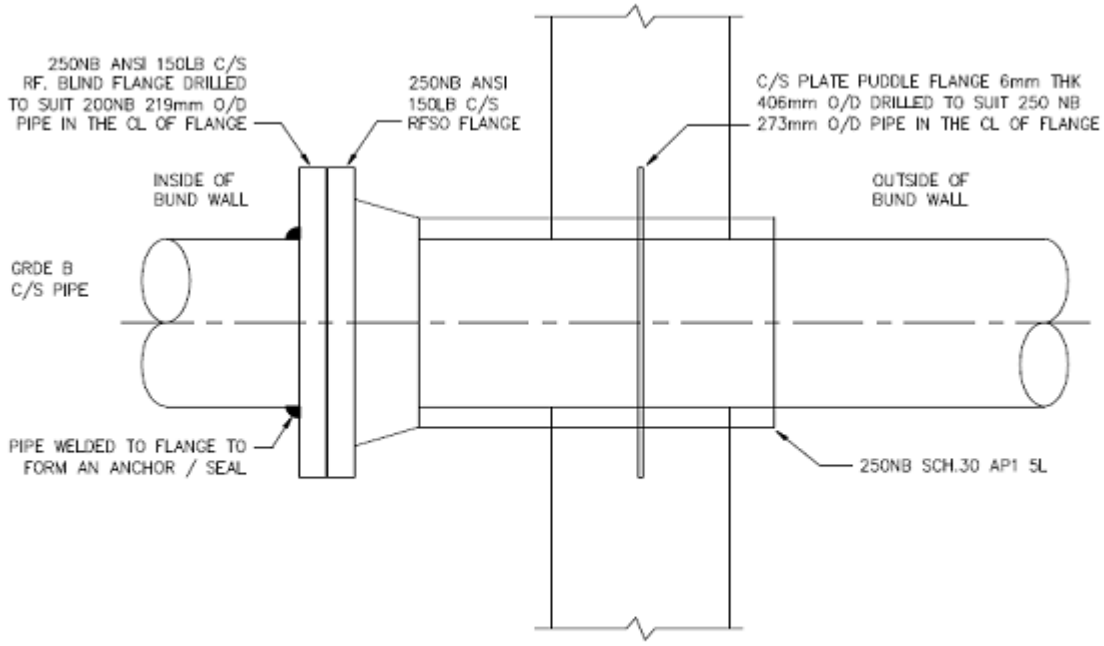
The water bar is to be grade 316 stainless steel 1.0 mm thick

A stainless steel flat bar 4 mm thick is to be placed over the joint to protect the caulking from any water jetting etc. The bolt holes are to be slotted vertically for expansion, and also horizontally if bolted on both sides of the concrete joint.

Appendix 10: Example of Concrete Compound wall Pipe Penetration

(Informative)

This is an example of a puddle flange cast into a compound wall – a 200 NB pipe in a 250 NB sleeve passing through a compound wall. The wall shall be reinforced sufficiently to withstand all of the stresses imparted by the pipe in a fire case. It may be necessary to apply fire proofing to the concrete wall in the vicinity of the penetration to avoid spalling of the concrete.



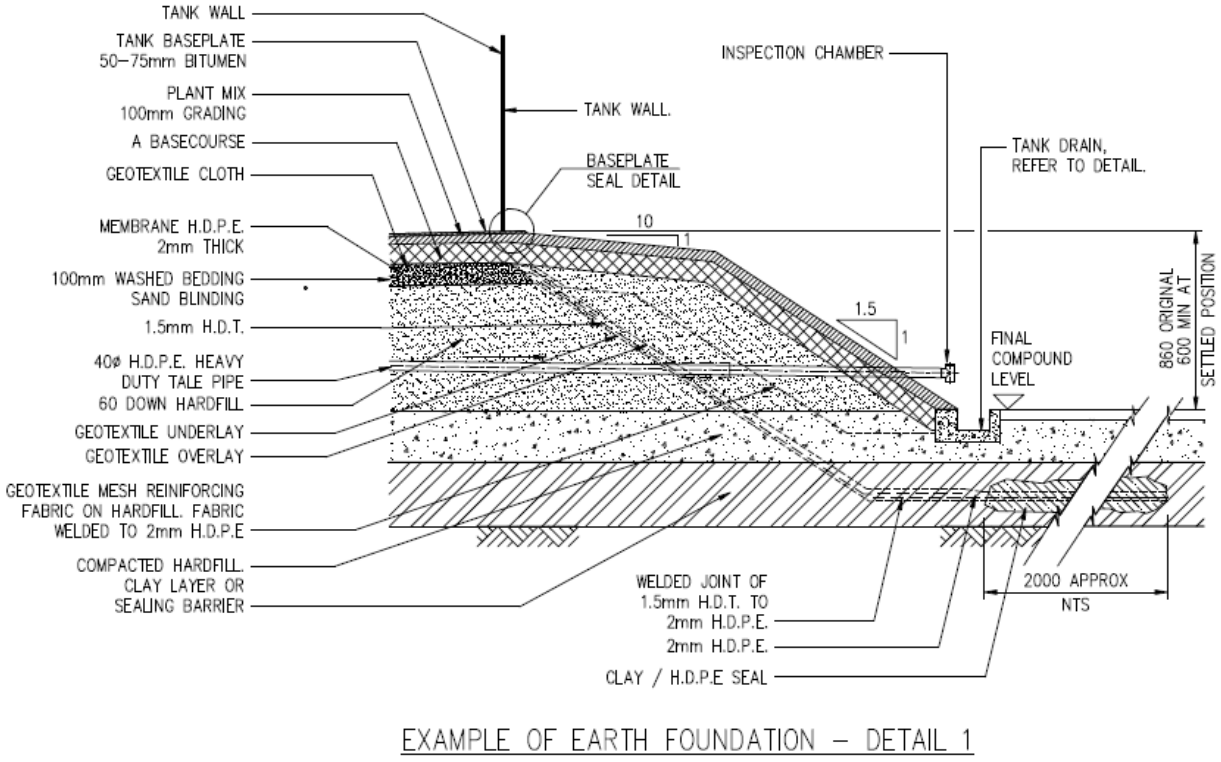
EXAMPLE PUDDLE FLANGE CAST INTO A BUND WALL

With this detail, expansion and contraction of the piping for all foreseeable situations must be adequately catered for to prevent damage to the wall.

