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Transport of dangerous goods by sea

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TRANSPORT OF DANGEROUS GOODS BY SEA

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I certify that all the material in this disertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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ABSTRACT

Within maritime transport dangerous goods count for about 50%. According to the general name, they present different types of risk and, therefore, dangers to life of all kinds.

This dissertation is a study of some aspects of the transport of dangerous goods by sea. The classification criteria are examined since classification is the gateway through which certain goods enter into a special domain governed by specific rules.

As the sea mode of transport handles very large quantities of dangerous goods and, sometimes, for long periods of time, the safety requirements for ships are analyzed as to ensure the safe movement of such goods.

Within the transportation chain the port is, probably, the most sensitive link. The aspects of entry procedures, storage and segregation, checking, emergency response, and national regulation for port areas are examined. To meet the requirements for emergency response, guidelines for contingency planning are given.

All operations of the management of dangerous goods are carried out by people. Safety relies largely on them. Special attention is paid to the training of the people involved and the ways to achieve good results are shown.

The final chapter is intended as a suggestion as to how the national regulations should be designed and what they should contain. The necessity to harmonize regulations pertaining to different modes of transport is emphasized in the conclusions.

List of Abbreviations

ADN	European Provisions Concerning the International Carriage of Dangerous Goods by Inland Waterway
ADR	European Agreement Concerning the Transport of Dangerous Goods by Road
CDG	IMO´s Sub-Committee on Dnagerous Goods
CIA	Chemical Industries Association
ECOSOC	United Nations´ Economic and Social Council
EmS	Emergency Procedures
EPC	Emergency Planning Committee
FP	Flash Point
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
IBC	Intermediate Bulk Container
ICAO	International Civil Aviation Organization
IEC	International Electrotechnical Commission
ILO	International Labour Organization
IMO	International Maritime Organization
MFAG	Medical First Aid Guide
MSC	IMO´s Maritime Safety Committee
NERC	National Emergency Response Committee
OECD	International Organization for Economical Co-operation and Development
RID	Regulations Concerning the International Carriage of Dangerous Goods by Rail
SOLAS	International Convention on Safety of Life at Sea
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
UKDOT	United Kingdom´s Department of Transport
UN	United Nations Organization
UNCTAD	United Nations´ Commission for Transport and Developement

USCG	United States' Coast Guard
USDOT	United States' Department of Transportation
USEPA	United States' Environment Protection Agency

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CHAPTER 1

REGULATORY BACKGROUND

1.1 Introduction

Life has to go on no matter the cost. It sometimes has needs which, if not properly handled, could cause serious damage to life itself. One of these needs is the chemical industry the products of which are all around us. The food we eat is grown with artificial fertilizers. The clothes we wear are partly made of artificial fibers. Explosives used in mining or even to destroy life are the output of the chemical industry as well as medicines, detergents, toys, wire coating, etc.

The raw materials for the chemical industry and its products have to be transported from the producer to the consumer. Much of this trade is carried out by ships, the size of which range from small coastal vessels to large bulk carriers.

All these raw materials and products which can cause damage to life and the environment are defined by the general term dangerous goods. According to Brunnings (1992c, 7) dangerous substances can, arbitrarily, be subdivided into two groups:

1. Bulk Dangerous Substances carried by purpose-built ships and fixed tanks:
   - flammable liquids
   - dangerous chemicals
   - liquefied gases
   - dangerous solids;
2. Packaged dangerous goods, carried by all types of ships except tankers, in:
   - packagings
   - freight containers

- portable rail and road tanks
- vehicles and wagons
- barges.

The objective of this dissertation is to analyze aspects of the transport of dangerous goods in packaged forms by sea. As is well-known from experience dangerous goods in packaged forms carried by sea cannot always be looked at exclusively. Some aspects relating to those transported in bulk or by other modes are touched.

Chapter One looks at the history of the transport of dangerous goods by sea, the way the regulations are set up, and the national and international organizations involved in the rulemaking process emphasizing the role of the IMO.

Chapter Two deals with the means of transport used in the maritime mode. For the safety of transport the means of transport, be it container, barrel, tank, etc., must be tested and, if such a means successfully passes the test, a certificate of compliance shall be issued for it. This chapter looks also at the performance tests to which packaging of dangerous goods is subjected, and the marking of the packagings.

Chapter Three analyses the ways the dangerous goods are classified and grouped. There are two elements the selection of suitable packagings, correct identification, marking, labelling and placarding depend upon.

Chapter Four emphasizes the requirements with which a ship carrying dangerous goods should comply in order to ensure safe transport.

Chapter Five looks at the notification and acceptance procedures required by the regulations for any mode of transport bringing dangerous goods into a port as well as the documents which should accompany the transport, and the checks carried out by the Port Authority.

Chapter Six deals with the dangerous goods in port which is a link in the transportation chain between the sea mode on one side and rail, road and inland water modes on the other. Three major aspects are analyzed, namely the requirements for the

warehouses and terminals, the segregation of dangerous goods ashore and the emergency response. It emphasizes the need for contingency planning and an overall emergency response plan covering all dangerous goods in port no matter the mode and means of transport they are brought by and the state they are in, i.e. packaged, solids, liquids or liquefied gases in bulk.

Chapter Seven shows the importance of training in the operation of the transport of dangerous goods. Training of personnel, involved one way or another in the movement of dangerous goods, depends upon the information known and circulated between those concerned. Therefore, communication is another very important aspect for the safety of transport.

Chapter Eight deals with the need for national regulations for port areas. This, as a consequence, requires the setting up of different specialized organizations which should back-up the Regulating Authority. This chapter also shows what such regulations should contain.

The concluding part emphasizes the need for uniform regulations at international level for all modes as the most important requirement for safer transport.

1.2 History

The transport of dangerous goods by sea has developed considerably during and, especially, since the second world war. Due to the diversification of chemical production and the tremendous increase in quantity, the threat posed to life and the environment increases accordingly. The local and international communities have become more and more aware of the necessity to set up and implement rules which regulate not only the transport of dangerous goods, but also other activities implied by and related to it.

The first mention of dangerous goods in an official document was at the end of the last century in UK maritime law. The first SOLAS Conference which took place in 1914 mentioned that, in principle,

'the carriage of goods which by reason of their nature, quantity and mode of stowage' might put at risk the lives of the passengers or the safety of the ship, is forbidden. The government had to decide which goods were dangerous in the way described by the Conference and to set up national regulations.

Different countries have developed national regulations or guidelines for the transport of dangerous goods by ships. However, regulations and practices differ from country to country. Sometimes these regulations and practices have crossed the borders of the country of origin. In some cases they have created disputes and claims. Those involved in the transport of such cargoes were in difficulty due to different requirements relating to, for example, identification, packagings and marking, stowage and segregation. As a consequence, governments and international organizations have recognized the necessity of internationally valid regulations which not only improve the safety, but also facilitate the transport of dangerous goods to and from different countries.

In 1929 the SOLAS Conference recommended the implementation of specific regulations to be observed by those involved in the transport of dangerous goods. In 1948, as a result of the expansion of the transport of dangerous goods by sea, the SOLAS Conference added a new chapter VI to the Convention, dealing with the "Carriage of Grain and Dangerous Goods". A classification of dangerous goods carried by sea was adopted. The Conference established that goods should be considered dangerous on the basis of their properties and characteristics. A labelling system should also be developed using distinctive symbols showing the kind of danger for each class of goods. At the same time the Conference recommended the continuation of the study in order for international regulations to be issued.

