

**The storage and handling of toxic  
substances**

Public Review Draft

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### **TECHNICAL COMMITTEE REPRESENTATION**

The following organizations were represented on the Technical Committee:

Government chemist  
National Environmental Management Authority  
National Transport and Safety Authority  
Kenya Railways  
Directorate occupational health and safety service  
Ministry of Health  
Ministry of Transport  
Kenya Maritime Authority  
Kenya Airways  
Kenya Transport Association  
Kenya ports authority  
Radiation protection board  
National Corridor Transit and transport authority  
Nairobi University  
Kenya police Service (Traffic department)  
Dangerous goods management ltd.  
Kenya Bureau of Standards — Secretariat.

### **REVISION OF KENYA STANDARDS**

In order to keep abreast of progress in industry, Kenya Standards shall be regularly reviewed. Suggestions for improvements to published standards, addressed to the Managing Director, Kenya Bureau of Standards, are welcome.

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# **The storage and handling of toxic substances**

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## Fore Word

This Kenya Standard was prepared by the Technical Committee on Transport of dangerous goods under the guidance of the Standards Projects Committee, and it is in accordance with the procedures of the Kenya Bureau of Standards.

Preparation of the Standard was commenced following a request from the standards approval committee that a series of Standards be prepared on the storage and handling of dangerous goods.

The objective of this Standard is to provide users of toxic substances with such requirements and recommendations for the storage and handling of those substances as are appropriate to the interests of safety of persons and property.

This Standard deals with dangerous goods of Class 6.1, as classified in the UN Recommendations on the Transport of Dangerous Goods

The series of Standards covering the storage and handling of dangerous goods presently comprises the following Standards:

- LP Gas-Storage and handling Code of practice for the safe handling of cryogenic fluids
- The storage and handling of flammable and combustible liquids
- Anhydrous Ammonia-Storage and handling (known as the SAA Anhydrous
- The storage and handling of pesticide
- The storage and handling of hazardous chemical Materials-Class 5.2 substances (organic peroxides)
- The storage and handling of liquefied chlorine gas
- The storage and handling of corrosive substances
- Liquefied natural gas - Storage and handling
- The storage, handling and transport of liquid and liquefied polyfunctional isocyanates
- The storage and handling of oxidizing agents
- The storage and handling of gases in cylinders

During the preparation of this standard, reference was made to the following documents:

AS/NZS 4452: 1997

Acknowledgement is hereby made for the assistance derived from these sources.

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# KENYA STANDARD

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## The storage and handling of toxic substances

### 1.1 Scope

This Standard sets out requirements and recommendations for the safe storage and handling of toxic substances Class 6.1

The Standard also applies to other dangerous goods that are assigned a Class 6.1 subsidiary risk, except where they are of Class 2, or where more stringent requirements apply under another relevant Standard or applicable regulation.

This Standard applies in locations that are generally industrial, commercial or rural in nature, including laboratories.

This Standard does not apply to-

- (i) the transport on land of toxic substances.
- (ii) storage in port areas.

**1.2 Application** The requirements of this Standard apply in conjunction with, but do not take precedence over, any government regulations that apply in any area.

Where the toxic substance being kept has one or more Subsidiary Risks, reference shall be made to the Kenyan Standards relevant to the classes of those risks and the more stringent requirements shall apply.

NOTE: Where no Kenyan Standard applies for a particular Subsidiary Risk, reference should be made to the relevant regulatory authority.

Where polyfunctional isocyanates are kept, reference to Kenyan standard shall also be made and the more stringent requirements shall apply.

NOTES:

1 Toxic substances that are classified as dangerous goods may also be classified as workplace hazardous substances. As such they will also be subject to the legislative requirements relating to workplace hazardous substances. Cognizance of the relevant requirements of the Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) is also necessary.

2 An installation may come under the regulatory control of several authorities having differing areas of responsibility, and an approval from one authority does not necessarily constitute an approval from the others.

3 Cognizance of the relevant requirements of the Building Code of Kenya is necessary for all matters relating to building works.

4 The bulk transfer of toxic substances between a ship and an onshore storage is controlled by the relevant regulatory authority.

For minor storage (as defined in Clause 1.5.17) of toxic substances, only Sections 1, 2, 6 and 9 of this Standard apply. For transit storage (as defined in Clause 1.5.37) of toxic substances, only Sections 1, 3, 6, 7 and 9 apply.

**1.3 NEW DESIGNS AND INNOVATIONS** Any materials, designs, methods of assembly and procedures which do not comply with the specific requirements of this Standard or are not mentioned in it but which give performance and safety equivalent to those specified are not necessarily prohibited. Under such conditions the relevant regulatory authority can advise on the procedure for approval.

### 1.4 Normative reference

UN (United Nations) Manual of tests and criteria Recommendations on Transport of dangerous goods

IMDG Code-International maritime dangerous goods code

CSC/IMO-International convention for safe containers

IATA (International air transport association -dangerous goods regulation

**1.5 DEFINITIONS** For the purpose of this Standard, the definitions below apply.

**1.5.1 Access-**a means by which persons and vehicles can approach and leave a specific location; includes walkways, platforms, stairways, ladders, roads and all other provisions for convenient entry and exit.

1.5.2 Approved, approval-with the agreement of, acceptable to, and meeting the prescribed standards of, the authority having jurisdiction.

1.5.3 Boundary-the perimeter of the whole of the site under the same occupancy as that on which the installation is situated.

1.5.4 Bulk-relating to toxic substances that are-

(a) in liquid or paste form and are kept in a container having a capacity of greater than in 4250 L

(b) in solid form (including powders) and are kept in a container in an undivided quantity exceeding in 250 kg.

**1.5.5 Bund-an** impervious embankment of earth, or a wall of brick, stone, concrete or other suitable material which may form part or all of the perimeter of a compound.

**1.5.6 Compound-**an area bounded by natural ground contours or by a bund, being sufficiently impervious to retain any spills or leaks of substances kept within the area pending the recovery of those spilled or leaked substances.

**1.5.7 Container-**anything in or by which dangerous goods are wholly or partly cased, covered, enclosed, contained or packed, whether such a thing is empty or partially or completely full, but does not include a vehicle or freight container.

1.5.8 Dangerous goods-substances and articles that-

(a) satisfy the tests and criteria for determining whether goods are dangerous goods as specified in -  
(i) the UN Manual of Tests and Criteria; or  
(ii) the UN Recommendations on the Transport of Dangerous Goods; or

(b) in Kenya, are determined to be dangerous goods by the competent authority.

**1.5.9 Fire resistance level (FRL)/fire resistance rating (FRR)-**the grading period, in minutes, determined in accordance with relevant regulation for-

(a) structural adequacy; (b) integrity; and

(c) insulation, and expressed in that order (e.g. 60/60/30).

NOTES:

1 Where an FRL/FRR is required, reference should be made to the Building Code of Kenya for guidance.

**1.5.10 Freight container-**an article of transport equipment that is of a permanent character and accordingly strong enough to be suitable for repeated use; specially designed to facilitate the transport of goods, by one or more modes of transport, without immediate reloading; designed to be secured and/or readily handled, having fittings for these purposes.

The term includes neither vehicles nor packaging; however, containers when carried on a chassis are included.

**1.5.11 Hazardous area-**an area in which an explosive atmosphere is present, or may be present, in quantities such as to require special precautions for the construction, installation and use of potential ignition sources.

**1.5.12 Ignition source-**a source of energy sufficient to ignite a flammable atmosphere, and which may include naked flames, exposed incandescent material, electrical welding arcs, mechanical or static sparks, and electrical or mechanical equipment not approved for use in hazardous locations.

**1.5.13 Incompatible**-in relation to toxic substances or the containers in which such substances are kept, the ability to react or combine with one another in a manner that increases the hazard of an individual substance, that could cause deterioration of any of those substances, that could increase the hazards in the event of fire, or that could increase the likelihood of contamination by toxic substances.

NOTES:

This definition should be read in conjunction with Clause 1.5.27.

2 Toxic substances and foodstuffs are an example of incompatibility.

3 Other goods with which toxic substances are incompatible may be identified and from relevant MSDSs.

**1.5.14 Installation**-all of those facilities on a site that are related to the storage or handling of toxic substances.

**1.5.15 Intermediate bulk container (IBC)**-a container, other than a packaging-

(a) used for the transport of dangerous goods of other than Class 2;

(b)

(c) having a capacity of not more than 3 m<sup>3</sup>; designed and constructed to be loaded onto, and unloaded from, a vehicle while filled; and

(d) complying with the ACTDG Specifications for Intermediate bulk containers for the Transport of Dangerous Goods! or otherwise approved design.

**1.5.16 Material safety data sheet (MSDS)**-a document that provides information on the identification, health hazards, precautions for use and the safe handling of a specific chemical product, and which complies with ISO

**1.5.17 Minor storage**-the storage of toxic substances in accordance with the criteria set out in Clause 2.2 of this Standard. Minor storage is that quantity which, in the event of loss of containment of the toxic substance in an emergency, will not unduly contribute to the emergency.

**1.5.18 Non-combustible**-material that does not support combustion or is deemed to be non-combustible when tested in accordance with ISO. For the purpose of this Standard, hardwood is deemed to be non-combustible.

**1.5.19 Package**-the complete product of the packaging operation, consisting of the packaging and its contents prepared for transport.

**1.5.20 Packaging-**

(a) in relation to dangerous goods of other than Class 2 that are liquid, a container having a capacity not exceeding 450

(b) in relation to solid dangerous goods, a container holding or capable of holding not more than 400 kg of those goods in an undivided quantity.

**1.5.21 Packing Group (PG)**-the division of dangerous goods (of other than Classes 1, 2, 5.2, 6.2 and 7) into three hazard groups as designated in the, in decreasing order of hazard, by the Roman numerals-

(a) 'I' for great danger;

(b) 'II' for medium danger; and

(c) 'III' for minor danger.

NOTE: The UN Manual of Tests and Criteria provides criteria for the assignment of Packing Groups.

**1.5.22 Pesticide**-any substance or mixture of substances intended for preventing or controlling any unwanted species of insects, plants and animals, including any substance or mixture of substances intended for use as a plant-growth regulator, defoliant or desiccant.

**1.5.23 Pipework**-an assembly of pipes, pumps, hoses, valves and fittings used in the transfer of toxic substances.

**1.5.24 Practicable**-practical with regard to-

- (a) the severity of the hazard or risk in question;
- (b) the state of knowledge about that hazard or risk and any ways of removing or mitigating that hazard or risk;
- (c) the availability and suitability of ways to remove or mitigate that hazard or risk; and
- (d) the cost of removing or mitigating that hazard or risk.

**1.5.25 Protected places**-these are deemed to include-

- (a) a dwelling, place of worship, public building, school or college, hospital, aged persons' accommodation, childcare facility or theatre;
- (b) a factory, workshop, office, store, warehouse, shop, building, or yard where persons are employed;
- (c) a ship lying at permanent berthing facilities;
- (d) any storage facility for dangerous goods outside the property boundary of the installation; or
- (e) an environmentally sensitive area, which includes but is not limited to- (i) a water catchment area (ii) a reservoir for drinking water; (iii) a freshwater or marine environment; or (iv) a national park or equivalent.

**1.5.26 Public place**-any place other than private property, open to the public, which the public has a right to use and which includes a public road.

Commercial building car parking areas are not considered to be public places.

**1.5.27 React dangerously**-in relation to the reaction of substances, to react in a manner that directly creates a hazard due to the reaction-

- (a) being violent;
- (b) producing an explosion;
- (c) producing a potentially explosive combination of products;
- (d) producing fire or rapid evolution of heat; or
- (e) producing toxic vapor or toxic gas.

NOTE: Examples of substances that react dangerously are acids and cyanides; stabilized acetone cyanohydrin evolving hydrocyanic acid gas in the presence of alkalis; and iron pent carbonyl reacting with water or steam to produce carbon monoxide.