Where the pipe cannot be anchored to the wall a different approach is required.

Appendix 11: Example of Vertical Tank Earthen Foundation

(Informative)



EXAMPLE OF EARTH FOUNDATION – DETAIL 1

The continuation of the compound floor sealing under the foundation pad is an important detail. Over time, the loads upon the tank foundation tend to cause settlement of the original base resulting in a cone down effect. This may result in tension cracks in a compacted compound floor.

The tank drain runs full circumference at the base of the tank pad foundation and has lateral/s that lead to the compound drain sump trap. The compound drain valve is always outside of the compound and is sized for the fire fighting water case.

The tell tale drains to the outside of the foundation skirt and enables detection of a leak into the foundation.

Appendix 12: Crest Locus Limit

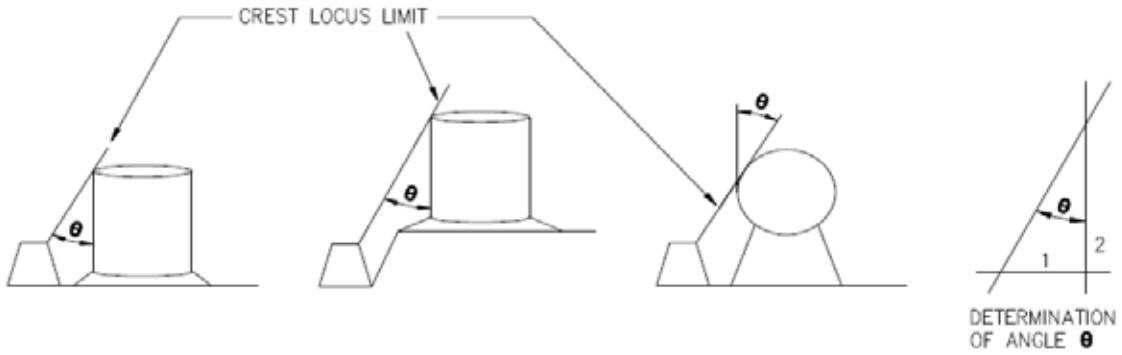
(Normative)

The inside edge of the compound wall shall be spaced from the tank so that it is outside the crest locus limit.

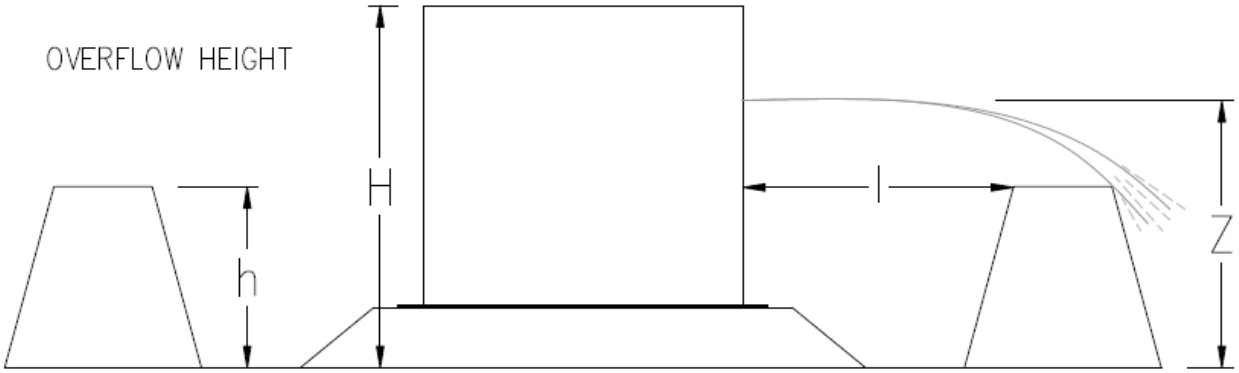
Crest Locus

Tan θ = 0.5

θ = 26.5^0



Crest Locus Refinement - Jetting



For a small diameter sharp edged hole in a tank shell:

C_v = velocity coefficient.

$$l^2 = 4C_v^2(z-h)(H-z)$$

In practice $C_v \approx 0.99$. For this purpose assume $C_v = 1$

Conservatively then:

$$l = [4(z-h)(H-z)]^{0.5}$$

Therefore for a given compound height $\underline{h}$, distance l is at minimum when:

$$z = 0.5H+0.5h$$

giving the solution:

$$l_{min} = H-h$$

Appendix 13: Shields About Tanks

(Informative)

In circumstances where non flammable substances are unable to ensure that a leak will fall into the compound, it may be possible to utilise a shield around the tank to deflect the hazardous substance into the compound. The shield is to be installed to allow for ease of removal for inspection. In this example the shield stands off the shell by 40mm allowing air movement in order to prevent continuous dampness that could result in corrosion of the shell.

Shields must not be used where there is any possibility that water cooling of the tank shell may be required,

Example – Shielded tanks

Appendix 14: Tertiary Containment

(Informative)

Tertiary containment provides an additional barrier to prevent the uncontrolled spread of hazardous liquids. This minimises the consequences of a failure in the primary and secondary containment systems. Tertiary containment is achieved by means external to and independent of the primary and secondary containment systems, such as site drainage and sumps, diversion tanks, impervious liners and/or flexible booms.

Tertiary containment can be provided by raised mounds or canals, concave paved areas with isolatable storm drains, ramp down car parks etc. around a site, or storage areas within a site.

The mounds may be planted for landscaping enhancement but care should be taken when choosing the plant species. Shallow rooting species such as grasses are preferable to deeper rooting species. The deeper rooting species such as trees potentially allow for root penetrations through the tertiary containment wall, thus compromising the integrity of the containment system.

Channelling within a tertiary containment system is required to direct overspills away from sensitive areas within, e.g. office blocks, adjacent public places or highways, or ignition sources if flammable spills.

The tertiary containment system leak integrity should be designed having regard to the location of the site within the surrounding environment e.g. presence of underground streams, aquifers, potable water catchment areas etc.