Recognizing the need for uniform international regulations for all modes of transport and the existing regulations which were very different from one another, a Committee of Experts on the Transport of Dangerous Goods was set up at the request of the

Transport and Communications Commission of the Economic and Social Council (ECOSOC) in 1953. By that time a number of international agreements had already been established, such as:

- the International Regulations on the Transport of Dangerous Goods by Rail(RID) which still apply in 33 European countries;
- the Special Conditions for the Transport of Goods in International Traffic by Rail set up and binding for the former socialist countries;
- the Hague 1939 International Convention on the Transport of Combustible Liquids in Inland Navigation;
- the provisions relating to dangerous goods contained in the Convention on International Civil Aviation;
- the already mentioned SOLAS '48 Convention for seaborne transport.

The UN Committee of Experts produced a report in 1956 containing:

- a list of most commonly carried dangerous goods by all means of transport;
- the classification of dangerous goods. The classification adopted by SOLAS 1948 Convention has been taken into account;
- the system of labelling based on both symbols and colours and taking into account the systems used in different countries and the symbols recommended by the International Labour Organization (ILO) and the RID Committee of Experts;
- the documents which should accompany the dangerous goods.

This report is known as the UN Recommendations or "Orange Book" and offered the general framework to which the existing regulations and practices could be adapted in order to get an as high as possible level of uniformity.

On 17th March 1958 the Convention establishing the International Maritime Organization (IMO), adopted on 6th March

1948, entered into force. The Organization was inaugurated on 6th January 1959. A new specialized agency of the United Nations, it came into existence to undertake, amongst other things, the work of regulating the transport of dangerous goods by sea.

In 1960 another SOLAS Conference took place. This time an entire chapter VII was allocated to deal exclusively with the carriage of dangerous goods. The revised Convention entered into force on 26th May 1965 and applied to ships of 500 GRT or more engaged in international voyages. This Conference by its 56 recommendations invited the IMO to undertake further studies for drawing up an international code on the transport of dangerous goods by sea, by co-operating with the UN Committee of Experts and taking into account the regulations and practices already existing in different countries and at the international level.

A Working Group on the Carriage of Dangerous Goods (CDG) was established which consisted of experts nominated by governments with considerable experience in the carriage of dangerous goods. At the end of 1965, after the work was completed, the CDG Working Group became a Sub-Committee of the Maritime Safety Committee (MSC). The result was the International Maritime Dangerous Goods (IMDG) Code approved by the IMO Maritime Safety Committee in 1965 and recommended to governments for adoption by the IMO Assembly Resolution A.81(IV) of 27th September 1965 which has been replaced by the Resolution A.716(17) of 6th November 1991. The IMDG Code was immediately adopted by Belgium as the first country recognizing it. So far some 50 countries have either made it mandatory or are applying it as a recommendation.

The IMDG Code contains basic principles, detailed recommendations for each substance and practical recommendations for each class. It has also an alphabetical index and a general index which expedites the work of those using it. Although designed for mariners, it is useful to all those involved in storage, handling and transport, from manufacturers to consumers. Since 1965 the IMDG Code has undergone many changes to keep pace with the changing needs of the industry. This updating is done by amending the Code. The amendments which do not affect the

principles of the Code may be adopted by the MSC, according to Resolution A.716(17) on 6th November 1991, while the others must be endorsed by the IMO Assembly. A set of amendments is the result of one or more meetings of the CDG Sub-Committee. After up to one year from their adoption by the MSC, the amendments are published. The exact date of implementation is established by the MSC and this date should not be earlier than six months after publication. According to MSC 57/27 the time scale for amendments to the IMDG Code is as follows:

'1 complete revision of the IMDG Code resulting in a new edition should normally be made at intervals of not less than four years;

2 substantial amendments to the provisions of the Code should normally be adopted at intervals of not less than four years;

3 urgent substantial amendments and amendments to cover new reclassified or regrouped substances and any necessary consequential amendments in the Annexes and Supplements to the Code should be made at intervals of not less than two years; and

4 any departure from these intervals could be considered on the basis of well-justified proposals arising from new developments, experience or accidents.'

The latest 1990 consolidated edition of the IMDG Code, which includes Amendment 25-89, is published in four loose-leaf volumes in English, French and Spanish. The content of each volume of the Code is given in the Appendix 1.

Volume I of the IMDG Code consists of:

- General Introduction containing the chapter VII of

the SOLAS '78 Convention, Annex III to MARPOL 73/78 and description of, i.a. identification, packing, marking and labelling of dangerous goods as well as special provisions for freight containers, portable tanks, road tank vehicles, stowage and segregation, fire-prevention and fire-fighting, roll-on roll-off ships, shipborne barges, etc. A new Section 27 on the transport of wastes has been included with Amendment 26-91;

- Annex I to the IMDG Code giving packing recommendations; and

- the alphabetical General Index of the dangerous goods and marine pollutants carried by ships, followed by the Numerical Index.

Volumes II, III and IV consist of the individual schedules of each substance listed in the General and Numerical Indexes.

The IMDG Code has also a sixth volume containing:

- Emergency Procedures(EmS)
- Medical First Aid Guide(MFAG)
- Packing Cargo Transport Units
- Use of Pesticides in Ships.

After the publication of this edition of the IMDG Code a new Amendment 26-91, adopted by the MSC in May 1991, entered into force on 1st January 1993. Amendment 27 is under preparation and expected to be implemented on 1st January 1995. According to present estimates it includes amendments to more than 1200 pages which leads to the need for reprinting the Code. A considerable amount of these pages is due to the implementation of MARPOL Annex III.

In fact the IMDG Code was extended to cover the marine pollution aspects by an earlier amendment(25-89) which added the new Section 23 and had to be implemented as from 1st January 1991. The reason for this was to assist the implementation of the Annex III of MARPOL 73/78 through the IMDG Code. Annex III

contains the regulations for preventing pollution by harmful substances carried in packaged forms. As, according to MPEC 35(27) from 17th March 1989 the revised provisions of Annex III can be treated as equivalent to existing provisions, Parties to Annex III were encouraged to give effect to the revised provisions immediately after entry into force of the original Annex III. It came into force on 1st January 1992.

Amendment 26-91 has further extended the IMDG Code by introducing a new Section 27 on the transport of wastes. It is the result of the Basel Convention that entered into force on 5th May 1992. This Convention as well as Section 27 does not cover the radioactive wastes to which the Code of Safe Practice on the International Transboundary Movement of Radioactive Wastes of the International Atomic Energy Agency(IAEA) applies.

Coming back to the SOLAS Convention, another Conference was held in 1974 which further revised the 1960 version. The new SOLAS '74 entered into force on 25th May 1980. It has subsequently been substantially modified. SOLAS '74 Convention has the same chapter VII dealing with dangerous goods. The only difference with respect to SOLAS '60 Convention is the elimination of regulation 6 as it is no longer necessary. Since 1974 several amendments to SOLAS, concerning the transport of dangerous goods, were adopted by the MSC. The latest entry into force of an amendment is 1st February 1992. There are other amendments adopted by MSC, which are expected to enter into force on 1st January 1994 and 1st October 1994 respectively. The amendments adopted by the MSC Resolution 22(59) on 23rd May 1991 has introduced a new regulation 7-1, applicable from 1st January 1994, relating to reporting of incidents involving dangerous goods. This regulation is contained in the 1992 consolidated edition of SOLAS.

1.3 International Organizations

As the transport of dangerous goods affects all modes of transport and many industries, consequently the entire world

community is involved, one way or another, and therefore is interested in regulating the process to ensure safe operations.