**1.5.28 Regulatory authority**-the statutory authority having jurisdiction for that particular aspect of the storage and handling of Class 6.1 substances.

NOTE: More than one authority may be involved in relation to such matters (see Note 2 to Clause 1.2).

**1.5.29 Restricted area**-an area to which access is only available to such persons as are authorized by the occupier.

**1.5.30 Retail premises**-premises on which goods of Class 6.1 are kept for the purpose of sale to the general public.

**1.5.31 Screen wall**-a structurally-sound wall that is impervious to liquid and vapor and is constructed of materials that are substantially resistant to attack by the toxic substances kept.

**1.5.32 Segregation**-the isolation of goods that are incompatible, or react dangerously, from each other within a storage area.

**1.5.33 Separation**-the isolation of dangerous goods stores from protected places, public places, boundaries or other dangerous goods stores.

**1.5.34 Shall, should, may-the word 'shall'** is to be understood as mandatory and the word 'should' as advisory; 'may' implies the right to use discretion.

**1.5.35 Tank**-a receptacle, other than an intermediate bulk container, having a capacity of at least, 450 L, for liquids and a capacity of at least 500 L for gases. 'Tank' includes-

- (a) a demountable tank, which is a tank designed to be carried on a vehicle, having no permanent attachment to the vehicle chassis and includes a tank container and portable tank;



(b) a portable tank, which is a tank within the scope of the requirements of a 'portable tank' or 'portable tank for gases' in Section 13 of the General Introduction to the **IMDG Code**; and

(c) a tank container, which is a portable tank within the scope of the requirements for 'container' in the International Convention for Safe Containers (CSC/IMO).

#### **1.5.36 Toxic substances**-substances and articles that-

(a) are listed as Class 6.1 substances

(b) meet the classified criteria specified in the UN Manual of Tests and Criteria; (c) have a primary risk of another class and a Subsidiary Risk of 6.1; or

NOTE: For the purposes of this Standard, the term 'toxic substances' is deemed to include toxic articles.

**1.5.37 Transit storage**-storage of toxic substances, in accordance with Section 3 of this Standard, held in transit for at least 12 hours not more than three normal working days.

#### **1.6 PACKAGING** A packaging that is to be filled with toxic substances shall-

(a) for use other than at the premises at which it is to be filled, meet the requirements of relevant Kenyan standard; and

(b) for use at the premises at which it is to be filled, be constructed-

(i) with sufficient strength and durability for its proposed service; and

(ii) such that all components of the packaging that may be directly in contact with the contents are compatible with the contents.

**1.7 LABELLING** Packages containing toxic substances shall be labelled in accordance with the relevant Kenyan standard.

**1.8 SECURITY OF STORAGE AREAS** All storage areas shall be appropriately secured from access by unauthorized persons. The storage area shall be considered a 'restricted area'.

#### **1.9 SEPARATION AND SEGREGATION**

1.9.1 Separation of stores from protected places, public places and boundaries. All stores containing toxic substances, in quantities above those for minor storage, shall be separated from protected places, public places and boundaries by the minimum distances determined from Table 1.1.

To calculate the minimum separation distance from a store to a protected place, public place or boundary, the distance corresponding to the quantity of toxic substances stored and their Packing Group is determined from Table 1.1(A), and multiplied by the risk factor determined in Table 1.1(B) and the protection factor determined in Table 1.1(C). Except for a retail store's public access point, a minimum separation distance of 5 m for PG I substances and 3 m for PG II and PG III substances shall apply.

Where quantities of toxic substances in excess of 500 tonnes are stored, they shall be separated by distances determined by risk assessment.

##### **NOTES:**

1 Appendix C gives a worked example of the calculation of separation distance.

2 Where the separation distance is measured across a boundary to a protected place or public place on neighboring premises, and subsequent developments on those neighboring premises compromise the original separation distance, then the relevant regulatory authority may require that the original installation be modified, relocated or taken out of service, to ensure that the separation distance remains in compliance.

3 Other requirements may be specified in the DOSH ACT for the Control of Major Hazard Facilities.

Separation distances may be measured in a horizontal plane around an intervening screen wall, provided that-

(a) where the height of the store is greater than or equal to that of the protected place, the wall shall extend at least 1 m above the highest container in the store;

(b) where the height of the store is less than that of the protected place, the wall shall extend at least 1 m above the protected place or extend as a roof above the store;

(c) the wall shall be marked such as to indicate the maximum permissible storage height;  
And

(d) the wall and the roof, if any, shall have a fire resistance level (FRL)/fire resistance rating (FRR) of at least 120/120/120.

NOTE: Where an FRL/FRR is required, reference should be made to the Building Code of Kenya.

## 1.9.2 Segregation

**1.9.2.1** Segregation of substances that are incompatible or which may react dangerously  
Stores of toxic substances shall be segregated from incompatible goods and goods with which they may react dangerously in accordance with the following:

(a) Where the substances being kept are incompatible-

(i) they shall be kept in separate compounds; or

(ii) they shall be segregated by a distance of at least 5 m, except that, where both substances are solids, the minimum segregation distance may be reduced to 3 m.

(b) Where the substances being kept may react dangerously-

(i) they shall not be kept within the same compound, or in compounds that share a common drainage system; and

(ii) they shall be segregated by a distance of at least 5 m.

(c) Where toxic substances are being consolidated for transport, they may be held in a vehicle or freight container, provided that they are segregated within that vehicle or freight container in accordance with the IMDG Code or IATA Dangerous

Goods Regulations, as appropriate to the intended mode of transport.

Where used, bunds shall comply with Clause 5.7. Where toxic substances are kept with other dangerous goods that are compatible and do not react dangerously with each other, the two storage areas should be discrete ones (for good housekeeping reasons).

**1.9.2.2** *Segregation from foodstuffs*, other products for human or animal consumption, empty foodstuff containers, material for the production of foodstuff packaging's and medical and veterinary material shall not be kept in the same room, store or cabinet as any dangerous goods of Class 6.1, Packing Group I. Foodstuffs, other products for human or animal consumption, empty foodstuff containers, material for the production of foodstuff packaging's and medical and veterinary material may be kept in the same store or room as dangerous goods of Class 6.1, Packing Group II or III, provided that-

(a) they are kept at least 5 m away from the dangerous goods;

(b) they are not kept in any compound that is provided for the dangerous goods; and

(c) the dangerous goods are in packages that are not opened.

A toxic substance shall not be kept on or above any shelf in which any food, drink or medicine is stored or displayed, or in any cupboard, box or other place in which articles of food, drink or medicine are stored or kept for use.

**1.9.2.3** *Measurement of segregation distances* The distances specified in Clauses 1.9.2.1 and 1.9.2.2 may be measured in a horizontal plane around an intervening screen wall, provided that the screen wall extends a distance of at least 1 m above the highest storage and is clearly marked to indicate the highest storage permitted. Where any of the goods being so segregated are of Classes 2.1, 3 or 5, such a screen wall shall have an FRL/FRR in accordance with the requirements given in the appropriate Australian Standard for that class of dangerous goods. Where the goods so segregated are of Class 4, the screen wall shall have an FRL/FRR of at least 240/240/240.

NOTE: Where an FRUFRR is required, reference should be made to the Building Code

**1.9.2.4** *Co-storage of Class 6.1 with a Subsidiary Risk 3* Minor quantities of dangerous goods of Class 6.1/Subsidiary Risk 3 and dangerous goods of Class 3/Subsidiary Risk 6 may be stored with other Class 3 dangerous goods, provided that such a store meets the requirements of both this Standard Such goods in greater than minor quantities

shall not be kept within a store for dangerous goods of Class 6.1 that have no Subsidiary Risk.

NOTE: This is because the flammability risk will increase the risk associated with the storage of toxic substances.

Where a store contains goods that are both flammable and toxic, the addition of a minor quantity of Class 6.1 dangerous goods will not unduly increase the risk. However, the addition of a greater amount of Class 6.1 dangerous goods will increase the risk.

**TABLE 1.1**  
**MINIMUM SEPARATION DISTANCES FOR STORES OF TOXIC SUBSTANCES**

**(A) Separation distance**

Aggregate quantity kept tones or m3(KL)	Minimum separation distance, m		
	PG I	PG II	PG III
≤1	10	6	6
> 1 ≤10	16	10	6
> 10 ≤ 20	18	12	8
> 20 ≤ 50	20	16	10
> 50 ≤ 100	30	20	16
> 100 ≤ 200	40	30	20
> 200 ≤500	50	35	30

NOTE: For quantities greater than 500 tones or 500 m3, a risk assessment shall be carried out.

**(B) Risk factor**

Storage/handling activity:	Factor
Storage cabinets (packages are closed)	0.5
Package store (packages are closed)	0.5
Package store (packages are opened or it lied)	1.0
Bulk store (toxic substance presents no inhalation hazard)	1.0
Bulk store (toxic substance presents an inhalation hazard)	2.0
Bulk store (toxic substance presents an inhalation hazard)	2.0

**(C) Protection factor**

Protection to place/boundaries:	Factor
Protected place"	1.0
Retail sale public access point (minor quantities of closed packages of PG II and PG III)	0.0
Premises boundaries or public place	0.5

\* When separation distances are applied to an on-site protected place, the factor may be reduced to 0.5, subject to appropriate risk identification, assessment and control.

**SECTION 2 MINOR STORAGE**

**2.1 SCOPE OF SECTION** This Section specifies the criteria for minor storage classification for toxic substances, and the requirements for such storage.

NOTE: The underlying concept of minor storage is that quantities below a certain level are so small, or are so scattered and separated, that they present little real risk and in an emergency will not unduly hinder the activities of emergency personnel or contaminate the surrounding area.

**2.2 CRITERIA FOR CLASSIFICATION AS MINOR STORAGE** Storage of toxic substances in packages, in compliance with Table 2.1, is classified as minor storage.

**TABLE 2.1  
MAXIMUM QUANTITIES OF TOXIC SUBSTANCES  
PERMISSIBLE AT VARIOUS PREMISES FOR  
DESIGNATION AS MINOR STORAGE**

Types of premises	Maximum quantity, kg or L		
	PG I	PG II	PG III
Residential premises	1	10	10
Fan $\geq 2$ ha	10	500	100
All other premises	100	3500	1000

**NOTES:**

- 1 Units of kilograms are applicable to solids and units of liters to liquids. The maximum quantities specified in terms of 'kg or L' are the sum of the number of kilograms of solid substances plus the number of liters of liquid substances.
- 2 The quantities on any given line may be aggregated.

**2.3 REQUIREMENTS APPLICABLE TO MINOR STORAGE**

The following requirements apply to minor storage:

- (a) Storage areas shall be secured against unauthorized entry.
- (b) A supply of water shall be available at a nearby location, for personal hygiene.
- (c) Adequate ventilation shall be provided for all storage and handling areas (see Clause 6.3.2).
- (d) Packages shall not be kept near substances with which they are incompatible or with which they may react dangerously.
- (e) Packages shall be kept away from sources of heat.
- (f) Packages shall be kept securely closed when not in use.
- (g) Packages shall be kept in such a manner as to avoid spillage.
- (h) Appropriate spillage-retention measures shall be provided at locations where packages are likely to be opened or their contents transferred.
- (i) The contents of a package shall not be transferred to any other container for storage, unless the latter is suitable for the storage of the toxic substance and is clearly marked in accordance with Clause 1.7.

**NOTE:** Where the contents of a package have been transferred into another container, the resultant package, if it is to be used for transportation, is required by the relevant regulatory authority to comply with the ADG Code

(j) Appropriate control measures shall be instituted for any process involving product transfer operations, e.g. decanting or filling.

(k) Appropriate personal protective equipment shall be worn by any person involved in product transfer operations (see Clauses 6.7.2(d) and 6.8).