- Tertiary containment will be utilised when there is an event that causes loss of containment e.g. compound joint failure or firewater overflowing from a compound during a prolonged tank fire, and is intended to ensure that loss of hazardous substances does not result from such an event.
- Tertiary containment plans shall be prepared, having regard to the ground and location characteristics of the site.
- Tertiary containment measures minimise the consequences of a major incident that causes the failure of or exceeds the storage capacity of the secondary containment system.

Tertiary containment enables time to mobilise additional measures to be deployed if an incident escalates.

Example 1 – Example of tertiary containment area.

In this example, the entire site is hard paved with a perimeter concrete nib wall. There are individual ramped storage areas within the site where localised spills are trapped. The site's surfaces outside of the storage areas are contoured to this catchment and sump area. The float switch of the pump has lockouts driven from analysers for contamination.

The system should be designed and operated to ensure that only clean rainwater is discharged into the environment. Contaminated material (including rainwater) that is collected should be disposed of correctly. The more toxic or rain susceptible areas can be roofed over to minimise the possibility of contamination.

With such a system the design of the total available catchment volume and pumping capacity over time should take into account the 50 year rainfall case. (Subject to Resource Consent conditions).

Where hydrocarbons are involved, it may be necessary to provide a separator. This could be an under/over weir system to enable at least simple primary oil separation with dedicated pumps for recovery, plate interceptors, absorbers etc.

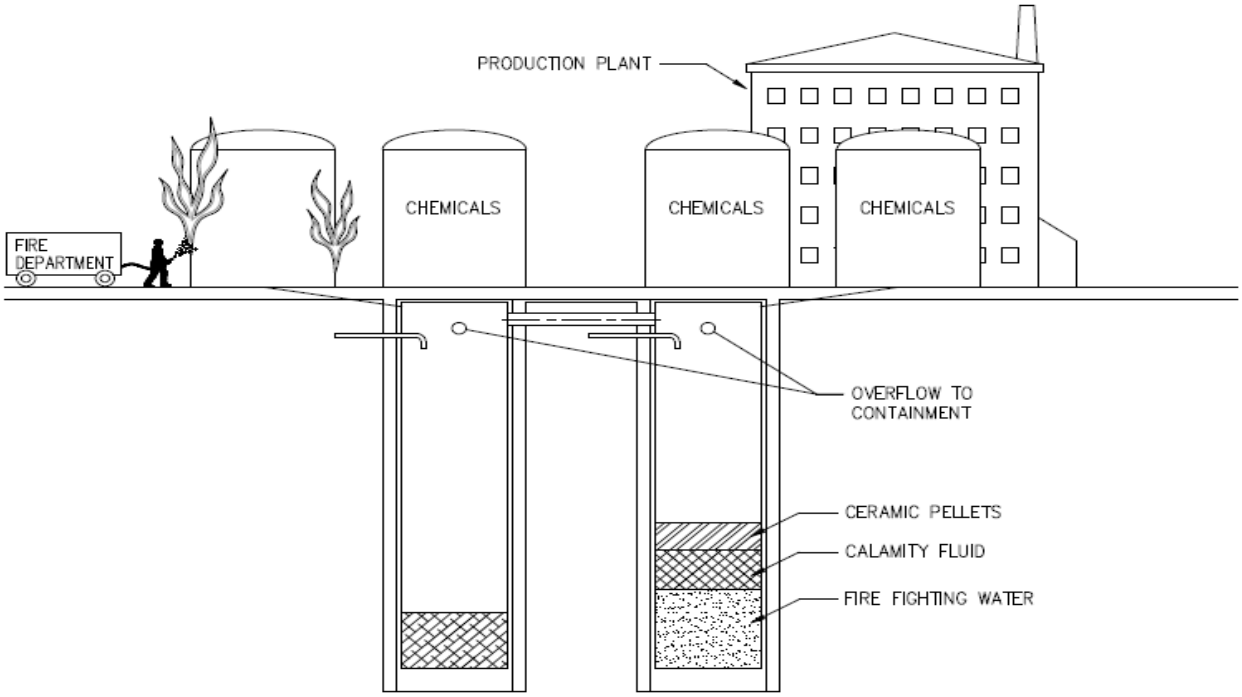
When designing a hazardous site in a vacant area, thought should be given to the possible need for increasing the protection systems when the surrounding area becomes developed.

Example 2 – example of compounded yard that can be utilised as tertiary containment.

This photo is of an agricultural supplier store with external hard paved area that has been contoured into several catchment areas with hi-lighted drain sumps. The combined sumps lead to an isolation valve prior to exiting the site. The store room has significant secondary containment system capacity.

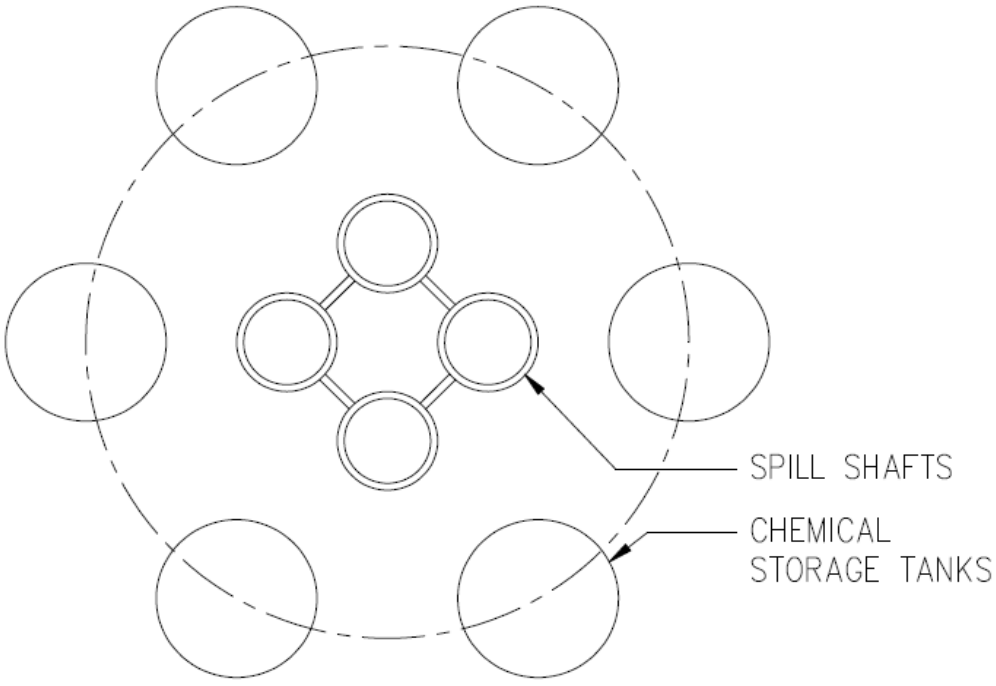
From inside the store looking out showing the compound ramp and contoured paving.