The United Nations, as an umbrella organization, has the responsibility at the international level, in this field. The ECOSOC, as an UN body, has requested the Secretary-General, in its Resolution 468 (XV) of 15th April 1953, to appoint a Committee of Experts on the Transport of Dangerous Goods. If the setting up of a variety of regulations, by different countries and organizations relating to different modes of transport, can be considered as a first step in regulating the movement of dangerous goods, then a second step is necessary, namely the harmonization of these different systems which in many cases conflict with one another. This is the task of the Committee of Experts. It can be achieved by designing recommendations which can then be used by the specialized agencies of the UN and by other organizations and governments as a guide in drafting uniform regulations or, at a slower pace, in smoothing the differences between the existing ones.

The conflicting differences occur between the regulations pertaining to different modes of transport within one country, rather than between the regulations pertaining to the same mode of transport from different countries. This is the result of the fact that the international regulations, adopted by the organizations regulating different modes of transport, were entirely, in most cases, or partly accepted by the countries. Therefore, these organizations have the most important and difficult obligation towards the harmonization of different regulating systems.

The specialized agencies and conventions governing different modes of transport are, i.a.:

1 International Maritime Organization (IMO) which, through its Assembly and MSC, adopts conventions, recommendations, codes and guidelines covering the transport of dangerous goods by sea;

2 International Civil Aviation Organization (ICAO) for air;

3 International Atomic Energy Agency(IAEA) for all modes of transport when radioactive substances are involved;

4 Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID);

5 European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR);

6 European Provisions Concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN/ADNR).

There are many other organizations involved in transport or protection of the environment and which participate in the regulating process. The more they are the more different regulations are produced and the more difficult it is to come to an agreement as to the harmonization of the systems. The co-ordination of steps of different organizations towards uniformity is made even more difficult by the differences in the timing of acceptance of the amendments to their publications.

Fortunately there are positive signs of willingness towards co-operation and one example is the Joint Group of the IMO, the World Health Organization (WHO) and the International Labour Organization (ILO) which produced the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG). Actually many organizations are organizing meetings where representatives of other organizations are invited. At the 17th session of the Committee of Experts on the Transport of Dangerous Goods in December 1992, the development of a World Convention on the Transport of Dangerous Goods was proposed by Italy, in order to facilitate the harmonization of the rules applicable to the various modes of transport of dangerous goods. Such a Convention

would make the UN Recommendations legally binding internationally and would avoid duplication of efforts and lack of homogeneity. Although the principle of the proposal was warmly supported by other countries, finally the Committee did not support the proposal.

The IMO Resolution A.717(17) adopted on 6th November 1991 stresses the need for co-operation as the only way towards the desired harmonization.

As the signs indicate, it will be a long way.

CHAPTER 2

MEANS OF TRANSPORT IN THE MARITIME MODE - PACKAGED FORMS -

The maritime mode of transport is, by far, the main system of transport of dangerous goods when is analyzed from the quantitative point of view and, consequently, the one posing a potentially serious threat to human life and the environment. Therefore, safety when transporting in the maritime mode is a very important aspect to look at and to be controlled by regulations and construction standards.

The transport of dangerous goods in packaged forms accounts for

> `some 10% - 15% from the total world trade of such goods and... is tending to increase in volume and in the variety. Nevertheless... there are relatively few accidents associated with such goods.´
>
> (Wardelmann,1)

The means of transport used for the movement of dangerous goods in packaged forms in the maritime mode and covered by the IMDG Code are: very small and small receptacles, cylinders up to 1000 litres, drums up to 450 litres, cans, boxes, bags, unit loads, intermediate bulk containers (IBCs), freight containers, portable tanks, road and rail vehicles, bulk packaging and other cargo transport units and shipborne barges.

A transport operation implies, in most cases, a combination of two or more modes of transport. Therefore the national and international regulations should be aligned with the UN

Recommendations and become more uniform, easier to ascertain and assist trade keeping in view of the fact that the UN Recommendations have worldwide relevance for all modes of transport.

It is well-known that, where a regulatory change, even a small one, involves an alteration to packing practices, a considerable time may be required for this alteration to be implemented. Consequently, transitional arrangements are necessary in order to permit a peaceful orderly change in current practices.

The IMDG Code and ICAO Technical Instructions are based on the UN Recommendations while the RID/ADR Regulations, effective until 30 April 1985, were not. New RID/ADR Regulations for classes 3, 6.1 and 8 came into force on 1 May 1985 and were based on the UN Recommendations. From 1 May 1990 the packages to be used have to be tested and marked in accordance with the RID/ADR Regulations which are also based on chapter 9 of the UN Recommendations.

The UN Recommendations and the IMDG Code place the dangerous goods, except those of classes 1, 2, 6.2 and 7, into three packing groups according to the degree of danger they present.

Packing group I - high danger (X)
II - medium danger (Y)
III - minor danger (Z)

Grouping criteria are presented further in chapter 4.

The provisions of the IMDG Code take into account the mandatory requirements on packing set forth in regulation 3 of part A of chapter VII of the 1974 SOLAS Convention(387), as amended, stating that:

`The packaging of dangerous goods shall be:

1 well made and in good condition;

2 of such a character that any interior surface with which the contents may come in contact is not dangerously affected by the substance being conveyed; and

3 capable of withstanding the ordinary

risks of handling and carriage by sea.'

For classes 1, 2, 6.2 and 7, due to their special properties and characteristics, the packagings are made to match the requirements for individual substances or groups thereof.

Explosives should be packed in packages complying with the requirements for medium danger - packing group II unless contrary specific provisions are made in the individual schedules.

For gases the containment systems are divided into receptacles of low, medium and high pressure. The division is based on the following arbitrary limits of filling pressure at 15° C:

'1 low pressure - up to and including 2 MPa;
2 medium pressure - over 2 MPa, up to and including 7 MPa;
3 high pressure - over 7 MPa.'

(IMDG Code, 2003F)

Receptacles shall comply with the national standards of the country concerned and shall be subjected to performance tests before being used and, periodically, during service.

Class 6.2 substances are substances containing viable micro-organisms or their toxins which are known, or suspected to cause diseases in animals or humans. Transport by sea of infectious substances is very rare.

'A package for infectious substances shall include an inner packaging comprising:
- a watertight primary receptacle;
- a watertight secondary receptacle;
- absorbent material, placed between the primary and secondary receptacles, in such a quantity as to be sufficient for absorption of entire contents of the primary receptacle or receptacles - in case several primary receptacles are placed in one secondary receptacle.'

(IMDG Code, 6301)

Radioactive substances may present two hazards, one resulting from their radioactive nature and the other from their chemical nature. Either one or both are important.

The safe transport of radioactive materials depends on strong transport packagings subjected to very severe tests (e.g. the so-called flasks used for nuclear fuel have been dropped from a plane to test their strength).

The packaging for radioactive substances consists of one or more receptacles, absorbent material, spacing structures, radiation shielding and devices for cooling, for absorbing mechanical shocks and for thermal insulation.

The provision in the IMDG Code is based on the principles of the International Atomic Energy Agency's (IAEA) Regulations for the Safe Transport of Radioactive Material, 1985 edition, as amended by Safety Series No.6, Supplement 1988.

Packaging for class 7 materials

'are designed, as necessary, to:

1 retain the material;
2 serve as shield to reduce radiation to an acceptable level;
3 prevent criticality; and
4 promote heat dissipation.'

(IMDG Code, 7005-6)

The general construction requirements for packagings used for classes 1, 2, 6.2 and 7 substances are set out in detail in the introduction to each respective class.