- (l) Any spills or leaks shall be cleaned up immediately, and disposed of in accordance with Section 9.
- (m) Wastes shall be disposed of in accordance with Section 9.

**2.4 STORAGE ON FARMS** The maximum quantity of toxic substances allowed as minor storage on farms is as given in Table 2. 1. This quantity is permissible only provided that-

- (a) such substances are not intended for resale;
- (b) the area of any such fan is at least 2 ha and is used or intended to be used for agricultural, horticultural, floricultural or pastoral purposes;
- (c) the ground around the storage area is kept clear of combustible vegetation or refuse for a distance of at least 3 m;
- (d) potential flow of spillage is prevented from reaching any protected place, watercourse or property boundary by such means as the use of natural ground slope, or the provision of a diversion channel, kern or bund;
- (e) the store is separated from any protected place or dwelling on the property by at least 10 m;
- (f) any store is separated from the boundary of the property by at least 15 m; and
- (g) where there are two or more minor stores on the same property, each may be treated as a separate minor store if they are separated by a distance of at least 100 m.

### **SECTION 3 TRANSIT STORAGE**

**3.1 SCOPE OF SECTION** This Section specifies requirements for the temporary storage of toxic substances, and of other dangerous goods being held in the storage area with them, when in transit.

**3.2 DELINEATION OF TRANSIT STORAGE AREAS** Areas used for the transit storage of toxic substances shall be deemed to be separate areas if apart from each other and from other storage areas by at least 15 m.

**3.3 REQUIREMENTS FOR TRANSIT STORAGE** Unless otherwise directed by the regulatory authority, the following requirements apply to the transit storage of toxic substances and of other dangerous goods being held in the storage area with them:

- (a) The quantity of toxic substances held in each transit storage area shall not exceed 200 t. Where toxic substances are held in the one area with other dangerous goods, the aggregate quantity of all dangerous goods kept shall not exceed 200 t.
- (b) Except when in freight containers, the maximum quantity of each pallet stack stored in the transit storage area shall not exceed 25 t, gross mass. Such pallet stacks shall be at least 5 m apart.
- (c) Freight or tank containers containing packaged or bulk toxic substances in a transit storage area shall-
  - (i) not be stacked more than two containers high and two containers deep;
  - (ii) where stacked two containers deep, be provided with access to both sides of each stack;
  - (iii) not be in the same vertical stack as any container of other classes of dangerous goods; and
  - (iv) be separated from containers of other classes of dangerous goods by at least 3 m unless a greater distance is required by Clause 3.3(e).
- (d) The spillage catchment and clean-up facilities of the site shall be capable of handling at least 100% of the capacity of the largest tank, compartment or package in the area

NOTE: In order to facilitate the management of emergencies, it is recommended that compound capacities be about 10% greater than the minimum values specified above.

(e) Parked road vehicles loaded with toxic substances shall be separated from any other loaded vehicles by at least 1.5 m, and from any other dangerous goods stores within the area by at least 5 m.

(f) Access and escape routes shall be clearly defined and kept clear.

(g) Specific facilities, which may include a designated area, shall be provided at the site for dealing with tanks or packages that are-

## **SECTION 4 STORAGE AND HANDLING OF PACKAGES**

**4.1 SCOPE OF SECTION** This Section sets out requirements and recommendations on the storage and handling of packages of toxic substances, NOTE: Sealed intermediate bulk containers (IBCs) having a capacity not exceeding 1.5 m<sup>3</sup> may be stored in accordance with the requirements of this section in the same manner as packages.

**4.2 TYPES OF PACKAGE STORES** An installation for the storage or handling of packaged toxic substances may be, but is not limited to, any of the following:

(a) A room, enclosure or area within a building.

(b) A roofed structure or room, attached to an external wall of another building.

(c) A freestanding, roofed structure or building (not attached to any other building)

(d) An indoor storage cabinet.

(e) An outdoor storage area with a security fence.

### **4.3 LOCATION OF STORE**

**4.3.1 General** The following principles apply when determining the store's location where this is not specifically covered by local government zoning or other ordinances; their purpose is to protect people, the environment and property in the event of an emergency, e.g. fire, flood or spillage:

(a) Avoid close proximity to houses, schools, hospitals and similar congested areas.

(b) Avoid proximity to water courses and open storm water channels.

(c) Ensure that the store is above the highest recorded flood level.

(d) The store should be located at such distance from any accumulation of flammable or combustible materials, so that, in the event of a fire in those materials, the heat load will not impinge on the integrity of the store.

### **4.3.2 Separation and Segregation**

**4.3.2.1 Separation distances**, all package stores of toxic substances shall be separated from a protected place, public place and the boundaries of the premises by at least the distances determined by Clause 1.9.1.

**4.3.2.2 Segregation distances** All package stores of toxic substances shall be segregated in accordance with Clause 1.9.2.

## **4.4 GENERAL REQUIREMENTS FOR PACKAGE STORES**

**4.4.1 Requirements for stores other than indoor storage cabinets** Package stores for toxic substances, other than indoor storage cabinets, shall comply with the following general requirements, as appropriate:

(a) Unless otherwise approved, stores shall be located on a floor that has immediate access for emergency personnel.

(b) At least two means of access shall be provided to stores which have a floor area exceeding 25 m<sup>2</sup>. (See also Clause 6.2.2.)

(c) Stores shall be designed, constructed and operated in a manner that will allow the housekeeping requirements of Clause 6.4 to be carried out effectively. Provision shall be made to allow for the washing down of the floor area.

(d) Stores shall have wall and roof sheeting and main structural members constructed from materials which are non-combustible and resistant to attack by the material stored.

(e) Lighting shall comply with Clause 6.2.4.

(f) Adequate ventilation shall be provided for all storage and handling areas (see Clause 6.3.2).

(g) Stores shall be provided with a means of either containing a spill or diverting it to a compound within the boundaries of the premises. The net capacity of any compound shall be-

(i) for Packing Group I liquids, 100% of the aggregate volume of liquids kept.

(ii) for Packing Groups II and III liquids, 25% of the aggregate volume of liquids kept.

In any case, the net capacity of any compound shall be at least the capacity of the largest container kept.

The compound shall be impervious to the material it is designed to contain.

#### NOTES:

In order to facilitate the management of emergencies, it is recommended that compound capacities be about 10% greater than the minimal values specified above.

Earth by itself without a lining does not satisfy the impermeability criteria given above.

(h) All areas used for decanting shall have floors that are capable of containing a spill or of diverting it to a suitable compound within the boundaries of the premises.

(i) Packages shall be kept in a manner such that they cannot fall and cause spillage outside the compound.

(j) Stores shall be secured against unauthorized entry, in accordance with Clause 1.8

(k) Where provided, and except where they are designed as spill trays or compounds, racks or shelves shall be designed and constructed in such a manner as to prevent the accumulation or pooling of liquid.

(l) Where racking is used, the layout of racks shall be such as to provide clear passage for escape of personnel.

#### NOTES:

(m) It is recommended that the width of aisles between racks be at least 1.2 m.

(n) Where packages are stored on pallets, sufficient clear maneuvering space should be made for fork lifts, in accordance with the forklift manufacturer's specification.

(o) In stores and associated handling areas where combustible dusts or flammable vapors may be generated (e.g. handling a pesticide contained in a low flash point solvent), a hazardous area, as defined in may exist; all electrical and other equipment in any such hazardous areas shall be suitable for use in those zones.

(p) The following items shall be provided within 7 m of, but not nearer than 2 m to, stores where packages are opened:

(i) A safety shower and eye-wash facilities

(ii) Water for the washing of hands.

(q) Any lunch room or area for eating and drinking shall be separate from the storage area.

Lockers, where provided for storing personal clothing and property, shall be located away from the storage area.

#### 4.4.2 Requirements specificity for indoor storage cabinets

**4.4.2.1 Types of substances kept** Cabinets designated for the storage of packages of toxic substances shall not be used for the storage of goods that are incompatible, or that react dangerously

**4.4.2.2 Maximum quantities to be kept** The maximum quantity of toxic substances kept in

a single cabinet shall not exceed 250 kg or 250 L, of which not more than 50 kg or 50 L shall be of Packing Group II and not more than 25 kg or 25 L shall be of Packing Group I.

NOTE: Units of kilograms are applicable to solids and units of liters to liquids.

**4.4.2.3 Cabinet design** The following requirements apply to the design of cabinets:

- (a) The walls, floor, door and roof shall be of double-walled sheet steel construction, having a thickness of at least 0.75 mm, with a space at least 40 mm between the walls, which may be either an airspace or filled with non-combustible insulation.
- (b) Cabinets shall be provided with a self-closing, close-fitting door.
- (c) Cabinets for the storage of toxic substances shall be lockable.
- (d) The cabinet bottom shall form a liquid-tight compound at least 150 mm deep and capable of containing at least 25% of the maximum storage capacity.
- (e) Any shelves in cabinets shall be designed to permit free air movement.
- (f) The materials of any components that are critical to structural integrity shall not melt at temperatures of less than 850°C, seals or gaskets excepted.

**4.4.2.4 Ventilation provisions** Where mechanical ventilation of the cabinet is required the following requirements apply, in addition to the requirements of Clause 6.3.2:

- (a) The design of any vent opening in the cabinet wall shall not compromise the structural strength of the cabinet.
- (b) The extraction system shall be sufficient to ensure that the ambient concentration of any toxic substance within the breathing zone of any person using the cabinet is maintained as low as practicable.
- (c) Where a cabinet incorporates provisions for connection to an external venting system—
  - i) the vent opening shall be provided with a means for permanent closure when venting is not required;
  - ii) the information supplied with the cabinet shall include instructions on the installation and operation of the vent system; and
  - iii) the cabinet vent design shall be such as to ensure that surrounding work areas are not contaminated by emissions.

NOTE: Ventilation provisions should be designed by an appropriately qualified engineer.

**4.4.2.5 Cabinet location** The following requirements apply to the location of cabinets:

- (a) Cabinets shall be so located in relation to exits and stairways that they will not impede the escape of persons in the event of fire.
- (b) Cabinets shall be located near to a provision for the washing of hands.
- (c) Irrespective of the occupancy of the building, not more than one cabinet shall be installed in each 100 m<sup>2</sup> of building area, and the separation distance between any two cabinets shall be at least 3 m.

**4.4.2.6 Cabinet marking** Cabinets shall be marked in accordance with Clause 7.4.1.



**4.5 REQUIREMENTS FOR PACKAGE FILLING OPERATIONS** The following requirements apply to package filling operations:

(a) Airborne emissions shall be controlled by a suitable ventilation system as determined by site assessment, such as a workplace hazardous substances assessment.

NOTE: An extraction system may require a scrubber prior to venting to atmosphere.

(b) Prior to commencement of any filling operation, all associated filling equipment shall be cleaned free of any residues of substances that are incompatible or that can react dangerously with the product being used in the filling operation.

(c) Where a toxic substance is being supplied from a bulk container, an emergency shut-off device shall be fitted to the package-filling equipment. The emergency shut-off device shall be-

(i) clearly marked with its function and method of operation;

(ii) capable of operation from two points, one immediately adjacent to, and one remote from the filling point;

(iii) capable of stopping the flow of product into any containers associated with the filling operation; and

(iv) in compliance with the requirements of Clause 4.4.1.

(d) The transfer of toxic substances from packages to other containers shall be conducted in a dedicated area away from racking or shelving associated with the storage area.

(e) The package filling area shall be capable of containing a spill or of diverting it to a compound within the boundaries of the premises.

(g) Where the toxic substance has a Subsidiary Risk of Class 3, no active or potential ignition source shall be introduced to the package filling area without authorization, e.g. by means of a work permit (see Clause 6.6.3).

## **SECTION 5 STORAGE AND HANDLING I BULK**

**5.1 SCOPE OF SECTION** This Section sets out requirements and recommendations applicable to the storage and handling of toxic substances in bulk.