Example 3 – Deep Shaft Tanks



DEEP SHAFT TANKS – ELEVATION

Another option where suitable surface areas are not available. This utilises concrete pipes up to 5 metres diameter and 18 metres deep. The ceramic pellets act like a floating roof, minimising the exposed surface area and thereby reducing vapourisation.



PLAN

Appendix 15: Chemical Incompatibility

(Informative)

The storage should be organised to minimize the hazards associated with leaks, spills, and accidental mixing of incompatible chemicals. The following steps will assist this process.

- Use the Safety Data Sheets to catalogue the nature of the substances.
- Establish the incompatibility, reactivity and stability of the substances. Guides to incompatibility have been approved as codes of practice under the HSNO Act.
- Where a separation distance is required for incompatible substances and the substances require secondary containment, it is necessary to both separate the substances and locate them in separate compounds with any drainage segregated.

  A possible layout is to have 3 aisles of which the outer 2 aisles have compounds sufficient for the stored volumes of each of the incompatible substances and the middle isle is used for inert non hazardous substances as a buffer.
- Shelves should have enough clearance to accommodate the largest container.
- Do not store chemicals (except cleaners) under sinks. Use approved flammable storage cabinets, corrosive storage cabinets, shelving or compounds suitably built and lined for the substance.
- Avoid storing liquids above solids or powders.
- Avoid stockpiling chemicals. Purchase only what is needed.
- Conduct periodic cleanouts to prevent accumulating unnecessary chemicals.
- Do not sort and store chemicals alphabetically unless they have first been separated into hazard classes.
- Ensure that caps and lids on all chemical containers are tightly closed to prevent evaporation of contents. A Teflon or PVC cap liner may be used to provide a better seal.
- Avoid exposure of chemicals to heat or direct sunlight. This may lead to the deterioration of storage containers and labels, as well as the degradation of the chemicals. Some time-sensitive chemicals such as peroxide-formers can be affected as well.
- Prevent materials from falling off storage shelves e.g. by installing lips.
- Avoid storing chemicals on countertops or in fume hoods except for those in current use.

Appendix 16: Threshold Quantities for Secondary Containment Register

(Informative)

Item	Substance	Classification	Quantity	Threshold	Exceeded Yes / No

Appendix 17: Secondary Containment Capacities Register

(Informative)

Provide a unique tank number, location or identification on the site plan. The description should be sufficient to ensure that each tank can be unequivocally identified.

The register may be combined with other HSNO criteria such as controlled zones required for class 2.1.1, 2.1.2 and 3.1 flammable substances.

Secondary containment capacity of large systems may require a surveyors report to establish the capacity.

Location or Tank Number	**Description**	**Total Pooling Potential litres**	**Secondary containment Capacity Required Litres**	**Secondary Containment Capacity Provided Litres**	**Controlled Zones Metres**	**HILU High Intensity Land Use Metres.**	**LILU Low Intensity Land Use Metres.**

Appendix 18: Compound Testing

(Informative)

Height (mm) of water above the compound floor at test start: ___mm. (Use ullage method from lip of still well.)

Date / Time	Weather	Comments	Compound Dip mm	Compound Loss mm	Evaporation Dip mm	Evaporation Loss/Gain[1] mm	Net Seepage Loss (A+B)

[1] In this column, a loss is expressed as a negative amount and a gain is expressed as a positive amount

Appendix 19: Test Certifier Performance for Secondary Containment

(Informative)

Performance Standard for Secondary Containment

For Test Certifiers

ORIGINALLY PRINTED AUGUST 2009

PERFORMANCE STANDARD

New Zealand Government

This standard is one of a series being produced by ERMA New Zealand to assist test certifiers in their certification work. ERMA New Zealand expects all test certifiers to adhere to the information given. The performance of test certifiers will be audited against these standards, as will any complaint made against a test certifier.

It is not intended to be a comprehensive review of the relevant regulations. It covers those items subject to test certification. If in doubt, refer to the appropriate regulations or site and storage document.

This standard does not address the test certification of class 1 explosive substances.

Checklists are provided for test certifiers to use and are available to test certifiers on the secure area of the website. Test certifiers should complete these checklists and keep them for further reference and audit.

1. Introduction

This standard explains the test certificate requirements for secondary containment under the emergency management provisions of the Hazardous Substances and New Organisms Act 1996.

Test certificates must be held for:

- locations where flammable and oxidising classes[6] of hazardous substances are present; and
- stationary container systems where combustible[7], toxic, corrosive or ecotoxic[8] substances are present that do not have a flammable (other than combustible) or oxidising classification.

The test certifier must certify that a hazardous substance location or a stationary container system has a secondary containment system in place as required by the emergency management regulations. Any non-compliance with the controls must be noted and the person in charge advised of the shortcomings. Non compliances must be rectified before the test certificate can be issued or renewed. If a certificate cannot be issued, you must notify the enforcement agency (Department of Labour) and ERMA New Zealand. See the Test Certifier Service Guidelines, Section 1.8.

This standard is designed to:

- set out the criteria specified in the legislation to ensure compliance with the secondary containment controls that are subject to test certification;
- advise test certifiers of the components of the test certificate;
- ensure assessments are consistent and that the test certifier is able to identify the reason for issuing or not issuing a test certificate;
- provide test certifiers with a record of their assessment;
- provide a point of reference against which the performance of test certifiers may be audited;
- provide a point of reference for the investigation of any complaint levelled against a test certifier.

It refers to the relevant parts of:

- Hazardous Substances (Emergency Management) Regulations 2001, referred to as the emergency management regulations;
- Hazardous Substances (Classes 1 to 5 Controls) Regulations 2001, referred to as the classes 1 to 5 controls regulations;
- Transfer Notices, particularly the Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004, referred to as the DG Transfer Notice;
- Group Standards;
- Site and storage conditions for group standards[9], referred to as the site and storage conditions.