The types of packages and packagings recommended in the IMDG Code are those which, based on extensive past experience, ensure a high degree of safety. General specifications for packagings recommended for dangerous goods are set out in section 10 of the General Introduction of the IMDG Code. Detailed specifications and performance tests applicable to packagings recommended in the Code can be found in the revised Annex I to the Code. This follows closely chapter 9 of the UN Recommendations with respect to the packing of dangerous goods and takes into account regulation 3 -Packaging- of part A of chapter VII -Carriage of

dangerous goods- of the SOLAS '74, as amended. Annex I was adopted by the Maritime Safety Committee in 1984. From 1 January 1991 only tested packagings shall be used for the transport of dangerous goods by sea and they must be accompanied by a Certificate of Packaging Performance. One such certificate is shown in Appendix 2.1.

The types of packagings used in the transport of dangerous goods by sea are: drums, wooden barrels, jerricans, boxes, bags and composite packagings; each of which, in this sequence, has had a numeral from 1 to 6, allocated to it.

The types of material used are allocated letters as symbols as follows:
A - steel, B - aluminium, C - natural wood, D - plywood, F - reconstituted wood, G - fibreboard, H - plastics material, L - textile, M - paper, multiwall and P - glass, porcelain or stoneware.

Packagings shall be of good quality and be constructed and closed so as to prevent any leakage which might be caused under normal conditions of transport by changes in temperature, humidity or pressure. This requirement applies to both new and reused packagings which shall pass the tests prescribed in Annex I.

Tests should be carried out on packagings prepared as for transport. The substance to be transported may be replaced by another substance but, in this case, the tests' results must be interpreted taking into account the differences between the properties and characteristics of the two substances.

The following tests - called 'performance tests' - are required for packagings destined to contain a dangerous substance:

1. **Drop test** - applies to drums, barrels, jerricans, boxes and bags and according to the drop height and results, the packagings are assigned to packaging groups I, II and III.
2. **Leakproofness test** - designed for packagings intended to contain liquids. The packaging group is assigned

and depends on successful completion of tests at different air pressure levels.

3. **Hydraulic test** - carried out for metal, plastic and composite packagings designed for carrying liquids. The passing criterion is that the packaging shall not leak during the time the pressure is applied, time which depends upon the packaging material.
4. **Stacking test** - applies to all packaging except bags. A packaging is considered as having successfully passed the test if at the completion of the test it did not leak, and did not show either deterioration or distortion which could affect transport safety.
5. **Cooperage test for bung-type wooden barrels** - is meant to find out the elasticity of the wooden material the barrel is made of. If the diameter of the upper end of the barrel does not increase with more than 10% during two days after the hoops above the bilge are removed, it meets the test requirement.
6. **Leakproofness test for aerosol dispensers and small receptacles for gas** - is meant to establish wether a packaging leaks or is permanently deformed when it is being kept in hot water for a certain time.

Each packaging manufactured and intended for use according to the IMDG Code shall, after having successfully passed the test or tests meant for it, be marked as specified in Annex I to the IMDG Code.

Numerals and letters are used as symbols to form codes for each type of packaging giving, also, some other characteristics or information relating to cargo. The types and codes of packagings as described by Annex I of IMDG Code are shown in the Appendix 2.2 hereto.

As an example, the following markings:

1A1/Y 1.3/S/91
S/WMU/001
GB/IMO/92R

show that the package bearing it is:

(UN) -marked under UN packaging symbols, and is
1A1 -metal drum with non-removable head, of
Y -packaging group II, having
1.3 -density of substance contained;
S -substance is a solid;
91 -drum was manufactured in 1991, in
S -Sweden, by
WMU -World Maritime University;
001 -identification of the packaging specified by the competent authority.

These two lines stand for a new packaging when it is first offered for transport.The third line which may replace the second one, shows that the packaging has been reconditioned in:

GB -Great Britain, by
IMO -International Maritime Organization, in
92 -1992, and being
R -reconditioned,
L -has successfully passed the leakproofness test.

The markings may be applied in a single line or in multiple lines provided the correct sequence is respected and shall be durable, legible and of such a size relative to the packaging as to be readily visible.

2.1 Unit loads

For the purpose of recommendations of the IMDG Code, (0040), `unit load is taken to mean that a number of packages are either:

1 placed or stacked on and secured by strapping, shrink-wrapping or other suitable means to a load board such as a pallet;
2 placed in a protective outer packaging such as a pallet box;

3 permanently secured together in a sling.'

The unit loads shall be of regular shape in order to be easily and efficiently stowed, stacked and secured; shall be strong enough to withstand handling and overstowage without damaging the individual components, i.e. packagings.

From this definition it can be seen that a unit load is, in fact, a group of packagings, containing dangerous goods, secured together in unit. Therefore, the packagings shall meet the requirements of Annex I to the IMDG Code.

2.2 Intermediate Bulk Containers (IBCs)

'IBCs are rigid, semi-rigid or flexible portable packagings, other than those specified in Annex I to the IMDG Code that:

1 have a capacity of more than 250 litres but not more than 3.0 m3 (3,000 litres);
2 are designed for mechanical handling; and
3 are resistant to the stresses produced in handling and transport, as determined by tests.'

(IMDG Code, 0154)

IBCs are less used than containers, for example, in the maritime mode, but are fast gaining in popularity.

IBCs appeared as a need of the US Army during World War II. During the following decades German industry which adopted the IBC concept, developed it and, also, developed a series of regulations governing the construction and use of IBC systems. Adopted then by other developed countries it led the UN Committee of Experts on the Transport of Dangerous Goods to the responsibility for the formulation of international standards for the construction and use for of certain types of IBC.

In 1986 the Committee issued the first provisions covering

metallic and flexible IBCs in a new Chapter 16 in the UN Recommendations. This chapter was later expanded to cover other types of IBC, including rigid plastic and composite IBCs, and has been accepted by international modal transport organizations and governments as the basis for their own codes such as the IMDG Code for sea and RID and ADR regulations for rail and road, respectively.

According to HCB (July 1992, 63), although

> `the number of drums used [...] continues to greatly outweigh the number of IBCs of all types´,

they are more and more used due to the advantages over the former.

A very important advantage is the reduced handling, as time is money, since an IBC replaces five drums. This also reduces the product loss, which, in the case of high-value substances is more profitable.

They can be filled and emptied faster and more easily cleaned. IBCs have a life, in the case of the metallic type, of between 10 to 20 years while drums can hardly be reused. Of course there is an important disadvantage which is the high manufacturing cost.

Besides the types developed from the nature of material they are made of, differently constructed types were invented which, having in view the competition among manufactures, are better and better. As an example: the Uni-Fold IBC can be folded, when empty, and takes only one third of its erected size.

As for any packaging for dangerous goods, IBCs shall retain the substance contained and protect it against contamination from outside. It must be resistant to withstanding the handling and stresses due to overstacking and those resulting as a consequence of normal transport conditions.

IBCs are made of the same materials as for standard packagings with the exception of the P - porcelain and stoneware, which is replaced by N - metal (other than steel and aluminium).

Each IBC has attached to it a code which consists of:

`1 two Arabic numerals: 11 or 13 for rigid or flexible type respectively in case of solids discharged by gravity; 21 for rigid IBC in case of solids discharged under pressure of more than 10 KPa; 31 for rigid type in case of liquids;

2 one or more capital letters according to material from which the IBC is made;

3 followed, when specified in the relevant section, by an arabic numeral indicating the category of IBC; and

4 followed by a capital letter indicated the packaging group for which the prototype has been accepted:
- Y for packaging groups II and III; or
- Z for packaging groups III only.´

(IMDG Code, 0154)

Each IBC shall be capable of passing relevant performance tests. IBCs must be designed and manufactured as to satisfy the competent authority through the tests they are require to pass. Tests are carried out on IBCs prepared for transport but the substances may be replaced by others, in which case the results shall be interpreted taking into account the differences.
The tests an IBC is subjected to depend on the type of IBC,the material from which it is made and the cargo to be transported (e.g. organic peroxides).