**5.2 GENERAL** Provision shall be made to-

(a) enable lighting in the vicinity of the bulk storage area to comply with Clause 6.2.3; and

(b) ensure that bulk storage areas are ventilated to comply with Clause 6.3.2. All relevant requirements of Clause 7.2.1 shall be complied with.

**5.3 CONTAINER TYPES** A container for the storage or handling of toxic substances in bulk shall be one of the following:

(a) A portable bulk container, being -

(i) an intermediate bulk container (IBC);

(ii) a tank container complying with the requirements of the IMDG Code

(iii) a demountable tank complying with the requirements of -c-

(b) A fixed bulk container, i.e. a permanently positioned (fixed) tank, hopper or silo, that is filled and discharged in situ.

## **5.4 DESIGN AND CONSTRUCTION REQUIREMENTS APPLICABLE TO ALL BULK CONTAINER INSTALLATIONS**

**5.4.1 Materials of construction** The materials of construction of a bulk container, and its fittings and attachments, which are likely to come into contact with the toxic substance or its vapor, shall be compatible with the toxic substance to be contained.

**5.4.2 Installation Bulk containers** shall be installed above ground level. The underside of any part of the container in contact with concrete foundations or saddles, or other support structure, shall be protected from corrosion.

**5.4.3 Foundation** A bulk container shall be positioned on a foundation designed in accordance with good engineering practices and which is adequate to support, without unacceptable or uneven settling, the following loads and forces:

- (a) The direct load imposed by the container when full of either water or product, whichever is the denser.
- (b) Any possible overturning forces, in particular those that may be applied by wind when the container is empty.
- (c) Any uplift or other distorting forces that may occur in a light container being subjected to pressure variations.

Any means of attachment between the tank and its supporting structure or foundation should be adequate to withstand any such forces that may be applied to it.

NOTE: Because of the wide variety of surface, subsurface, and climatic conditions, it is not practicable to specify design data to cover all situations.

**5.4.4 Supports** Where a bulk container is installed on supports, the supports shall comply with the following requirements:

- (a) The supporting structure shall either be constructed of non-combustible, corrosion-resistant materials or be suitably protected by coatings.
- (b) The supporting structure shall be designed in accordance with the requirements of the Kenyan Standard appropriate to the type of construction
- (c) Any welded-on support, bracket or other fitting shall be welded in such a manner as to prevent penetration of water that is likely to cause corrosion of the tank (e.g. weep holes shall be at the lowest point of mounting pads).

**5.4.5 Bearing area** The method of support of a bulk container shall avoid excessive concentration of loads on the supporting portion of the container shell. Legs, cradles or similar methods of support shall be attached in a manner that will prevent possible corrosion of the container through the build-up of moisture.

**5.4.6 Vents** Where provided, vents shall be of sufficient design and capacity such that-

- (a) potential blockage by deposits is avoided;
- (b) bulk containers are adequately ventilated to ensure safe dispersal of vapors;
- (c) the pressure or vacuum resulting from filling, emptying or atmospheric changes cannot cause the maximum allowable operating stresses of the container to be exceeded; and
- (d) they shall not discharge directly to atmosphere in areas where people congregate.

NOTE: The relevant regulatory authority may require that vents discharge through an appropriate vapor absorption or scrubber system or that a vapor recovery system be used.

**5.4.7 Transfer points** A transfer point (the point where the pipework from a bulk container terminates) shall comply with the following:

- (a) It shall be suitably anchored and protected from impact by vehicles or swinging loads.
- (b) It shall be provided with a quick-action shut-off valve if the transfer point is positioned at or below the highest level of liquid in the container or pipework.
- (c) It shall be separated from any protected place or boundary of the premises on which the toxic substances are kept by the following minimum distances:

- (i) For PG I 10 m.
- (ii) For PG II 6 m.
- (iii) For PG III 6 m screen wall, provided that the wall extends at least 1 m above the height of the transfer point.

(d) It shall be located in such a manner that any vehicle transferring product into, or receiving product from, the container-

- (i) can stand wholly off any public road; and
- (ii) is not required to enter the container compound.

(e) It shall be clearly identified and marked to show the product being transferred.

(f) Where a transfer point is fitted with a liquid-tight cap, provision shall be made such as will give an immediate warning should an attempt be made to remove the cap while filling line valves are open, e.g. a try-cock in the filling cap.

(g) A safety shower and eye-wash facilities, and water for the washing of hands, shall be located within 7 m of, but not nearer than 2 m to, any product transfer point

(h) Where a bulk container of PG I liquid toxic substances has a product transfer line connected to a pump, then that line shall have valves at either end, between the container and the pump. There shall be a bleed valve between the other valves.

i) Any outlet from a drain valve fitted to a bulk container shall be fitted with a blank flange.

j) All manually operated valves shall be clearly marked to indicate 'open' and 'closed'.

(k) Where a bulk container for the storage of liquid PG I toxic substances is connected to a processing plant, manufacturing plant or some other consuming device:

- (i) the delivery system to the plant shall incorporate a high and low pressure cut-out switch which is capable of shutting down any pump that is connected; and
- (ii) a non-return valve shall be fitted in the discharge line to prevent any other liquids from entering the container.

(l) Where a transfer point is outside the bund, suitable spill containment appropriate to the quantity and nature of the toxic substances being transferred shall be provided

**5.4.8 Liquid lines** -Liquid lines shall comply with the following:

a) All liquid lines connected at or below the liquid level of the bulk container shall be fitted with a shut-off valve at the nozzle through which liquid is transferred into or out of the container, and a shut-off valve at the tank end of the line. There shall be a hydrostatic relief valve in any line enclosed by two valves. The open and closed positions for the valves shall be clearly marked. Where the capacity of the container exceeds 100 m<sup>3</sup> and-

(i) where liquids of PG I are stored, all liquid outlet shut-off valves shall be fitted with a remote means of activation; or

(ii) where liquids of PG II or PG III are stored, there shall be a readily-accessible secondary back-up valve located outside the bund wall.

b) Provision shall be made to enable the complete and safe draining of transfer hoses and filling lines in order to prevent loss of product.

c) where the fill tube is to extend below the surface of the liquid, it shall be provided with a syphon breaker and may require a splash plate.

d) All liquid lines shall be clearly marked to indicate flow direction.

NOTE: Tanks should be filled through the top wherever possible

**5.4.9 Overfill protection** A bulk container shall be fitted with a high-level alarm when the capacity of the container exceeds 50 m<sup>3</sup> and information on the level inside the container is not continuously available to any person filling it. If such a container is used to store PG I liquids, it shall be fitted with an independent extra-high-level alarm and an associated automatic filling cut-off device.

#### **5.4.10 Ancillary equipment for tanks**

**5.4.10.1 Pipes, including flexible hoses** The following requirements apply to pipes and flexible hoses:

(a) Pipes and pipe joints shall be constructed of a material that is resistant to attack by, and is compatible with, the liquid toxic substance under all service conditions.

(b) All pipes shall be adequately protected from physical damage. If plastics pipes cannot be adequately protected, metallic pipes shall be used.

NOTE: Plastics are subject to embrittlement, environmental stress cracking and 'ageing'. They are more susceptible to physical damage than aluminum or stainless steel. Their physical properties can be seriously affected by extremes of ambient temperature.

(c) All above-ground pipes shall be color coded in conformity

(d) Pipework shall be well supported, and protected from potential damage by traffic.

(e) Flexible hoses shall not be used, except at transfer points.

NOTE: The use of bellows joints should be avoided.

(l) Where the toxic substance has a Subsidiary Risk of Class 3, all ancillary equipment shall comply with the appropriate requirements.

Pipes should be either welded or flanged. The use of screw fittings should be avoided wherever possible.

**5.4.10.2 Accessories** Valves, pumps, flow meters, other accessories and lubricants shall be suitable for use with the toxic substance being handled.

All valve components made of non-ferrous metals and their alloys shall not be used where they would be in direct contact with liquid cyanide components.

All manually operated valves shall clearly indicate how to open and shut them and shall be fitted with non-removable handles.

**5.4.10.3 Transfer systems** Where a bulk container will be pressurized for the purpose of product transfer, the fittings and pipework shall be designed for the maximum pressures that may develop.

**5.4.10.4 Tank heaters** Where a tank is provided with a means of heating, such heating shall be provided on the external surface of the tank if there is-

(a) a risk of a dangerous reaction between the toxic substance and the heating medium; or

(b) a risk of danger should the heating element fail and come into contact with the toxic substance.

In such cases a means of thermostatic control shall also be fitted to the container shell.

**5.4.10.5 Electrical equipment** Electrical equipment installed in a hazardous area associated with the storage and handling of toxic substances shall be suitable for use in that area.

**5.5 ADDITIONAL REQUIREMENTS FOR PORTABLE BULK CONTAINERS** In addition to the requirements of Clause 5.4, the following requirements shall apply to portable bulk containers:

(a) except where they comply with the requirements of Clauses 5.3 and 5.4, portable bulk containers shall not be filled from road tankers.

(b) Portable bulk containers shall be adequately restrained during lifting.

- (c) The venting provisions on portable bulk containers shall be operational at all times.
- (d) All liquid shut-off valves on demountable tanks shall be closed prior to the tank being disconnected from the discharge system.
- (e) The filling and transport of portable bulk containers shall be conducted in accordance with the and, where applicable, the IMDG Code

## 5.6 ADDITIONAL REQUIREMENTS FOR FIXED TANKS

**5.6.1 General** Fixed tanks shall comply with the requirements of Clauses 5.6.2 to 5.6.7, in addition to the requirements of Clause 5.4.

**5.6.2 Materials of construction** The materials of construction of fixed tanks and their fittings and attachments that are likely to come into contact with a toxic substance shall be-

- (a) substantially resistant to attack by the toxic substance under all service conditions; or
- (b) lined in a manner such as enables compliance with Clause 5.6.4.

### NOTES:

1 Materials of construction may be considered to be substantially resistant to attack if, after an initial reaction with the toxic substance, an impervious (passivating) film, which prevents further reaction, is formed-s-provided that such a film is not subjected to conditions likely to destroy it (e.g. regular cleaning, product changes).

2 The design thickness of construction materials should allow for any losses associated with regular cleaning or product changes over the service life of the tank.

3. Where the loss of tank material is considered to be an acceptable operating condition and is incorporated into the tank design, the required material thicknesses should be designed for a service life of at least 10 years. The thickness should be checked at least annually, and the tank maintained appropriately. Detailed records of such tests should be kept for the lifetime of the tank.

### 5.6.3 Tank design and construction

The design, construction and certification of fixed tanks shall comply with the following requirements, as applicable:

- (a) Steel tanks intended to be operated at atmospheric pressure or at pressures not exceeding 100 kPa (gauge) shall be designed and constructed in accordance with the relevant requirements of ISO or other equivalent Standards.
- (b) Steel tanks intended to be operated at pressures exceeding 100 kPa (gauge) shall be designed and constructed in accordance with relevant ISO or other equivalent Standards.
- (c) Glass-fiber reinforced plastic tanks for operation at atmospheric pressure shall be designed and constructed in accordance with ISO or other equivalent Standards.
- (d) Rotationally molded polyethylene tanks for operation at atmospheric pressure shall be designed and constructed in accordance with relevant standards.
- (e) Fixed bulk containers shall be constructed according to specifications approved under legislation

**5.6.4 Tank lining** Any lining material for a fixed tank shall be substantially resistant to attack by the contents of the tank, and shall be not less elastic than the material of the tank. When applied to a tank, the lining shall be homogeneous, non-porous, and free from perforations. Joints and seams in the lining shall be made by fusing the material together or by other approved means, and shall be tested for continuity using a non-destructive testing method (e.g. spark testing).