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[6] Classes 3, 4 or 5
[7] Class 3.1D
[8] Classes 6, 8 and 9
[9] The secondary containment conditions set out in the site and storage documents repeat the emergency management regulations controls. The clause numbers vary from group standard to group standard and consequently are not referenced in this document.

2. Hazardous substance location test certificates

A hazardous substance location test certificate must be issued where flammable and oxidising classes of hazardous substances are held in quantities which exceed their respective threshold quantities. The threshold limits for a hazardous substance location are set out in Schedule 3 Table 4 of the classes 1 to 5 controls regulations or in the site and storage conditions. Toxic, corrosive and ecotoxic substances are not part of the location test certificate and do not need to be examined.

The test certificate must list the hazardous substance locations that have been certified at a place as well as the classifications involved so that the person in charge is in no doubt regarding the extent of the assessment.

2.1. When does secondary containment need to be test certified?

If a place holds or is likely to hold a quantity of hazardous substances of a particular hazard classification greater than the threshold specified in Schedule 4 of the emergency management regulations, a secondary containment system is needed.

2.2. Which regulations must be certified?

- regulations 25 and 36 to 41 of the emergency management regulations are to be certified as being complied with;
- regulation 36 must be read in conjunction with regulation 25, it is the capacity of the container that must be considered and not what it might contain;
- regulation 36(2A) requires the quantities in different sized packages be aggregated;
- regulations 37 to 39 define the capacity of the secondary containment system;
- regulation 40 is specific to storage below ground and requires the secondary containment system to have a capacity at least equal to the total pooling potential;
- regulation 41 is about excluding energy and ignition sources that are capable of causing ignition or thermal decomposition;
- for a substance subject to a group standard, the conditions are set out in the site and storage conditions.

2.3. What is the capacity of the secondary containment system?

The capacity required of the secondary containment system for flammable and oxidising classifications is set out in the following table.

Minimum Capacity Requirements for Secondary Containment

Container Size	**Quantity – Total Pooling Potential (TPP)**	
	Less than 5,000 litres	**Greater than or equal to 5,000 litres**
≤ 60 litres	At least 50% TPP	2,500 L or 25% TPP whichever is the greater
> 60 and up to 450 litres	At least 100% TPP	5,000 L or 50% TPP whichever is the greater
> 450 litres	At least 110% of the capacity of the largest container	
Below ground	At least 100% TPP	

2.4. Are there exceptions to the secondary containment controls?

You need to check if the secondary containment controls have been varied. The changes will be set out in the DG Transfer Notice or covered in the site and storage documents. Of particular note is:

- the storage of petrol, aviation gasoline and racing gasoline;
- the storage of fuel on farms;
- an additional subclause to regulation 36 of the emergency management regulations that deals with secondary containment for pipe work;
- the EPA may, on application, modify the aggregate capacity limit of a group of stationary containers, Schedule 9, Clause 2 of the DG Transfer Notice;
- a reduction in the capacity of the secondary containment system may be approved by the EPA or allowed if in accordance with a code of practice, Schedule 9, Clause 3 of the DG Transfer Notice.

Exceptions to the HSNO regulations have been allowed under certain conditions for “existing” locations (i.e. those that were in place at the time of transfer). The exceptions are set out in the following approved codes of practice:

- Code of Practice for the Management of Existing Stationary Container Systems up to 60,000 litres Capacity. See clauses 2.9, 3.2, 4.3, 5.2, 6.3, 7.2, 8.3, 8.4, and Appendix 4;
- Code of Practice for the Management of Existing Stationary Container Systems at Timber Treatment Facilities;
- Code of Practice for Above Ground Stationary Tanks with Integral Secondary Containment. See clause 2.1.

2.5. What is to be test certified?

The test certifier must certify that:

- where the quantities of flammable and oxidising substances require secondary containment, secondary containment is in place;
- the capacity of the secondary containment meets the legislative requirements;
- the substance can, subject to unavoidable wastage, be recovered; and
- controls are in place to:
  - exclude any energy or ignition sources; and
  - prevent contamination.

2.6. What must be achieved by the containment system?

For a secondary containment system, the following emergency management regulations must be satisfied:

- the secondary containment system has sufficient capacity to contain the minimum quantity required by the legislation, regulations 37, 38, 39 and 40;
- the substances can be contained if they escape from the container, regulation 35(a)(i);
- the substances can be recovered subject to unavoidable wastage, regulation 35(a)(ii);
- the system complies with an approved code of practice, regulation 35(b);
- where class 3 to 5 substances are contained, sources of energy capable of causing then to ignite or decompose thermally are excluded, regulation 41(b);
- controls prevent the substance from being contaminated by incompatible substances and materials, regulation 41(d).

2.7. What evidence is needed of the ability to contain the substance?

The person in charge must satisfy the test certifier that the regulations are being complied with. Sufficient evidence would be demonstrable compliance with accepted engineering principles and practices designed to achieve these performance standards.

Confirmation might take the form of:

- compliance with a recognised standard such as AS 1940[10], NZS/AS 3833[11] or a code of practice approved by the EPA or other government agency;
- an engineer's "as built" report and drawings;
- records of testing of the compound such as those recommended in the Ministry for the Environment publication, "Above-ground Bulk Tank Containment Systems" that deals with petroleum products in above-

[10] AS 1940 Australian Standard – The storage and handling of flammable and combustible liquids.
[11] AS/NZS 3833 Australian/New Zealand Standard – The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers.

ground bulk storage tank containment systems. Section 8 deals with means of achieving satisfactory containment standards, Section 10 refers to permeability testing;

- an inspection programme that provides evidence that the compound holds water, there are no damp patches on the walls or at the base, and there are no drain holes or obvious breaches.

3. Stationary container system test certificates

For stationary container systems, Part 4 of the emergency management regulations is relevant. In this case the secondary containment system must be test certified where a stationary tank contains a combustible, toxic, corrosive or ecotoxic substance that does not have another flammable or oxidising classification and stationary container system capacity criteria are exceeded. The requirement is set out in Schedule 8, clause 92(2)(d) of the DG Transfer Notice.