A certificate shall be issued should the IBC successfully pass the required test or tests.
Markings applicable to IBCs can be divided into primary marking, applicable to all IBCs, and additional marking, applicable in relation to the requirement for every type of IBC.

Primary marking:

31HA1/Y/12 92
S/WMU/1820
8700/1250

This shows that the IBC is:

- 31 - for liquids; composite IBC of
- H - a rigid plastic inner receptacle; and
- A1 - a steel outer casing with non-removable head;
- Y - packaging group II;
- 12 92- manufactured in December 1992; in
- S - Sweden; by
- WMU - World Maritime University; having
- 1820 - as serial no. allocated by competent authority;
- 8700 - the maximum load permitted on top (in kg);
- 1250 - maximum permissible gross mass (in kg).

2.3 Freight containers

A freight container, as defined by IMDG Code (0046), is:

> '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 dangerous goods, by one or more modes of transport, without intermediate reloading; designed to be secured and/or readily handled, having fittings for three purposes.'

Containers became of international concern in the early '60s and even if their characteristics have been improved, the box has not changed in principle.

Containers are used for the transport of packaged dangerous goods or as bulk packagings for solid dangerous goods. When they are used for packaged dangerous goods the container forms an additional protection for the cargo transported.

Containers are very much in use today by all modes of transport. According to Brünings (1992b,3), about 40 million tons of dangerous goods are transported annually by sea in containers.

There are two container types used for the transport of

dangerous goods, i.e. the closed container which totally encloses the cargo by permanent structure, and the open container which is not a closed container.

Each container offered for transport shall be approved in accordance with the International Convention for Safe Containers (CSC), 1972, as amended when applicable.

The UN Committee of Experts on the Transport of Dangerous Goods has issued the UN Recommendations intended for harmonization of existing and coming national regulations related to the transport of dangerous goods in containers.

IMO for sea and ICAO for air transport have already incorporated the UN Recommendations into their own codes and recommendations.

The most difficult situation occurs in the case of a container engaged in multimodal transport. As an example of how complex multimodal transport of dangerous goods is, the FCL container, which travelled

> `from Munich to Yokohama, has observed not less than 17 international and national regulations.´
>
> (Brünings 1992b, 11)

The UN Convention on International Multimodal Transport of Goods tries to facilitate the transport in containers by speeding up the operations, especially those hampered by different national regulations.

As mentioned before, a container offered for the transport of dangerous goods shall comply with the provisions of the IMO´s International Convention for Safe Containers (CSC) and, therefore be tested and regularly inspected. Should the container pass the tests and inspection, a CSC Safety Approval Plate shall be affixed on the container by the national administration responsible.

In the case of radioactive substances, the container shall meet the requirements of the International Atomic Energy Agency (IAEA)´s Regulations.

Before loading the dangerous goods into containers, the

latter has to be inspected and found clean, dry, in apparent good order, and have the CSC Safety Approval Plate affixed to it. The packagings containing the dangerous goods have to be in accordance with the requirements of the IMDG Code's Annex I. This means improved, if not double, safety measures related to those goods.

IMO and the International Labor Organization (ILO) have jointly issued 'Guidelines for Packing of Cargo in Freight Containers' which assist those involved in loading/unloading dangerous goods in freight containers. Packing of dangerous goods into containers appears to be the operation where the major deficiencies occur. According to the Final Report of the Free and Hanseatic City of Hamburg(9-10), on a joint inspection program, from 2910 containers inspected in participating ports from western Europe, 619 deficiencies in stowage and securing and 782 in marking according to IMDG Code, were detected. Together with other deficiencies detected, more than every second container with dangerous goods was found to be deficient.

Since this is the situation for containers coming from a developed country, i.e. Finland, consider the situation in developing countries where it is more difficult for many reasons.

It is obvious that adoption of conventions and implementation of international regulations and recommendations at a national level is very inefficient without proper inspection measures. Training of the people involved is another aspect which is dealt with in Chapter 7.

2.4 Tanks

This term covers portable tanks and road tank vehicles.
Portable tank, as defined by IMDG Code (0052),

> 'means a tank having a capacity of more than 450 litres whose shell is fitted with items of service equipment or structural equipment necessary for the transport of

dangerous liquids whose vapour pressure is not more than 3 bar - absolute - at a temperature of 50° C. It is a tank that has stabilizing members external to the shell and is not permanently secured on board the ship.'

A road tank vehicle is a portable tank permanently secured to a vehicle frame. Tanks are used for the transport of dangerous goods of classes 2, 3, 4, 5, 6, 7, 8 and 9.

The transport of dangerous goods in tanks by sea is regulated by the IMDG Code which is based on the UN Recommendations, Chapters 12 and 17.

Unlike the UN Recommendations, the IMDG Code has otherwise grouped the tanks and has included road tank vehicles in its regulations.

Having in view the requirements necessary for the safe transport of dangerous goods in tanks, and the 8 class diversity of dangerous goods, the portable tanks and road tank vehicles were divided into three parts:

1. Portable tanks and road tank vehicles for dangerous goods other than class 2;
2. Portable tanks and road tank vehicles for non-refrigerated liquefied gases of class 2;
3. Portable tanks and road tank vehicles for refrigerated liquefied gases of class 2.

IMO has promoted different types of tanks to be used for the transport of dangerous goods, each of which has certain characteristics which enable it to be used for the safe carriage of a liquid, or more liquids at a time, with certain properties. They are known as IMO tank types 1 to 8.

The tanks used for the transport of dangerous goods other than class 2 are types 1 and 2. Under the approval of a competent authority, type 4 tank, which is a road tank vehicle, may be used, but only for short international voyages.(i.e. within 200 Nm from a port or safe place or < 600 Nm between ports).

The second group, comprising the portable tanks and road

tank vehicles for the transport of non-refrigerated liquified gases of class 2, are type 5 which is a portable tank and type 6 which is a road tank vehicle.

The third and final group used for the transport of refrigerated liquefied gases of class 2 are type 7 - portable tank and type 8 - road tank vehicle. These last two types are thermally insulated and fitted with items of service and structural equipment necessary for the transport of refrigerated liquefied gases.

Each tank, no matter the type, shall be designed, manufactured, equipped, tested, marked and operated so as to meet the requirements of the competent authority of the country in which it is approved.

As in any packaging for dangerous goods, the tanks shall be inspected before every loading and possess a fitness certificate. Once loaded or unloaded, but uncleaned, it shall be handled, transported, stowed and segregated accordingly.

2.5 Vehicles

> 'Vehicle means any road freight or tank vehicle or railway freight or tank wagon permanently attached to an underframe and wheels, or chassis and wheels, which is loaded and unloaded as a unit. It also includes a trailer, semi-trailer or similar mobile unit,except those used solely for the purposes of loading and unloading.'
>
> (IMDG Code, 0128)

The IMO requirements with reference to vehicles are connected to the type of ship used, i.e. roll on-roll off ship.

The transport of dangerous goods in containers and tanks has already been analyzed. The differences for this type of ship come from the fact that loading and unloading are of wheel-moved type

which requires much more efficient securing devices and different segregation requirements bearing in mind that the holds extend almost the ship's length which means that it is a single compartment at each level.