**5.6.5 Level indication** Every fixed tank shall be fitted with an appropriate means of indicating the level of its contents. The level-indicating device shall be of such a design that the contents of the tank cannot leak if the device is damaged. The safe fill level of a tank shall be clearly marked on the level-indicating device.

A sight glass may be used as a level indicator, subject to the following conditions:

- (a) The toxic substance shall not be of Packing Group I.
- (b) The tank capacity shall not exceed 10 m<sup>3</sup>.
- (c) If the sight glass is fitted externally to the tank, it shall have a self-closing shut-off valve and a manual isolation valve on the line that connects the sight glass to the tank below liquid level.
- (d) The sight glass shall be protected from all potential damage.
- (e) If the sight glass does not have the same coefficient of linear expansion as the tank wall, a flexible connection shall be used for attachment of the upper section of the sight glass.

NOTE: The flexible connection is to ensure that damaging stresses are not applied to the sight glass.

**5.6.6 Nozzles** Where nozzles are used to lead liquid into a tank, they should be provided with internal projections to prevent liquid splashing or running down the internal wall of the tank.

**5.6.7 Overflow systems** Every fixed bulk container shall be fitted with a suitable overflow system discharging either to the area within the bund walls or to a collection and holding point. Such a system shall be constructed so as to prevent any overflow running over the outer surface of the container or its supports.

## 5.7 BUNDS AND COMPOUNDS

**5.7.1 General** All bulk containers for liquid toxic substances shall be provided with a compound complying with the requirements of this Clause (5.7).

NOTE: It is recommended that reference be made to the definitions given in Clauses 1.5.5 and 1.5.6.

**5.7.2 Capacity of compounds** The net capacity of a compound shall be-

- (a) for toxic substances of Packing Group I, at least 100% of the total storage capacity of all containers located within the compound; or
- (b) for toxic substances of other Packing Groups, at least 100% of the capacity of the largest container located within the compound.

NOTES:

1 In order to facilitate the management of emergencies, it is recommended that compound capacities be about 10% greater than the minimum values specified above.

2 If tanks are interconnected, and leakage from one can lead to the emptying of others, their entire contents shall be safely contained.

**5.7.3 Design and construction** Compounds and, where they are provided, bunds shall comply with the following requirements:

(a) The materials of construction shall be substantially resistant to attack by any toxic substance that they may be required to contain.

(b) They shall be sufficiently impervious to retain and to enable the recovery of any spillage.

NOTE: Earth by itself without a lining does not satisfy the impermeability criteria given above. Bunds, where they are provided, shall also comply with the following requirements:

- (i) Except where the containers are double-skinned, the minimum separation distance between a container and the bund shall be as shown in Figure 5.1, i.e. the top inside edge of the bund shall not be inside the crest locus limit. If, at any time, the container is to be held under pressure, the so-determined minimum separation distance between the bund and the container shall be increased appropriately.

NOTES:

1 Where the containers are double-skinned, reductions in the above-specified separation distances may be allowed by the relevant regulatory authority.

2 Where installations do not comply with the above requirements, deflector screens may be used on bunds.

- (ii) They shall be designed to withstand the hydrostatic pressure expected to be exerted on them when they are full.
- (iii) The point at which any pipe passes through the wall of a bund shall be sealed to prevent leakage from the compound.
- (iv) Provision shall be made for a ready means of entry and exit by personnel into and out of the compound.

NOTE: Provision should be made in the design of the compound to allow for emergency exit by personnel and for any injured personnel to be rescued.

#### **FIGURE 5.1 BUND LOCATION LIMIT**

**5.7.4 Compound drainage** A compound shall be drained in accordance with the following requirements:

- (a) Substances that might react dangerously shall not be directed into a common compound.
- (b) Any valve controlling the drainage from a compound shall be located outside the bund unless specific approval has been obtained for an inside location. The valve shall be of a type for which the distinction between the open and shut positions is obvious, and shall be resistant to the material contained in the tank and to any possible mixtures resulting from a spill into the compound.
- (c) Except during the supervised drainage of water, any compound drain valve shall be kept closed. The valve shall only be opened by an authorized person, responsible for supervising the drainage. The drainage provision for the compound should slope away from any bulk container to a sump which, in turn, is drained from the lowest practicable level. Where drainage is achieved by gravity, a manually controlled, normally closed valve shall be provided. Where drainage is achieved by pumping, the pump shall be manually controlled.

NOTE: Drainage by gravity, and the subsequent disposal of the waste, may require consultation with the relevant regulatory authority.

**5.7.5 Maintenance** All bunds and compounds shall be maintained in such a manner that compounds are capable of retaining the capacity specified in Clause 5.7.2 and that they continue to prevent the escape of any contained liquid.

#### **5.8 LOCATION OF BULK CONTAINERS**

5.8.1 General Bulk containers for toxic substances shall not be wholly or partially buried.

5.8.2 Separation and segregation

5.8.2.1 Separation With due regard being given to Clause 1.9.1, all bulk containers of toxic substances shall be separated in accordance with the following requirements:

- (a) The minimum separation distance between fixed tanks shall be 1m.
- (b) The minimum separation distances for bulk containers from a protected place, public place and the boundaries of the premises shall be as determined by Clause 1.9.1.
- (c) Where a bund is provided, the minimum distance to a protected place, public place and boundaries of the premises shall be measured from the top inside perimeter of the bund, as determined by Clause 1.9.1.

5.8.2.2 Segregation See Clause 1.9.2

#### **5.9 FILLING OF BULK CONTAINERS**

5.9.1 General The following general requirements apply to the filling of bulk containers with toxic substances:

- (a) A bulk container shall not be filled with toxic substances unless the container is in good condition and complies with the requirements of this Standard.

(b) A container shall not be filled in excess of its safe filling level. (c) Hand-held hoses shall not be used for filling.

(d) Product transfer shall not be commenced until all essential gauges, valves, fittings and connections are illuminated to a level of at least 50 lx.

(e) At least one person who is trained in the product transfer procedures shall remain in attendance during the transfer operation—from the time that the first delivery connection is made until the last hose has been disconnected.

(f) A written procedure for the transfer of toxic substances to or from bulk containers shall be located at every loading position for containers.

(g) The surface at every loading position for bulk containers shall be so graded that any spillage from a delivery vehicle drains into a dedicated sump or containment area. The capacity shall be at least equal to the capacity of the largest tank or compartment on the delivery vehicle.

#### NOTES:

1 Where toxic fluids are to be transferred from a road or rail tank vehicle, the requirements of the ADG Code/NZS 5433 for the transfer of fluids apply in addition to the requirements of this Clause.

2 The requirements applicable to transfer points for the filling of bulk containers are provided in Clause 5.4.7. Filling connections The filling connection to a storage container shall be liquid-tight. Transfer hoses Transfer hoses shall comply with the following:

The length of any hose required to connect a road or rail tank vehicle to a filling point shall not exceed 6 m.

Where necessary, to permit compliance with this requirement, a permanent filling line shall be installed.

A transfer hose shall not be run across any area normally accessible to vehicles unless adequate precautions are taken to prevent any vehicle from driving over the hose or striking its connections.

Transfer hose assemblies shall be visually inspected and hydrostatically tested in compliance with the ADG Code/NZS 5433. Hoses that fail such inspections or tests shall be either disposed of immediately or repaired and retested prior to further use.

Transfer hoses used for toxic substances shall not be used for foodstuffs, medical products, or other products for human or animal consumption.

## SECTION 6 OPERATIONAL AND PERSONNEL SAFETY

**6.1 SCOPE OF SECTION** This Section sets out requirements and recommendations on matters relating to operational and personnel safety. It applies to all stores.

### 6.2 GENERAL PRECAUTIONS

**6.2.1 Work procedures** Safe systems of work, including procedures commensurate with the quantity and nature of the toxic substances being kept, shall be developed and implemented.

NOTE: Appendix c outlines the tasks for which operating procedures may be required.

**6.2.2 Control of entry** In order to prohibit unauthorized personnel from gaining access to plant, equipment and materials, those visitors, contractors' personnel and other persons whose duties require their entry into a restricted area should, wherever practicable, be accompanied at all times by a member of the occupier's staff. Where this is not practicable, except as provided in the Tote below, such persons shall, before entry into such an area, be given a written list of the hazards present and the appropriate precautions to be observed.

NOTE: It is recognized that compliance with this requirement would not be possible where emergency services personnel have to enter the premises to attend to an emergency when the premises are unattended; a safety information board displaying relevant precautions would be sufficient for such purposes.

**6.2.3 Clear access** The means of entry into and exit from the areas, rooms or buildings where toxic substances are kept or handled shall be kept clear at all times.



**6.2.4 Lighting** Whenever people are in an area where toxic substances are kept-

- (a) lighting, of sufficient luminance as to enable a person to easily read all markings on packages, signs, instruments and other necessary items, shall be available in areas where people are working;
- (b) interior lighting shall be of at least the luminance specified in AS 1680.2.0; and
- (c) sufficient lighting shall be available on the internal roads which lead to areas, rooms or buildings where dangerous goods are kept or handled and which may be used by people in the course of their work at the premises.

### 6.3 CONTROL OF EXPOSURE

**6.3.1 Control strategies** The following hierarchy of control strategies should be used to identify appropriate control measures for limiting personal exposure to toxic substances:

- (a) Elimination of the toxic substance from the process.
- (b) Substitution of the toxic substance with a less harmful substance. (c) Minimization of the inventory of toxic substances.
- (d) Engineering controls, chiefly-
  - (i) enclosure of the toxic substance; and
  - (ii) ventilation to remove the toxic substance from one area and displace it to another.
- (e) Administrative (procedural) protection restricting access to a toxic process, and so controlling the dose to the individual. This should be used in conjunction with medical monitoring and personal protective equipment.
- (f) Personal protective equipment, to be used where the hazard cannot be eliminated or adequately controlled.

**6.3.2 Ventilation** Whenever people are in an area where toxic substances are kept, the following requirements shall apply:

- (a) The store shall be provided with adequate natural or mechanical ventilation.

NOTE: Adequate ventilation is dependent on the nature of the toxic substance and the circumstances of its use.

Where a toxic substance is likely to present an inhalation hazard (of dusts, mists or vapors), assessment shall be made in accordance with relevant workplace hazardous substances regulations and appropriate controls and monitoring implemented.

Ventilation shall be sufficient to maintain the ambient concentration of any vapors or dusts in the storage area as low as practicable. Where the toxic substance has been assigned an exposure standard by directorate of occupational health and safety, exposure levels shall be kept below this level.

In Kenya, recommended workplace exposure standards are set by directorate of Occupational Safety and Health. Exposure levels should be kept below the recommended levels.

NOTE: Where no exposure standard is assigned to a toxic substance, it is not implied that the substance is not hazardous to health.

- (d) Where mechanical ventilation is required, the system shall comply with relevant international standard.

- (e) For toxic substances, exhaust air dilution by means of general exhaust ventilation and local exhaust ventilation are the appropriate techniques. Exhaust air flow rates shall be determined by an appropriately qualified engineer.

NOTE: The extraction system may require a scrubber prior to venting to atmosphere.

Where the toxic substance has a Subsidiary Risk of Class 3, no active or potential ignition source shall be introduced as part of a mechanical ventilation system.

### 6.4 HOUSEKEEPING

**6.4.1 Site upkeep** The area within any compound, and for a distance of 3 m from it, shall be kept clear of extraneous matter.

**6.4.2 Bulk storage installations** The means of access to bulk storage compounds, including ladders and catwalks and platforms around tanks, shall be maintained in a safe condition. Hatches, manholes, tank openings and the like shall be kept closed when not in use.