3.1. When does secondary containment need to be test certified?

The capacity criteria for a test certificate are:

- a below ground tank; or
- an above ground tank with a capacity of more than 5,000 litres; or
- a below ground process container; or
- an above ground process container with a capacity of more than 1,000 litres.

3.2. Which regulations must be certified?

The regulations set out in Sections 2.2 above have to be followed, but with the following variations:

- the references to packages will not apply, emergency management regulations 36(2A), 37 and 38;
- control of energy sources will be relevant only to combustible substances, regulation 41(b);
- if the substance has a toxic or biological corrosive substance class people must be prevented from being directly exposed to the substance, regulation 41(c).

3.3. What is the capacity of the secondary containment system?

The secondary containment provisions for storage tanks and process containers subject to test certification are the same as for the tanks for flammable liquids.

Minimum Capacity Requirements for Secondary Containment

	Quantity – Total Pooling Potential (TPP)
> 450 litres	At least 110% of the capacity of the largest container
Below ground	At least 100% TPP

3.4. Are there exceptions to the secondary containment controls?

The exceptions are found in Section 2.4 above.

3.5. What is to be test certified?

The test certifier must certify that:

- where the quantities of toxic, corrosive and ecotoxic substances require secondary containment, secondary containment is in place;
- that the capacity of the secondary containment meets the legislative requirements;
- the substance can, subject to unavoidable wastage, be recovered; and
- controls are in place to:
  - prevent people from being directly exposed to the substance, if it is a toxic or biological corrosive substance; and
  - prevent contamination.

3.6. What is required of a secondary containment system?

The requirements are found in Section 2.6 above.

3.7. What evidence is needed of the ability to contain the substance?

The evidence is as in Section 2.7 above.

Attachment 1

Hazardous Substance Checklist for Secondary Containment

This assessment is for the purposes of evaluating the secondary containment element of a location or stationary container test certificate

Test certifiers should complete this checklist as part of their assessment when certifying a location. If any of the controls are not met, a test certificate must not be issued. The test certifier must advise the client and the Department of Labour of any deficient items.

There is no requirement to provide recommendation which could be construed as a conflict of interest.

Premises/Company:

Contact Name:

Physical Address:

Date of Assessment:

Test Certifier:

Notes:

Attachment 2 Threshold Quantities for Secondary Containment

Item	Details	Yes / No	Comments			
1	The facility has an inventory of hazardous substances?		If No Person in Charge to prepare one			
2	The threshold quantities have been established?		If No Person in Charge to prepare one			
3	Threshold quantity for the following hazard classifications	Substance	Classification	Quantity	Threshold	Exceeded Yes / No

Secondary Containment (Part A)

Item	Requirement	Complies Yes/No	Evidence of Compliance
4	The capacity of the secondary containment system to hold a pooling substance has been determined? Regulations 37, 38, 39 and 40.		
5	The secondary containment system has sufficient capacity to contain the minimum quantity required by the legislation?		
6	The substances will be contained if they escape from the container? Regulation 35(a)(i).		
7	The substances can be recovered subject to unavoidable wastage? Regulation 35(a)(ii).		
8	The system complies with a code of practice approved by the EPA? Regulation 35(b). *Note: Codes of practice that address secondary containment are:* · *Management of Existing Stationary Container Systems up to 60,000 litres Capacity;* · *Above Ground Stationary Tanks with Integral Secondary Containment;* · *Management of Existing Stationary Container Systems at Timber Treatment Facilities.*		
9	Sources of energy capable of causing ignition or thermal decompose are excluded where class 3 and 5 substances are present? Regulation 41(b)		
10	Direct exposure of people is prevented where toxic or biological corrosive substances are present? Regulation 41(c).		

11	Controls prevent the substance from being contaminated by incompatible substances and materials? Regulation 41(d).		

Location or Tank Number[7]	Description[7]	Total Pooling Potential litres	Secondary containment Capacity Required Litres	Secondary Containment Capacity Provided Litres	Complies Yes/No

[7] Provide a unique tank number, location or identification on the site plan. The description must be sufficient to ensure that each tank can be unequivocally identified.

Appendix 20: Hazard Classification

(Normative)

Physical Hazard Classification

Property	**Explosiveness**						**Flammability**									**Capacity to Oxidise**		
Class	**Class 1**						**Class 2**		**Class 3**		**Class 4**					**Class 5**		
Subclass	**1.1** Mass explo-sion	**1.2** Pro-jection	**1.3** Fire & minor blast	**1.4** No signif-icant hazard	**1.5** Very insen-sitive	**1.6** Extre-mely insen-sitive	**2.1.1** Gases	**2.1.2** Aerosol	**3.1** Liquid	**3.2** Liquid desensit-ised explosive	**4.1.1** Readily comb-ustible	**4.1.2** Self reactive	**4.1.3** Desen-sitised explo-sive	**4.2** Spontan-eously combust-ible	**4.3** Dan-gerous when wet	**5.1.1** Liquids/ solids	**5.1.2** Gases	**5.2** Organic peroxide
Hazard Classifi-cation	**1.1A**						**2.1.1A**	**2.1.2A**	**3.1A**	**3.2A**	**4.1.1A**	**4.1.2A**	**4.1.3A**	**4.2A**	**4.3A**	**5.1.1A**	**5.1.2A**	**5.2A**
	1.1B	**1.2B**		**1.4B**			**2.1.1B**		**3.1B**	**3.2B**	**4.1.1B**	**4.1.2B**	**4.1.3B**	**4.2B**	**4.3B**	**5.1.1B**		**5.2B**
	1.1C	**1.2C**	**1.3C**	**1.4C**					**3.1C**	**3.2C**		**4.1.2C**	**4.1.3C**	**4.2C**	**4.3C**	**5.1.1C**		**5.2C**
	1.1D	**1.2D**		**1.4D**	**1.5D**				**3.1D**			**4.1.2D**						**5.2D**
	1.1E	**1.2E**		**1.4E**								**4.1.2E**						**5.2E**
	1.1F	**1.2F**	**1.3F**	**1.4F**								**4.1.2F**						**5.2F**
	1.1G	**1.2G**	**1.3G**	**1.4G**								**4.1.2G**						**5.2G**
		1.2H	**1.3H**															
	1.1J	**1.2J**	**1.3J**															
		1.2K	**1.3K**															
	1.1L	**1.2L**	**1.3L**															
						1.6N												
				1.4S														