2.6 Barges

> 'Shipborne barge or barge means an independent, non-self-propelled vessel, specially designed and equipped to be lifted in a loaded condition and stowed aboard a barge-carrying ship or barge feeder vessel.'
>
> (IMDG Code, 0136)

Barges are used for the transport of dangerous goods in packaged forms and of solid bulk materials possessing chemical hazards. Shipborne barges present the advantage of being tugged to places closer to the destination which the ship cannot reach, such as rivers, channels, or even berths with not enough water for the ship's draft. This means reduced handling and, consequently, reduced losses or even accidents. Shipborne barges shall be approved in accordance with requirements for certification of the competent authority which may delegate a classification society or other organization.

Marking, labelling, placarding and segregation of dangerous goods transported by barges are as those for the type of package used and the corresponding segregation requirements.

A common aspect of all these means of transport of dangerous goods in packaged forms is the pollution risk in the case of pollutants being transported. Each means of transport, like each packaging, has to bear the marine pollutant mark.

CHAPTER 3

CLASSIFICATION CRITERIA OF DANGEROUS GOODS

The scope of any mode of transport, when it comes to dangerous substances, is the safety of transport.

One of the most important elements taken into consideration for the above mentioned aim is the correct classification and grouping of dangerous goods. These two elements dictate for such cargoes the selection of suitable packagings, correct identification, marking, labelling or placarding and necessary information regarding precautionary measures or emergency response in case of accidents.

The classification aspect came to IMO's attention soon after the Organization came into being in 1958 and the Assembly had met for the first time in 1959. The Organization convened the International Conference on Safety of Life at Sea (SOLAS) 1960. During this Conference a new chapter VII for SOLAS, dealing with the carriage of dangerous goods by sea, was adopted.

This new chapter incorporated the classification made in 1956 by the UN Committee of Experts on the Transport of Dangerous Goods in their Recommendations known also as the `Orange Book'.

In order to assist the UN Economic and Social Council to promote a universal code covering matters relating to the carriage of dangerous goods by all modes of transport, the Conference recommended that IMO, in co-operation with the UN Committee of Experts on the Transport of Dangerous Goods, should develop the International Maritime Dangerous Goods Code (IMDG Code). One of the requirements was in respect of classification of dangerous goods. The classification of dangerous goods has

been done by the type of the risk involved and the order of the classes has no connection with the degree of danger. The hazards posed by dangerous goods are very diverse and may include: explosibility, suffocation, flammability, support of rapid combustion, toxicity, radiation, corrosivity and others.

For the purposes of the carriage of dangerous goods by sea, the following classification has been made mandatory by Regulation 2 of part A of chapter VII of SOLAS, 1974 (386,7) as amended:

'Class 1 - Explosives
Class 2 - Gases: compressed, liquefied or dissolved under pressure
Class 3 - Flammable liquids
Class 4.1 - Flammable solids
Class 4.2 - Substances liable to spontaneous combustion
Class 4.3 - Substances which, in contact with water, emit flammable gases
Class 5.1 - Oxidizing substance
Class 5.2 - Organic peroxides
Class 6.1 - Poisonous (toxic) substances
Class 6.2 - Infectious substances
Class 7 - Radioactive materials
Class 8 - Corrosives
Class 9 - Miscellaneous dangerous substances, that is any other substance which experience has shown, or may show, to be of such a dangerous character that the provisions of this part shall apply to it.'

For the purposes of the IMDG Code it has been found necessary to subdivide a number of these classes and to define and describe in greater details the characteristics and properties of dangerous goods.

Such classification is shown in Appendix 3.1.

The classification of dangerous goods into nine main classes and into sub-classes, and compatibility and packaging groups is largely based on a hazard assessment of a scientific nature, which has been applied to most known and commonly transported dangerous cargoes and which ought to be applied to all new dangerous goods offered for transport. The variety of dangerous products in use today is so diverse that it has, so far, been impossible to precisely evaluate each one. Work is constantly in progress at national and international levels, and will continue until all cargoes, which might pose a danger to human beings or the environment, have been scientifically assessed.

The assessment of the hazards of a dangerous substance according to Brünings(1992a,2) comes through different ways:

- `practical historical knowledge - as´ in case of certain explosives `whose characteristics and properties were assessed by observations during almost continuous wars in one area or another of the World´;
- `long-term experience´ - as in the case of `asbestos´ whose dust was found to cause lung disease;
- `accidents´ - in which the substances, that later proved to be dangerous, were involved;
- `systematic approach in connection with laboratory work and tests´ - in which the substances are subjected to different conditions that can lead to the occurrence of the risk.

There is another way, called `trial and error method´, which is not recommended

> `because it postulates a conscious risk taking which may be lethal... Today the systematic and scientific approach by means

of laboratory work and control tests is the only acceptable way to determine the properties and hazards of substances.'

The classification criteria adopted by the IMO for the transport of dangerous goods by sea is based on the criteria adopted by the UN Committee of Experts and laid down in the relevant chapters of the UN Recommendations. The criteria are reflected in IMDG Code and some criteria have been included in the introduction to some classes.

For class 1 - explosives - the acceptance and test procedure designed by the UN Committee of Experts is shown in Appendix 3.3.

This classification procedure must be undertaken before a new product is offered for transport.

From this acceptance and test procedure it can be seen that class 1 is a restricted class having the view that explosives which are considered to be too dangerous are not to be accepted for transport by sea. Therefore, only39 those explosive substances and articles listed in the IMDG Code should be accepted for transport by sea.

Class 1 comprises:

a) explosive substances, except those which are too dangerous to transport or those where the predominant hazard is one appropriate to another class;

b) explosive articles, except devices containing explosive substances in such quantity or of such a character that their inadvertent or accidental ignition or initiation during transport shall not cause any effect external to the device either by projection, fire, smoke, heat or loud noise;

c) substances or articles not mentioned under a) or b) which are manufactured with a view to producing practical explosive or pyrotechnic effect.

Substances, materials and articles are classified as explosives according to a very large range of criteria listed in Orange Book's Tests and Criteria. Once a product is accepted as

an explosive, a series of tests is followed in order to assess the division and compatibility group to which that specific product belongs. In fact there are seven series of tests used in order to assess the division. Class 1 is unique in that the type of packaging and method of packing used frequently has a decisive effect on the hazard and, therefore, on the assignment of an explosive label to a particular division and compatibility group.

It is important, for the safety of experiments, that certain preliminary tests be conducted first. These tests will use small quantities of explosives. Only after that should a normal test using larger quantities be undertaken. The results from both experiments may be used for the classification procedure.

The competent authorities must prescribe the definitive test method. In addition, although class 1 is restricted, competent authorities have the right and power to approve transport of special explosives under special conditions.

For class 2 - gases - two diverging sets of criteria are currently used for acceptance within this class.

According to one system a gas is included in class 2 if it has a critical temperature of less than 50° C or if it exerts at 50° C a vapor pressure of more than 300 KPa (3 bar).

The other system accepts a gas as class 2 only if it exerts an absolute pressure of more than either 280 KPa (2.8 bar) at 21° C or 730 KPa (7.3 bar) at 54.4° C or if it exerts a Reid vapor pressure of more than 280 KPa (2.8 bar) at 37.8° C.

Although the results obtained by either set of criteria vary only slightly, it was impossible to reconcile the two systems. Therefore, no precise definition was given to gases and this class is said to comprise:

a) permanent gases - gases which cannot be liquified at ambient temperature even if they are compressed;

b) liquefied gases - gases which can become liquid under pressure at ambient temperature;

c) dissolved gases - gases dissolved under pressure in a solvent which may be absorbed in a porous material;

d) deeply refrigerated gases - e.g.liquid air,oxygen.

With regard to the packing of gases, the containment systems are divided into receptacles, which include both cylinders and receptacles of low, medium and high pressure. The division is based on arbitrary filling pressure limits at 15° C, as follows:

1. low pressure - up to and including 2 MPa;
2. medium pressure - over 2 MPa, up to and including 7 MPa;
3. high pressure - over 7 MPa.