**6.4.3 Package stores** Package stores are intended for the keeping of intact, closed packages of toxic substances. The following procedures in connection with storage of packaged toxic substances shall be established and maintained:

- (a) The aisles inside the store shall be kept clear. (See also Clause 6.2.2.)
- (b) Packages shall be regularly inspected and, when any signs of a spill, leak or deterioration of the package are observed, the suspect package shall be taken out of the store for examination, and repackaging if required. Such repackaging shall be performed in accordance with Clause 4.5.
- (c) Any contamination of the outer package shall be removed prior to replacing the package in the store.
- (d) Minor spills or seepage on the floor, walls or racks shall be treated in accordance with Clause 7.5.
- (e) Any packages that have been opened or partially used shall be clearly identified.
- (f) Labels shall be retained on emptied containers until the containers have been decontaminated, at which time the labels shall be removed or obscured.
- (g) Unless they have been decontaminated, empty containers that have held toxic substances shall be treated as though containing toxic substances, except that it may not be necessary to keep them in a compound.

**6.4.4 Inspection of plant and equipment** In order to ensure that items of plant and equipment are in a serviceable condition, they shall be periodically inspected by a trained person, as follows:

- (a) Bulk containers, pipework, valves, pumps, gauges, alarms and other safety devices shall be inspected visually or by simulation of operating conditions or by non-destructive testing.
- (b) All vents shall be inspected to ensure that passages are clear and that any relief valves are in an operable condition.  
The type and date of inspection, the results, and the name of the person who conducted it shall be recorded and retained.

**6.5 EFFLUENT CONTROL** Effluent lines shall be monitored so as to ensure-

- (a) compliance with any regulatory requirements relating to the discharge of harmful effluent; and
- b) that any harmful effluent does not escape from the premises before it has been appropriately treated.  
Accurate, up-to-date records shall be maintained for all such monitoring.

## **6.6 CONSTRUCTION AND MAINTENANCE WORK**

**6.6.1 General** Construction or maintenance work shall not be carried out in any store or cabinet in which toxic substances are kept, except with written authorization from a person designated for the purpose by the occupier of the premises.

When contemplating such work, the effect of carrying it out shall be evaluated. Where there is any doubt about the safety of the intended procedures, the toxic substances shall be moved? to another location before the work is commenced.

When maintenance work is to be carried out in a workshop on equipment from an area where toxic substances are kept; such equipment shall be checked so as to ensure that no residues remain, prior to the maintenance work being carried out.

NOTE: Particular care needs to be taken where hollow sections could contain solid residues.

**6.6.2 Routine work** All work for which a work permit is not required shall be supervised in such a manner as will ensure its safe conduct.

**6.6.3 Work permit** Except for routine, non-hazardous work, any work within a restricted area shall be authorized by means of a work permit which shall be issued only by a responsible person appointed by the occupier of the premises.

A work permit shall include details of the following:

- (a) The nature and extent of the work.
- (b) Any conditions to be observed, including the use of specialist equipment.
- (c) Any special conditions relating to hot work (see Clause 6.6.6).
- (d) Any personal protective clothing or equipment to be used
- (e) Actions to be taken in the event of personal contamination.
- (f) The period for which the permit is valid.
- (g) Any regular checking necessary to ensure that the safety requirements and conditions remain in force.
- (h) Any procedures and precautions for returning the plant to normal service.
- (i) Any firefighting equipment.
- (j) Authorization.

A work permit may define, within a restricted area, a safe area in which major maintenance or construction work may be performed without further permission. The physical limits of such a safe area shall be clearly designated.

NOTE: Considerable care is still necessary in a safe area, as some articles may be hazardous, irrespective of location. Used tanks, pipes and containers are examples.

**6.6.4 Preparation of work site** Any person who issues a work permit shall ensure that the site area and plant subject to the work permit are prepared in a manner such as will prevent the risk of fire, explosion or exposure to toxic substances. Precautionary measures shall include the following, as appropriate:

- (a) Identification of both the equipment to be worked on and all other affected equipment.
- (b) De pressurization and disconnection.
- (c) Isolation from other equipment.
- (d) Purging of the equipment.
- (e) Removal of any hazardous substances.
- (f) Sealing-off of sewers, drains and gutters.
- (g) Provision of fire-protection equipment.
- (h) Testing for toxic vapors and oxygen content.

**6.6.5 Completion of work** When work covered by a work permit has been completed, the person who issued the work permit shall, before allowing the plant to be returned to service, ensure that-s-

- (a) the work has in fact been completed;
- (b) any temporary arrangements, e.g. bypass lines or blank flanges, have been removed;
- (c) all personnel and equipment are accounted for; and

(d) the work permit is cancelled and the plant is cleared for return to service.

**6.6.6 Hot work** Any work involving cutting or welding by gas or electric arc or any work of equivalent risk (e.g. grinding, drilling, the use of percussion tools) shall not be undertaken within a restricted area where toxic substances are stored unless-

(a) a work permit has first been obtained; and

(b) any hazardous residues or vapors have been removed.

NOTE: Particular care needs to be taken where hollow sections could contain solid residues.

6.6.7 Work inside a confined space Whenever it is intended to enter or work in a confined space, a specific confined space entry permit shall be issued and all the requirements of shall apply.

## 6.7 PERSONNEL TRAINING

**6.7.1 Job knowledge** The occupier of premises on which toxic substances are kept or handled shall ensure that all persons concerned with the handling of such substances on the premises are made fully conversant with-

(a) the means of identifying dangerous goods and the properties of the specific substances handled by reference to the relevant MSDS or equivalent source of information; and

(b) applicable safety regulations and safe-handling procedures.

**6.7.2 Training** The occupier of premises on which toxic substances are kept or handled shall provide training to persons employed at the premises on the-

(a) nature of the work and safe methods of operation;

(b) properties of, and hazards associated with, the toxic substances stored or handled;

(c) location of first aid equipment, and first aid measures to be taken;

(d) correct use of personal protective equipment, and its care and maintenance; and

(e) actions to be taken in various emergencies, including spills, vapor escape, fire, explosion and poisoning. Simulated emergency exercises shall comprise part of the training.

**6.7.3 Personal hygiene** The following directions shall be followed by all persons whose work involves the handling of toxic substances:

(a) Do not introduce, keep, prepare or consume any food or drink, or use tobacco, in any place where toxic substances are stored or handled.

(b) Toxic substances should not be allowed to come in contact with the skin; if skin contact occurs, wash off immediately. After handling toxic substances, always wash your hands before eating, drinking, smoking or using the toilet, and after work.

(c) Immediately attend to injuries caused by contact, or suspected contact, with toxic substances.).

The above directions, or wording to the same effect, shall be prominently displayed in the work area.

NOTE: Occupational health and safety regulations also apply.

## 6.8 PERSONAL PROTECTIVE EQUIPMENT

**6.8.1 General** The occupier of premises where toxic substances are stored or handled shall-

(a) ensure that all persons on the premises are provided with appropriate personal protective equipment;

- (b) keep personal protective equipment in designated, well-identified locations and ready for use; and
- (c) maintain, in a fit state of repair, all personal protective equipment.

**6.8.2 Type of personal protective equipment** The following personal protective equipment shall be provided, as appropriate, at premises on which toxic substances are stored or handled:

- (a) Protective clothing complying with suitable for use with the specific toxic substances.

NOTE: PVC clothing is suitable for protection against many toxic substances. Periodic inspection should be carried out to ensure its continuing serviceability.

- (b) Eye protection, selected in accordance with relevant standard
- (c) Elbow-length protective gloves of suitably resistant material complying with relevant international standard
- (d) PVC or rubber boots, complying with and selected and maintained in accordance with relevant international standard
- (e) Respirators having filters appropriate to the duty, and selected, used and maintained in accordance with relevant standards
- (f) Self-contained breathing apparatus, and selected, used and maintained in accordance with relevant standards

A risk assessment should be conducted to determine the suitability of the personal protective equipment.

**6.8.3 Care and maintenance of personal protective equipment** Personal protective equipment shall be kept separate from normal clothing. As a minimum, gloves should be worn when handling contaminated personal protective equipment and clothing after use. Precautions should be extended depending on the degree of contamination and the toxic substance involved.

Maintenance of personal protective equipment and clothing shall be as follows:

- (a) After use, all personal protective clothing and equipment shall be cleaned with water or a solution appropriate for the toxic substance. The equipment shall be dried before being put away.
- (b) Gloves and boots shall be checked for leaks.
- (c) Self-contained breathing apparatus shall be maintained in accordance with relevant international standard.
- (d) Protective clothing shall be decontaminated then laundered in the normal way.
- (e) Grossly contaminated safety equipment or clothing shall be rendered unusable and disposed of in a manner approved by the local waste disposal authority.

NOTE: Occupational health and safety regulations also apply.

## 6.9 FIRST AID

**6.9.1 General** Advice shall be obtained from an occupational medical practitioner as to what first aid facilities and response are required. This will be dependent on the nature of the toxic substance, its quantity, and the location of the industry.

NOTE: Such practitioners can be found in the private sector, and public Departments of Health, Labor and Industry, and workplace compensation authorities.

An administrative procedure shall be in place to regularly review this advice as opinions on what constitutes an appropriate response and what antidotes, if any, are appropriate, are continually changing.

The following requirements shall also apply:

- (a) A first aid station shall be provided in a clean area and shall be in the care of a responsible person. It shall comprise, as a minimum, an appropriate first aid kit and first aid instructions, e.g. copies of MSDSs, for all toxic substances being kept or handled on the premises.

(b) A list of persons trained in, and designated as being responsible for the administering of, first aid shall be shown on all notice boards on the premises and at each first aid station. The names and telephone numbers of one or more on-call physicians, the nearest hospital, the Poisons Information Centre and the ambulance service shall be included on the list.

NOTE: Appendix E outlines basic information on first aid facilities, training, symptoms of poisoning and antidotes.

**6.9.2 First aid kit** In addition to the standard kit required by occupational health legislation, the following shall be supplied.

(a) Eye-wash facilities complying with relevant international standards

(b) Appropriate resuscitation facilities, and a poster detailing the correct method of resuscitation. Where antidotes are held, an administrative procedure shall be in place to ensure that they are replaced before their expiry date is exceeded. Antidotes and the instructions for their use should be kept in a clearly labelled box.

**6.9.3 First aid procedure** When any discomfort is reported, or a person has inhaled, ingested or been contaminated with a toxic substance, the procedures to be carried out include the following:

(a) Remove the patient to a safe place prior to treatment, if safe to do so. The rescuers shall be properly protected depending on the nature of the hazardous incident, for example appropriate personal protective equipment which can include self-contained breathing apparatus and lifelines.

(b) Send for a designated first aid person and, at the same time, obtain the MSDS for the toxic substance involved. Summon professional medical assistance without delay.

(c) If the patient has stopped breathing, ensure a clear airway and apply an appropriate method of artificial resuscitation.

NOTE: The appropriate method depends on the substance involved. Oxygen resuscitation or external air resuscitation may be required.

(d) If the eyes are contaminated, wash thoroughly with water from a low-pressure water source for at least 15 minutes.

(e) Remove all contaminated clothing and footwear. Wash contaminated area with soap and lukewarm water.

(f) Carry out appropriate first aid treatment and if medical assistance has not been summoned, transport the patient to a hospital or doctor.

(g) Send the MSDS, product label if available, and all relevant details of the accident, to the hospital or doctor with the patient.

## SECTION 7 EMERGENCY MANAGEMENT

**7.1 SCOPE OF SECTION** This Section sets out requirements and recommendations on planning for emergencies, maintenance of manifests, placarding and management of spills and leaks.

### 7.2 Planning FOR EMERGENCIES

**7.2.1 Considerations in designing premises** The likelihood of an incident occurring in an area used for the storage and handling of toxic substances can be minimized by good design and layout, sound engineering, good operating practices, and proper instruction and training of personnel in the performance of their duties.