Biological Hazard Classification

Property	**Toxicity**								**Corrosiveness**			**Ecotoxicity**			
Class	**Class 6**								**Class 8**			**Class 9**			
Sub-class	**6.1** Acutely toxic	**6.3** Skin irritant	**6.4** Eye irritant	**6.5** Sensiti-sation	**6.6** Mutagen	**6.7** Carcinogen	**6.8** Reproduc-tive / develop-mental	**6.9** Target organ	**8.1** Metallic corrosive	**8.2** Skin corrosive	**8.3** Eye corrosive	**9.1** Aquatic	**9.2** Soil	**9.3** Terrestrial vertebrates	**9.4** Terrestrial inverte-brates
Hazard Classifi-cation	**6.1A**	**6.3A**	**6.4A**	**6.5A**	**6.6A**	**6.7A**	**6.8A**	**6.9A**	**8.1A**	**8.2A**	**8.3A**	**9.1A**	**9.2A**	**9.3A**	**9.4A**
	6.1B	**6.3B**		**6.5B**	**6.6B**	**6.7B**	**6.8B**	**6.9B**		**8.2B**		**9.1B**	**9.2B**	**9.3B**	**9.4B**
	6.1C						**6.8C**			**8.2C**		**9.1C**	**9.2C**	**9.3C**	**9.4C**
	6.1D											**9.1D**	**9.2D**		
	6.1E														

Appendix 21: Evaluation

(Informative)

Process Safety

Consideration should be given to evaluating risks at the design phase of a project. Options for determining effectiveness include:

Layer of Protection Analysis (LOPA) and Safety Integrity Level (SIL) determination – hazard evaluation and risk assessment methodologies recommended in the Buncefield Report.

“What if” Analysis. A “what if” analysis explores every possible scenario that could be expected to happen and measures need to be in place to mitigate the events.

It is insufficient to rely on written procedures without a rigorous audit process established to mitigate the human failure weakness that may come to the fore.

Technical evaluation

Prior to upgrading existing, or building new, above ground secondary containment systems, technical and operability studies should be undertaken to assess the actual or potential effects of these facilities on the surrounding environment.

The UK Process Safety Leadership Group’s final Buncefield report “Safety and environmental standards for fuel storage sites” is recommended as the minimum standard for flammable liquids. The report covers in full, the processes required to ensure that the impacts on people and the environment from the primary and secondary containers is fully understood, and that the design eliminates the risk as far as is reasonably practicable.

Factors that should be taken into account when designing containment systems include the following:

- proximity to, and environmental sensitivity of, surface waters
- proximity to, and environmental sensitivity of, groundwater
- nature and volume of products stored
- resistance of containment materials to the product stored
- service loading on containment media
- provision for a sealing membrane under tanks
- seismic and climatic hazards
- the interfaces of the various structural elements within the compound
- leak detection devices
- overfill protection devices, and
- provision for the management of fire control water.

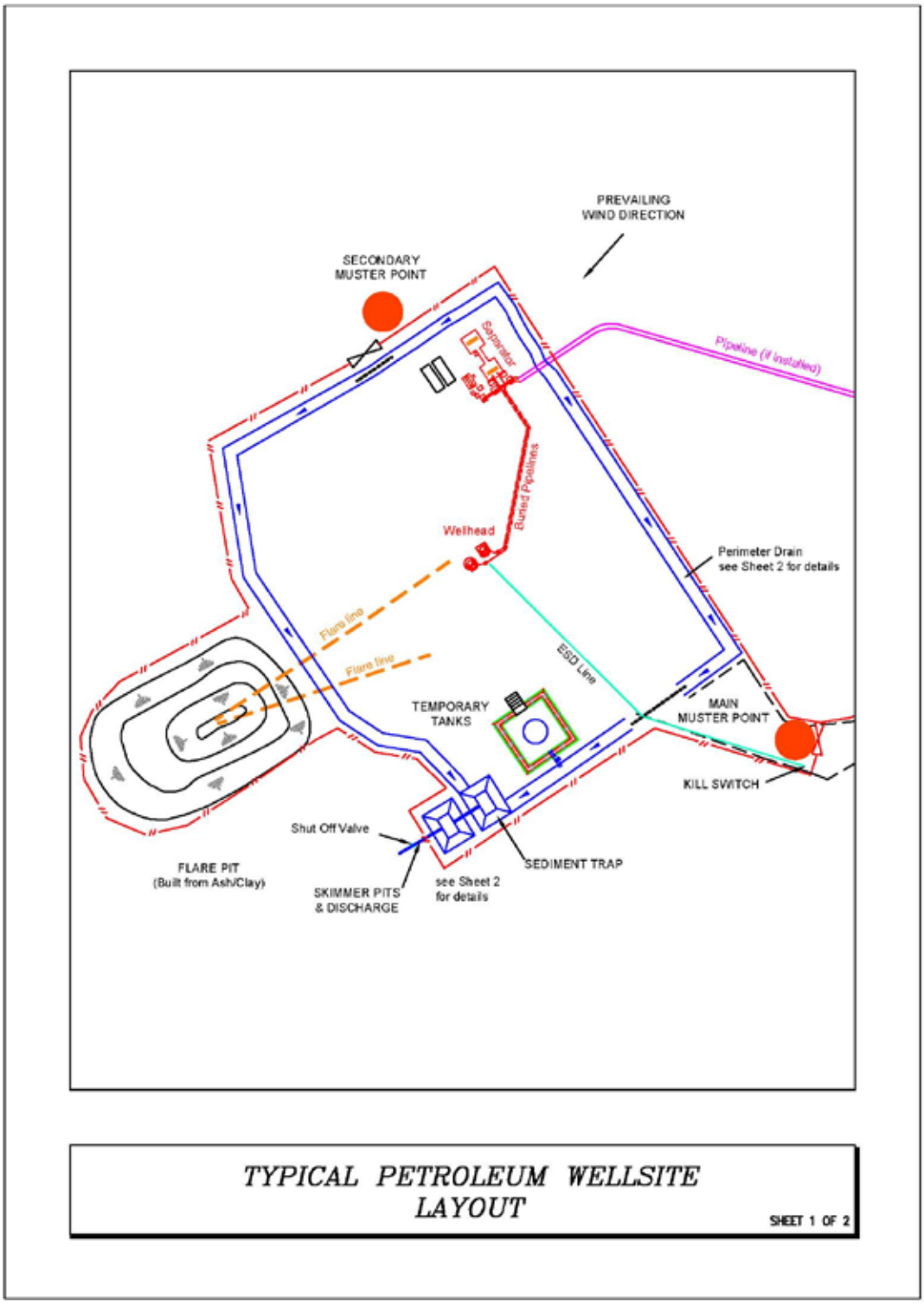
Overfill protection of the primary container