For class 3 - flammable liquids - the most important criterion is the flash point. To be more accurate it is the value of flash point of a flammable liquid. Flash point is the lowest temperature of liquid at which its vapor forms an ignitable mixture with air. According to this criterion, any liquid, except those where the predominant hazard is appropriate to another class, having a flash point not higher than +61° C, is considered as being a flammable liquid of class 3.

The flash point divides the flammable liquids into three groups called divisions as can be seen in Appendix 3.1. There are two techniques for determining the flash point but the values obtained, even repeating the same technique, are not always the same.

It can be seen that

> 'the flash point of a liquid is not an exact physical constant... It depends to some extent on the testing procedure, testing apparatus used and the ambient conditions.'
>
> (Orange Book, 5)

Whatever procedure or apparatus is used, it has to be clearly stated following the flash point value. The IMDG Code is using the closed cup test values which are lower than those obtained by open cup test with up to 5.1° C.

Regarding the packaging purposes the flammable liquids are assessed into three groups determined according to group category by reference to:

a) - the viscosity expressed as the flow time in seconds (refers to ISO standard 2431-84);
b) - the closed cup flash point;
c) - a solvent separation test;
d) - initial boiling point.

For class 4 - flammable solids; substances liable to spontaneous combustion; substances which, in contact with water, emit flammable gases - the classification and grouping criteria depends upon the division to which a certain substance belongs. In fact the division is assigned after specific tests which, by experiment, show whether or not the tested substance can be included in a certain division.

By and large, class 4 comprises substances other than those where the predominant hazard is appropriate to another class, which, under conditions of transport are readily combustible, may contribute to or cause fire.

Class 4.1 - flammable solids - according to the IMDG Code, this category deals with solids possessing the properties of being easily ignited by external sources, such as sparks and flames, and of being readily combustible, or of being liable to contribute to fire or cause fire through friction. Wetted explosives and substances which are self-reactive or energetic are also included, but only when the wetting agent, which can be water or certain other liquids, is uniformly distributed throughout the substance in the state in which it is to be transported.

Classification procedure comprises two steps. The first step establishes whether the substance tested is a flammable solid or not. The second step is more complex and shows whether the substance is a 4.1 division and, if so, which packing group has to be assigned to it. Actually the test is used to assess the packing groups II and III. Packing group I is assigned only to solids, normally wetted, which if in a dry state would be classified as explosive.

Class 4.2 - substances liable to spontaneous combustion - deals with solids or liquids possessing the common property of being liable spontaneously to heat and to ignite, and comprises pyrophoric substances and self-heating substances.

The classification tests are carried out to determine if a substance is a pyrophoric or a self-heating one. Regarding the pyrophoric substances the classification test methods differ for solids and liquids. For solids the procedure is a simple one; the powdery substance poured from a height of one meter on a non-combustible surface. In order to be considered a class 4.2 substance, the powder has to ignite during dropping or within 5 minutes. It may be repeated 6 times. If during these trials, no positive result is obtained, the substance is not a class 4.2.

For liquids the tests are grouped into two steps: one is for testing whether the mixture of that substance with an inert carrier ignites when exposed to air; the other is meant to establish if the substance ignites or chars a filter paper but only in case of a negative result in the first step.

The first step may be repeated six times. If the liquid to be tested is poured into a porcelain cup and it ignites within five minutes, it is considered as a class 4.2 substance.

The second step is repeated only three times and it is meant to determine if the liquid ignites or chars a filter paper within five minutes. If so, the liquid is class 4.2.

Regarding the assignment of packing group, all pyrophoric substances are included in packing group I.

For the self-heating substances the tests are carried out using samples in 2.5 and 10 cm cubes which are exposed for 24 hours at a constant temperature of 140° C. If, first, the 10 cm cube sample ignites or has a temperature of more than 200° C, the substance is a self-heating one and a further test is carried out. The second test is conducted with a 2.5 cm cube sample.

The substance which gives positive results in a second test is considered to belong to packing group II. The one which gives positive results in the first test, but negative results in the second test, has packing group III assigned to it.

Class 4.3 - substances which, in contact with water, emit flammable gases - deals, obviously, with solids and liquids having the common property of evolving flammable gases when wetted.

The test conducted for classification and grouping criteria is a complex one.

If, in contact with water, either spontaneous ignition takes place at any step of the test procedures or there is an evolution of a flammable gas at a rate greater than 1 litre per kilogram of the substance per hour, the substance is classified in division 4.3.

A division 4.3 substance, which reacts vigorously with water and the gas produced shows a tendency to ignite spontaneously or the rate of evolution of the gas is not less than 10 l/kg of substance over any one minutes, packing group I is assigned to it.

Packing group II is assigned to a substance which reacts readily with water such that it generates gas at a maximum rate of not less than 20 l/kg/h but not more than 10 l/kg/min.

A substance belongs to packing group III if it reacts slowly with water and maximum rate of evolution of flammable gas is greater than 1 l/kg/h but less than 20 l/kg/h.

For class 5 - oxidizing substances (agents) and organic peroxides - the classification criteria depends, as in case of class 4, on the division due to the different properties they possess.

Class 5.1 - oxidizing agents - are substances not necessarily combustible which, by producing oxygen, may cause or enhance the combustion of other materials.

Classification and grouping test methods for liquid oxidizing substances have not been developed yet.

As per Orange Book, two tests are conducting for any solid substance to be assessed/evaluated: one at 1 to 1 ratio, of mass, of substance to sawdust and one at 4 to 1 ratio. The burning results are compared with the 1 to 1 ratio of ammonium

persulphate, potassium perchlorate and potassium bromate. Each sample is prepared in conformity with very precise conditions and then ignited by an electrically heated wire. The experiment should be repeated three times.

If, for either ratio sample, the mean burning time established from three tests is not greater than the average of the three tests of ammonium persulphate, the substance is classified in division 5.1.

For a substance to be considered as packing group I, its burning time in either concentration, has to be less than that of potassium bromate.

For packing group II the burning time must not be greater than that of potassium perchlorate, but equal to or greater than that of potassium bromate.

For packing group III the burning time has to be equal to or less than that of ammonium persulphate and the criteria for packing groups I and II are not met.

Class 5.2 - organic peroxides - are substances liable to exothermic decomposition at normal temperature and when heated. Contact with impurities of acids, heavy metal compounds and amines can cause the decomposition.

By and large, organic peroxides may have one or more of the following characteristics:

- be liable to violent decomposition
- burn rapidly
- be sensitive to impact or friction
- react dangerously with other substances
- cause damage to the eyes.

According to IMDG Code (5201)

> `any organic peroxide should be considered for classification in class 5.2, unless the organic peroxide formulation contains:
> - not more than 1.0% available oxygen from organic peroxides when containing not more than 1.0% hydrogen peroxide; or
> - not more than 0.5% available oxygen from

organic peroxides when containing more than 1.0% but not more than 7% hydrogen peroxide.'

Organic peroxides transported by sea, are classified into five types according to the degree of danger they pose. A sixth type, which is too dangerous, is not accepted for transport in the packaging in which it is tested. There is also a seventh type, which is not included in class 5.2. They are counted from A to G. Those accepted for transport are B to F.

Both classification from B to F and assignment of packaging groups are related to the quantity of organic peroxides allowed per package. Because of the decomposition risk, especially if confined, packaging group I is not used. All organic peroxides are assigned to packaging group II.

The classification and grouping tests, which are very complex procedures, are thoroughly presented in the UN Recommendations on the Transport of Dangerous Goods, Tests and Criteria, Part III.