The design and layout of the facility shall include, where appropriate, provision for-

(a) sufficient space between bund walls, storage areas and other structures as will allow access for maintenance and during emergencies;

(b) a means of reducing any toxic emission to the outside atmosphere;

(c) alarms connected directly to the fire brigade;

- (d) water supplies;
  - (e) fire protection equipment;
  - (f) means of evacuation;
  - (g) protection of personnel responding to the emergency;
  - (h) access routes for fire brigade appliances;
  - (l) containment of leaks, spills and run-off of firefighting water; and
  - (j) the locations of the emergency plan (see Clause 7.2.2) and the safety information board (see Clause 7.4.2).
- Where so required by the relevant regulatory authority, the emergency service agencies shall be consulted with respect to the above matters.

**7.2.2 Emergency plan** The occupier of premises on which toxic substances are kept shall, in consultation with the emergency services and the relevant regulatory authorities, prepare a detailed plan for combating emergencies that might occur on site. The plan shall take into account any potential for the occurrence of fire, explosion, reaction or release of toxic substances. The plan shall be provided in two sets of documents, one for use by plant personnel and a second for emergency services use. The plan shall be appropriate to the size and complexity of the installation. Plant personnel shall be familiar with the emergency plan.

**7.2.2.1 Premises emergency plan** The emergency plan for use by plant personnel shall set out the procedures to be followed by the occupier's personnel in an emergency. The on-site emergency plan shall include, as appropriate-

- (a) actions to be taken in the event of a fire, spill, explosion, leak or other emergency, including fire-fighting actions, alarm activation, evacuation procedure, shutdown procedures, the establishment of emergency control centers, and mutual aid arrangements (e.g. cooperation with relevant authorities, the use of equipment on neighboring premises);
  - (b) a list of contact telephone numbers for emergency services, e.g. fire brigade, Poisons Information Centre/National Poisons and Hazardous Chemical Centre, ambulance, police, regulatory authorities and local hospital, the criteria for contacting them and the procedures to ensure that they are alerted promptly;
  - (c) evacuation procedures and the implementation of a warden system;
  - (d) the establishment of nominated assembly areas, away from the incident area and emergency services operations;
  - (e) training of personnel in carrying out the plan (which may involve the local fire brigade);
  - (f) the provision of material safety data sheets (MSDSs) in a readily-accessible location;
- And
- (g) appraisal and updating of the plan.

**NOTES:**

1. The MSDSs referred to in Item (f) may be additional to those copies required by Clause 6.9.1(a).
2. Recommended documents containing guidelines on the preparation of emergency plans are listed in Appendix F.

**7.2.2.2 Plan for use by emergency services** An emergency plan shall be prepared in order for the emergency services to carry out their duties expediently and efficiently. Such a plan shall be kept in a location approved by the relevant fire authority.

NOTE: The information to be provided in this plan for emergency services is set out in Appendix G.

**7.3 MANIFEST** Unless otherwise required by the relevant regulatory authority, a manifest shall be provided in accordance with the Work safe Kenyan Guidance note for emergency services manifests.

## **7.4 PLACARDING**

**7.4.1 Placarding of stores** Every installation in which toxic substances are kept shall be placarded in accordance with the Guidance note for placarding stores for dangerous goods and specified hazardous substances of Chemical Industry practice for warning signs for premises storing hazardous substances except that, where those requirements conflict with the requirements of the relevant regulatory authority, the requirements of that authority shall prevail.

Additionally, any other notices or warnings that are required by relevant regulatory authorities shall be displayed. These additional signs shall have lettering that contrasts with the background, and be clearly legible from any access point. Unless otherwise required, the height of the letters shall be at least 50 mm.

**7.4.2 Safety information board** Where required by the relevant regulatory authority, a safety information board, bearing information intended principally for the emergency services, shall be displayed at approved locations. The board shall provide the following information:

- (a) Location of the emergency plan.
- (b) Location of the manifest.
- (c) Location of personal protective equipment and clean-up materials.
- (d) Locations of essential services and of the controls for their distribution

NOTE: A pictorial layout of the site or building may also be required on the safety information board by the relevant regulatory authority.

## **7.5 MANAGEMENT OF LEAKS AND SPILLS**

**7.5.1 General** Every endeavor shall be made to prevent leaks or spills, and to control them if they do occur. Clean-up action shall be initiated immediately.

Leaked or spilled toxic substances shall be kept and disposed of in accordance with Section 9. The decontamination and clean-up procedure and investigation shall be carried out by a properly equipped and trained team of two or more persons.

NOTE: Entry into the affected area should always be under the supervision of a responsible person.

**7.5.2 Clean-up materials and equipment** In order to deal with leaks and spills, clean-up equipment, chemicals for neutralizing or decontaminating spills and absorbent materials shall be maintained at all premises on which toxic substances are kept or handled.

NOTE: A typical list of appropriate items is as follows:

- (a) Adequate quantities of absorbent material, e.g. sand, fuller's earth, or suitable proprietary substances for the toxic substance concerned.
- (b) Calcium hydroxide (hydrated lime) for use on acidic spills and pesticide spills.
- (c) Sodium bisulfate, for use with alkaline spills.
- (d) Sodium carbonate (soda ash).
- (e) Crushed calcium carbonate (limestone).



(f) A sufficient number of waste-recovery containers, for example, drums made of materials compatible with the substances being kept and appropriately marked as being for emergency use only.

(g) Approved containers made of appropriate materials, for the purpose of repackaging the contents of any leaking packages (see Clause 1.6).

(h) Portable pumps and decanting equipment.

(l) Shovels.

(i) Yard broom.

It is essential that the spill clean-up equipment be appropriate for the substance concerned, for example some toxic substances, for example, polyfunctional isocyanates react exothermically with alkaline substances such as sodium carbonate (soda ash) and with water.

**7.5.3 Actions for dealing with leaks and spill's** At every occurrence of a leak or spill, the emergency plan shall be implemented. When a dangerous situation occurs, the emergency services shall be notified.

Leaking packages shall be positioned in such a manner as to stop or minimize the leak and, if necessary, shall be moved to a safe location. Either the package should be placed in a suitable container, e.g. plastic bag or an oversize drum, or its contents should be transferred to clean packaging. The exterior of such clean packaging shall be clearly labelled in accordance with Clause 1.7.

Small spills on the floor, or on the walls or structures of a building, should be absorbed, and the absorbent placed in a suitable waste container for disposal.

**7.5.4 Maintenance of clean-up equipment** After use, equipment such as shovels, or similar, shall be decontaminated by an appropriate method, for example by soaking in a 5 percent sodium carbonate (soda ash) solution for at least 24 hours. The equipment shall be thoroughly washed with water containing detergent, then rinsed and dried.

## SECTION 8 FIRE PROTECTION

**8.1 SCOPE OF SECTION** This Section sets out requirements, recommendations and considerations relating to protection of stores of toxic substances from fire and for the fighting of fires in such stores. NOTE: It is essential that the requirements of the relevant regulatory authorities, including the fire authority, be observed; such requirements take precedence over any requirements of this Section.

**8.2 GENERAL CONSIDERATIONS** Toxic substances present certain specific hazards during a fire, namely-

(a) substances having a subsidiary risk of Class 3 may give off flammable fumes and smoke which may increase the intensity of the fire;

(b) they may give off toxic fumes or smoke;

(c) toxic combustion products may be present at a distance from the main site of the fire, and may have no odor;

(d) in addition to the toxic substance, the following may be the products of chemical fires: carbon dioxide, carbon monoxide, hydrochloric acid fumes, hydrogen cyanide, sulfur dioxide, and oxides of nitrogen (particularly from shouldering fires);

(e) spilled substances and contaminated debris may be toxic;

(f) some substances may react violently with water or other chemicals, causing them to be sprayed over a wide area;

(g) run-off from fires may present a hazard to persons and the environment

(see Clause 7.2.1(l)); and

(h) sealed packages containing volatile materials may rupture on heating.

### 8.3 FIRE PROTECTION MEASURES

**8.3.1 General** Fire protection is an important consideration in storage and handling locations for dangerous goods. Fire protection requirements for the premises shall be obtained from, and be implemented in conjunction with, the relevant regulatory authorities, including the fire authority.

Fire protection systems shall be appropriate to the hazard and include consideration of adjoining materials to not only deal with incidents in the dangerous goods but also to minimize the potential for the dangerous goods to become involved.

As a minimum, the fire protection provided for the store shall be in accordance with the BCA/NZBC.

**8.3.2 Fire protection requirements** The requirements for fire protection shall include the following:

(a) All firefighting equipment and fire-protection systems shall be designed, installed, operated, tested and maintained in accordance with relevant international Standards or other regulatory requirements,

(b) Where the toxic substances being stored have a Class 3 Subsidiary Risk, the fire protection requirements of relevant Kenyan standard shall apply.

(c) All firefighting equipment shall be kept readily accessible at all times.

(d) All firefighting connectors and booster connections shall be compatible with those of the local fire authority.

(e) Pressurized water or carbon dioxide type fire extinguishers on the premises shall not be kept within 30 m of a depot used for the storage of cyanide compounds and shall not be used in depots in which cyanide compounds are stored. Soda acid extinguishers, although obsolete, shall not be used on cyanide fires.

(f) All firefighting media provided in storage and handling areas for toxic substances shall be compatible with the specific toxic substances being kept or handled.

NOTE: Appropriate media for use in mixed dangerous goods storages should be selected in consultation with the fire authority.

(g) Where portable fire extinguishers of the appropriate type, number and capacity are required in any store or handling area for toxic substances, they shall be installed in accordance with AS 2444. A greater number may be specified by another relevant Australian Standard or the relevant regulatory authority.

(h) Self-contained breathing apparatus shall be used when approaching a fire involving toxic substances.

**8.4 ACTION IN THE EVENT OF FIRE** The action to be taken in the event of fire is as set out in the emergency plan (see Clause 7.2.2). In the event of fire, the emergency plan shall be implemented and the emergency services shall be notified. The management of a fire shall be the responsibility of the fire authority.

The emergency plan may include the following:

(a) Raise the alarm.

(b) Establish personnel safety.

(c) Close down plant and equipment.

(d) Evacuate the premises.

(e) Keep unauthorized personnel away.

- (f) Fight fire with the appropriate extinguishing medium. If only water is available, use ~ VI as fine spray or fog. Do not use jets -they break bags, glass containers and fragile packages.
- (g) If significant smoke is generated, evacuate all people on the installation to a safe location upwind of the source.
- (h) Ensure that fire-water and spilt product is contained within the premises as far as practicable. Protect public and semi-public water supplies.
- (i) If run-off occurs, or dangers arise from exploding containers, consider withdrawing and allowing the fire to burn out.
- (j) If in an extreme emergency firefighting with water is essential for large-scale safety reasons and run-off cannot be controlled, inform the water and health authorities.
- (k) Any person exposed to fumes, smoke or splashing, or any person showing signs of illness, dizziness or unusual behavior shall be placed under medical care. Poisoning can be mistaken for heat exhaustion, smoke inhalation or drunkenness. Remove contaminated clothing immediately (see Clause 6.9.3(e)).
- (l) Any run-off water from fires involving toxic substances should be contained and tested for residual toxins. Contaminated water should be treated before disposal.

NOTE: Cyanide can be destroyed by treatment with hypochlorite.

- (m) Where toxic substances have been involved in a building fire, air monitoring should be conducted to determine that the atmosphere is safe before people re-enter the building.
- (n) On completion of activities clean all equipment and clothing (see Clauses 6.8.3 and 7.5.4). Where possible, and consistent with the protection of persons and property, the fire site should be preserved in order to assist investigators in determining the cause of the fire.

## SECTION 9 WASTE STORAGE AND DISPOSAL

**9.1 SCOPE OF SECTION** This Section sets out requirements and recommendations for the safe storage and disposal of wastes, minor spills and damaged containers.