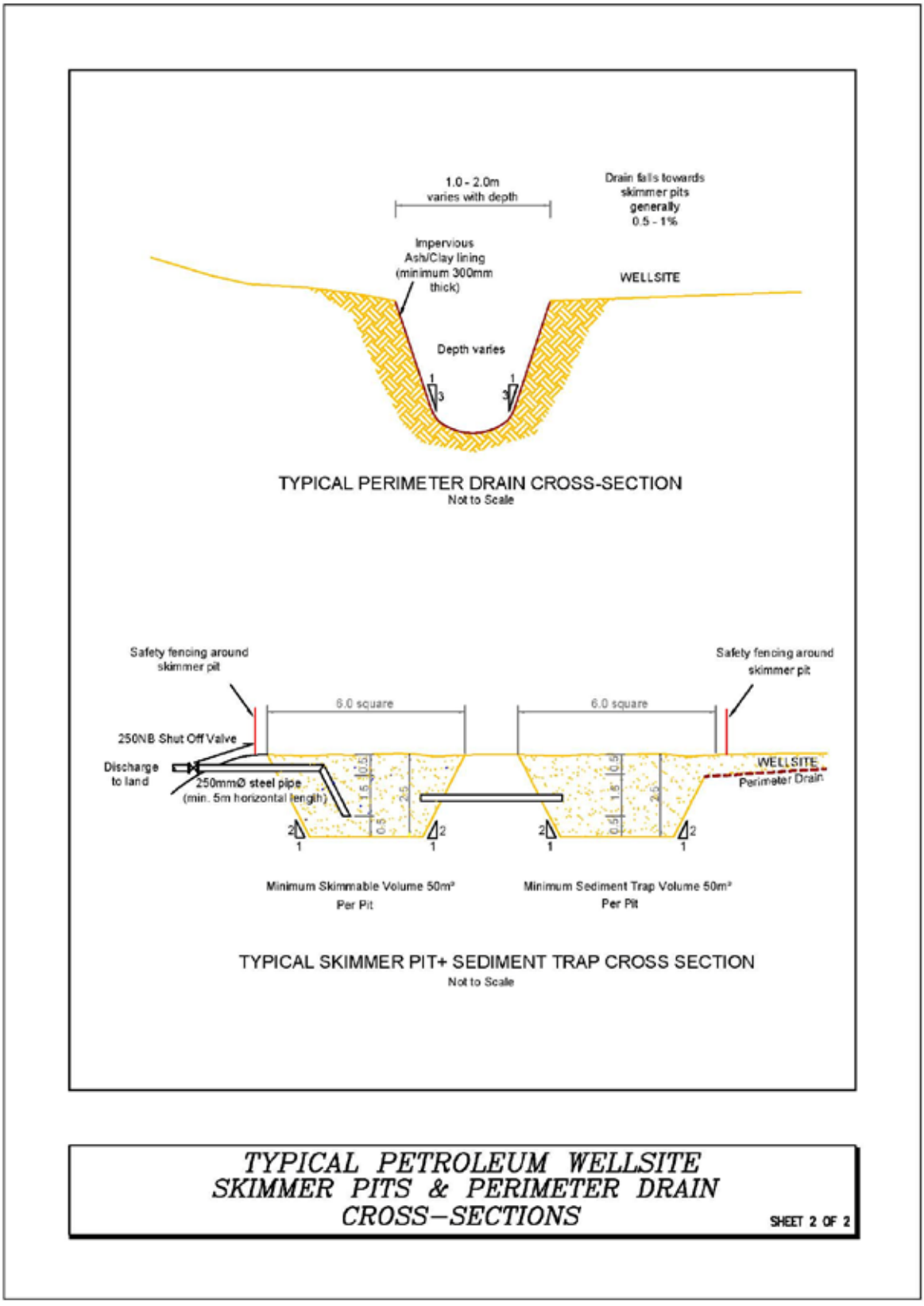
Overfill protection systems, including instrumentation, devices, alarm enunciators, valves and components comprising the indicators, alarms and shutdown systems, should be assessed using BS EN 61511 or equivalent standard, which sets a minimum performance for safety integrity levels. This includes the following considerations for overfill protection:

- design, installation, operation, maintenance and testing of equipment;
- management systems;
- the redundancy level including diversity, independence and separation;
- fail safe provisions, proof test coverage and frequency; and
- consideration of the common causes of failure.

Refer also to Appendix 8 ‘Overfill Protection’ of this Code.

Appendix 22: Perimeter Drainage System




1.0 - 2.0m
varies with depth
Drain falls towards
skimmer pits
generally
0.5 - 1%
Impervious
Ash/Clay lining
(minimum 300mm
thick)
WELLSITE
Depth varies
1
3
1
3
TYPICAL PERIMETER DRAIN CROSS-SECTION
Not to Scale
Safety fencing around
skimmer pit
Safety fencing around
skimmer pit
6.0 square
6.0 square
250NB Shut Off Valve
Discharge
to land
250mmØ steel pipe
(min. 5m horizontal length)
WELLSITE
Perimeter Drain
0.5
1.5
0.5
2.5
0.5
1.5
0.5
2.5
2
1
2
1
2
1
2
1
Minimum Skimmable Volume 50m³
Per Pit
Minimum Sediment Trap Volume 50m³
Per Pit
TYPICAL SKIMMER PIT+ SEDIMENT TRAP CROSS SECTION
Not to Scale
TYPICAL PETROLEUM WELLSITE
SKIMMER PITS & PERIMETER DRAIN
CROSS-SECTIONS
SHEET 2 OF 2

Environmental Protection Authority
Te Mana Rauhī Taiao

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