**9.2 STORAGE OF WASTES** Any installation in which toxic substances are kept or handled shall be provided with facilities for the storage of wastes and items contaminated with toxic substances. Such facilities shall comply with all of the requirements of this Standard. Wastes that still meet the criteria of the for classification as Class 6.1 substances shall, pending their disposal, be kept in accordance with all of the relevant requirements of this Standard. Waste packages shall be clearly marked as such.

### 9.3 ITEMS FOR DISPOSAL

**9.3.1 Toxic substances** The following categories of toxic substances shall be disposed of in accordance with Clause 9.5:

- (a) Any contaminated substance, including that which is fire affected.
- (b) All substances collected as leaks or spills (see Clause 7.5.3).
- (c) All residues.
- (d) Substances of doubtful quality or having illegible container labels

**9.3.2 Other items** Other items that shall be disposed of in accordance with Clause 9.5 are as follows:

- (a) Empty toxic-substance containers, other than those to be re-used. (Such containers require pre-disposal treatment-see Clause 9.4.)
- (b) Washings or chemical treatment products related to empty containers.

- (c) Equipment or clothing heavily contaminated with toxic substance
- (d) The contents of the store sump or compound used for collection of spills or run-off.
- (e) Water used for showering and washing. (f) Contaminated soil.

**9.4 PRE-DISPOSAL TREATMENT OF EMPTY CONTAINERS** Prior to their disposal, empty containers for toxic substances shall be decontaminated by-

(a) triple rinsing with the appropriate solvent, the washing preferably being added to the material for use, or being set aside for disposal; or

(b) chemical neutralization.

Except where the containers are to be refilled with the same substance, the container labels shall be removed or fully obliterated. Containers not for re-use shall be drained, punctured and preferably crushed to render them impossible to re-use.

Prior to disposal, waste solvents and washings shall be contained and treated in accordance with Clause 7.5.

**9.5 METHODS OF DISPOSAL** If disposal is necessary, the local waste disposal authority, National environmental management authority and the health department, as appropriate, shall always be consulted on the acceptability of the proposed method of disposal. Advice may also be obtained from the chemical companies supplying the products, environmental service companies or waste disposal companies.

## INFORMATIVE

### APPENDIX A

#### HAZARDS PRESENTED BY TOXIC SUBSTANCES

##### AI HEALTH HAZARDS

**AI.1 General** Toxic substances are classified as Class 6.1 Dangerous Goods due to their acute (immediate) lethal effect. Toxic substances are liable either to cause death or serious injury or harm to human health by skin absorption, oral ingestion or inhalation. They can also have chronic (long term) effects, e.g. liver disease or cancer might result after exposure to low levels over many years.

The following terms are relevant to the hazards of toxic substances:

(a) Toxicity, which is the ability to cause injury to biological tissue. Substances are assigned to Class 6.1 (toxic) on the basis of data relating to their acute effect, obtained from four sources, namely-

- (i) human experience;
- (ii) animal testing for acute oral toxicity (LD50 oral);
- (iii) animal testing for acute dermal toxicity (LD50 dermal); and
- (iv) animal testing for acute toxicity on inhalation (LC50).

The UN 'I' Manual of Tests and Criteria provides further information on these tests.

(b) Toxicology, which is the study of the toxic effect of a particular chemical on the body.

Exposure to a chemical depends on the form of the chemical (solid, liquid, dust, fume, mist, smoke, vapor or gas), the concentration of the chemical and the length of time of exposure. The potential routes of entry to the body and the sites of action differ for each chemical. The combination of toxicity of the product and the probability of absorption by a particular route determines the toxic hazard and hence the precautions to be taken in handling the material.

(c) Packing Group, which indicates their degree of toxic hazard as follows: (I) Packing Group I: great danger (very severe toxicity hazard).

(ii) Packing Group II: medium danger (serious toxicity hazard).

(iii) Packing Group III: minor danger (relatively low toxicity hazard).

**AI.2 Routes of entry** There are three main routes of entry for chemicals to the human body. These are the following:

(a) Skin absorption is an important means of entry to the body. Because organic solvents and organic pesticides can readily pass through the skin, often without any local effect on the skin, this is the major source of entry for these substances. Many organic pesticides, halogenated hydrocarbons, hydrogen cyanide, carbon tetrachloride, phenol and organic lead compounds are also readily absorbed through skin contact.

(b) Inhalation is a major and the most frequent route of exposure to volatile and airborne materials. Inhaled material is normally rapidly absorbed into the body and may result in toxic effects, depending on the dose.

(c) Ingestion is a less likely route for accidental poisoning, providing the precautions of not smoking, eating or drinking while chemicals are being handled, and washing chemicals from the skin after contact, are observed.

**A2 ENVIRONMENTAL HAZARDS** Toxic substances, if released to the environment, can have a major impact on living systems due both to their immediate effect and possible cumulative effect in the food chain. Many toxic substances are classified as Marine Pollutants by the IMDG Code.

Potential routes for release of the chemical to the environment should be assessed. The chemical's persistence, degradability, bio accumulative potential and aquatic toxicity, and other data related to Eco toxicity, e.g. effects on water treatment works, should be assessed and recorded.

**A3 OTHER HAZARDS** Approximately 30 percent of the ADG Code entries for toxic substances also have a subsidiary risk of another class. Toxic substances can be dangerous goods of Class 6.1 with or without subsidiary risks of 3, 4, 5 or 8, and dangerous goods of Classes 1, 3, 4, 5, and 8 with a subsidiary risk of 6.1. A limited number have multiple subsidiary risks.

The hazards of these other classes should be appreciated. Toxic substances can be incompatible, or may react dangerously, with other toxic substances. These additional hazards should be considered for storage, and in the selection of personal protective equipment.

## APPENDIX B

### EXAMPLE OF CALCULATION OF SEPARATION DISTANCE

Where a bulk store contains 15 tonnes of PG II toxic substances (which presents an inhalation hazard) the following separation distances apply:

From Table 1.1(A), minimum separation distance.....	12m.
From Table 1.1 (B), risk factor .....	2.0.
From Table 1.1 (C), protection factor to boundary or public place.....	0.5.
Therefore, minimum separation distance to boundary or public place	
	= 12m x 2.0x 0.5
	= 12m
From Table 1.1 (C), protection factor to protected places.....	1.0.
Therefore, minimum separation distance to protected place	=12MX 2.0X1.0
	=24M

## APPENDIX C

### OPERATING PROCEDURES

**CI PROCEDURES REQUIRED** The occupier of the installation should develop, implement and maintain written procedures appropriate to the installation, as follows:

(a) Operating procedures, covering all aspects of the day-to-day operation of the installation.

(b) Maintenance procedures, covering regular testing, inspection, and monitoring of equipment (see also Clause 6.4.4).

(c) Emergency procedures, covering actions to be taken in the event of fire, spillage, accident, equipment failure or other abnormalities or emergencies (see also Clause 7.2.2).

(d) Construction and maintenance procedures, covering new facilities and repairs to and modification of existing plant.

**NOTES:**

1 Many states have occupational health and safety legislation, which provides for consultative mechanisms at workplaces to enable management and workers to be jointly involved in the development of procedures and work practices.

2 Requirements for quality systems are given in ISO 9001 series of Standards.

**C2 PROMULGATION OF PROCEDURES** The procedures should be documented in notices, manuals or other recorded instructions as appropriate to the particular installation, on view or readily available on site.

**C3 REVIEW OF PROCEDURES** Procedures should be modified as necessary, following equipment and organizational changes, and shall otherwise be reviewed regularly.

**C4 OPERATING PROCEDURES** The operating procedures, where appropriate, should include-

- (a) initial commissioning procedures;
- (b) normal handling procedures;
- (c) transfer procedures;
- (d) monitoring of essential functions and components;
- (e) control of hazards including ignition sources;
- (f) manufacturer's operating procedures for the equipment;
- (g) housekeeping and site upkeep (see Clause 6.4);
- (h) management of leakage, spillage and clean-up (see Clause 7.5);
- (i) personnel safety and protective equipment (see Clause 6.8);
- (j) environmental monitoring;
- (k) operational of utilities; and
- (l) fire protection systems (see Section 8).

**C5 CONSTRUCTION AND MAINTENANCE PROCEDURES** Construction and maintenance procedures should include, as appropriate-

- (a) work authorization (see Clause 6.6.3);
- (b) work in confined spaces (see Clause 6.6.7);
- (c) testing of instrumentation, protective devices, alarms and monitors; (d) isolation and tagging of equipment;
- (e) control of contractors; (f) firefighting equipment; (g) pipework;
- (h) storage tanks;
- (l) drainage systems;
- (j) bunds;

- (k) electrical equipment;
- (l) ventilation systems;
- (m) fences and security measures;
- (n) lighting;
- (o) signs and notices; and
- (p) plant components, e.g. pumps, fans and package filling equipment.

**C6 EMERGENCY PROCEDURES** Documented emergency procedures should be prepared in accordance with Section 7 and first aid procedures in accordance with Clause 6.9.

**C7 COMPLIANCE WITH PROCEDURES** The procedures established for the installation should be complied with by all personnel at that installation. An audit system should be established to ensure compliance.

## APPENDIX D

### FIRST AID RESPONSE FOR TOXIC SUBSTANCES

**D1 PROVISION OF FACILITIES AND TRAINING** In addition to basic training, persons responsible for administering first aid should be trained in the specific hazards of the toxic substances handled or stored at the workplace. Where antidotes or oxygen are required, the responsible persons should be trained in their use.

In large workplaces and workplaces where there is a specific hazard, a first aid room or an occupational health Centre may be needed.

**D2 SYMPTOMS** The symptoms or biological effects of toxic substances will vary depending on the product involved.

The general symptoms of poisoning include headache, nausea and vomiting, drowsiness, changes in mental behavior, unconsciousness, convulsions and pain.

The diagnosis of poisoning may be simplified if the following factors are considered:

- (a) The circumstances of the incident e.g. leakage of chemicals.
- (b) The nature of the illness, and its relationship in time to recent chemical exposure.
- (c) Whether more than one person is involved and all display similar symptoms.

The effects of some toxic substances resemble those of typical illnesses, e.g. vomiting and diarrhea. Different individuals react differently to toxic substances depending on their health, constitution and the amount of the substance to which they were exposed. Also, the onset of symptoms may be delayed.

**D3 ANTIDOTES** In general, antidotes are rarely used as a first aid measure for poisoning. However, where the nature of the hazard, and location of the industry demands, they can be required; for example, a cyanide antidote kit might be held for cyanide compounds, and atropine (sulphate) for organophosphorus or carbamate pesticides or the combustion products of these pesticides.

Specialist advice should be obtained regarding the selection and use of antidotes.

Antidotes should only be administered by appropriately trained medical personnel after seeking advice from a medical practitioner.

## APPENDIX E

### INFORMATION TO BE PROVIDED TO EMERGENCY SERVICES

The information to be provided to emergency services should include the following:

- (a) A site plan indicating-
  - (i) the direction of north;

- (ii) the boundaries of the premises and the names of adjacent streets;
  - (iii) the location and identification of all buildings and external stores at the premises;
  - (iv) vehicular entry points, and vehicular access within the site; (v) the location of dangerous goods; and
  - (vi) the fire service layout.
- (b) A copy of the current manifest listing the quantities, classes, UN numbers, product and names of the dangerous goods being stored and the location of dangerous goods within the premises.
- (c) A list of names and telephone or pager numbers (including at-work and after-hours) of personnel within the occupier's organization who can provide specialist advice or assistance in an emergency.
- (d) Details of the evacuation system at the site, including-
- (i) the type of alarm and its means of evacuation;
  - (ii) the locations of assembly areas, to enable emergency services to quickly determine if all of the occupant's personnel have been evacuated; and
  - (iii) a means by which the emergency services can identify members of the warden structure for the premises.
- (e) Copies of the material safety data sheets (MSDSs) for all of the dangerous goods on the site.



NOTE Density applies to liquid samples only.

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