Although the total quantity of organic peroxides transported by sea is only `1% of all dangerous goods' (Wardelmann 1990, 40) and only small consignments are shipped at a time, serious attention shall be paid on such occasions.

Class 6 - poisonous and infectious substances - is divided into two subclasses:

- class 6.1 - poisonous (toxic) substances
- class 6.2 - infectious substances

Class 6.1 - poisonous (toxic) substances - comprises substances that possess the common property of causing death or serious injury or harming human health if swallowed or inhaled, or by skin contact. The degree of danger depends on the time of contact or the quantity of poisonous substance involved.

In assigning the packaging group to any poisonous substance, account should be taken of human experience in cases of accidental poisoning. In the absence of human experience, data obtained from animal experiments should be used. Besides these,

special properties of individual substance, such as liquid state, high volatility, any special likelihood of penetration, and special biological effects are to be taken into consideration.

Class 6.1 substances are grouped into three categories according to their degree of toxicity risk while transported. The IMDG Code (6006) divides the poisonous substances as follows:

`1 Packaging group I: substances and preparations presenting a very severe risk of poisoning;

2 Packaging group II: substances and preparations presenting a serious risk of poisoning;

3 Packaging group III: substances and preparations presenting a relatively low risk of poisoning.´

For classification and grouping purposes three routes of administration should be considered: inhalation, swallow and skin contact.

The criteria used are LD50 for oral and dermal toxicity and LC50 for inhalation toxicity and these are largely presented in the UN Recommendations on the Transport of Dangerous Goods and IMDG Code.

Class 6.2 - infectious substances - consists of substances containing viable micro-organisms or their toxins which are known or suspected to cause disease to animals or human beings.

Unlike the substances from other classes, infectious substances are not divided into three packaging groups. Instead, any infectious substances are packaged taking into consideration their individual properties and in such a way that they arrive at the destination in good condition and present no hazards to persons or animals during transport.

Class 7 - radioactive materials - comprises materials with a specific activity greater than 70 KBq/kg (2 nCi/g).

The transport of radioactive materials is regulated by the International Atomic Energy Agency´s Regulations for the Safe

Transport of Radioactive Materials, 1985 edition, as amended by Safety Series No.6, Supplement 1988

This class is not further divided.

The appropriate packing requirements, and hence the appropriate schedule, are related to the activity of the materials that are to be transported.

According to the specific activity a material has, it is assigned to one of the 13 schedules in the IMDG Code and, in case of transport, the requirements of that specific schedule shall be observed.

Class 8 - corrosives - comprises solids or liquids possessing, in their original state, the common property of being able, more or less severely, to damage living tissue and, in larger quantity, to cause damage to other cargoes or to the ship.

The grouping of corrosives has been done on the basis of experience including factors such as inhalation risk and reactivity with water. For packing purposes, corrosive substances have been divided into three groups:

Packaging group I - substances that cause visible necrosis of the skin of an animal in not more than 3 minutes or more than 3 minutes but not more than 60 and, in addition, to the second condition, have a vapor inhalation toxicity of class 6.1 corresponding to packaging group II.

Packaging group II - substances that cause visible necrosis of the skin of an animal in more than 3 minutes but not more than 60.

Packaging group III - substances that cause visible necrosis of the skin of an animal in more than 1 but less than 4 hours or exhibit a corrosion rate on steel or aluminum exceeding 6.25 mm/year at 55° C.

Class 9 - miscellaneous dangerous substances and articles and harmful substances - comprises dangerous substances not covered by other classes and harmful substances covered by Annex III of MARPOL, 1973, as modified by the Protocol of 1978.

Though no grouping criteria have been developed, the substances and articles of this class have been divided into two packaging groups on the basis of assimilation with goods having similar properties and characteristics. The packaging group to which a substance or article is assigned is given in its individual schedule.

For dangerous goods having more than one risk the table of Precedence of hazard given by Appendix 3.2 may be used. The packaging group assigned to a dangerous good having multiple risks is the most stringent packaging group of those applying to every class in the mixture regardless of the precedence of a hazard table.

In the case of mixtures containing one of the following substances:

- substances and articles in class 1,
- gases in class 2,
- self reactive substances and wetted explosives in class 4.1,
- pyrophoric substances in class 4.2,
- substances in class 5.2,
- substances in class 6.1 with Packaging Group I inhalation toxicity,
- substances in class 6.2, and
- materials in class 7

the precedence of a hazard table cannot be used since it does not deal with the above-mentioned substances. Meanwhile the risks of these substances always take precedence over the others.

Having arrived here it can be seen that the definitions of classes, given in SOLAS Convention and IMDG Code, are not definitions in the strict scientific sense of the word. For most of the classes criteria have been established to determine and define limits or thresholds of danger. The classification and definitions of classes of dangerous goods have been devised so as to provide a common pattern which should prove possible to follow in the various national and international regulations.

The aim is to provide general guidance as to which goods are

dangerous and as to the class in which, according to their characteristics, they should be included.

A considerable degree of standardization is thus achieved while retaining the flexibility necessary to deal with diverse situations.

There are a few substances not included in the UN Recommendations for which safe transport conditions are neither adequate nor feasible. The transport of such goods is prohibited except with special authorization of the competent authorities concerned and under special conditions laid down by these authorities.

At the same time there are borderline cases arising under any scheme of testing and classification. Therefore, there must be a competent authority to make the final decision. Generally such decisions are made by an office in the Administration which is responsible for the transport of dangerous goods. This is the 'Competent Authority' and is appointed by the Administration for this purpose. Such a decision may not receive international acceptance and may, therefore, be valid only in the country where it has been made. The UN Committee of Experts provides a forum for the discussion of such borderline cases.

Classification under the UN Recommendation is decided on the basis of data submitted by governments, intergovernmental organizations and other international organizations. A form, designed by the UN Committee of Experts to be used for new or amended classification, is shown in Appendix 3.4. However, the actual data submitted are not formally endorsed by the UN Committee of Experts on the Transport of Dangerous Goods.

The UN Recommendations are addressed to all modes of transport. Unfortunately the main systems of regulations in use differ in their bases for classification, labelling, listing and terminologies. Such discrepancies will create difficulties for shippers whose consignment might need to comply with heterogeneous regulations of countries of transit and final destination, or of the different modes of transport.

Therefore, using UN Recommendations would avoid these difficulties and would aid, rather then confuse, the user. A harmonized system in full use all over the world is more than necessary.

CHAPTER 4

SHIPS CARRYING DANGEROUS GOODS

Unlike the non-dangerous cargoes, the dangerous ones require stricter conditions for safe transport. Therefore, ships carrying dangerous goods must be built and equipped in such a manner as to preserve the integrity of this type of cargo from the moment of loading to the moment of discharging. Taking into account the risks posed by dangerous goods, the ship must also protect the non-dangerous cargoes, the ship herself, the environment and the crew against these risks. In order to achieve this goal the ship must be built and equipped according to the requirements of SOLAS '74 Convention and according to different codes.

The SOLAS Convention was the first international instrument used to improve the safety on board ships carrying dangerous goods. Its Chapter 7 consists of three parts:

1 Carriage of dangerous goods in packaged form or in solid form in bulk;
2 Construction and equipment of ships carrying dangerous liquid chemicals in bulk; and
3 Construction and equipment of ships carrying liquefied gases in bulk.

The provisions of this Chapter are supplemented by Chapter II-2 of SOLAS '74 regulation 38 and 54, and the Codes designed for specific types of cargoes, namely:

- International Maritime Dangerous Goods (IMDG) Code adopted by resolution A.434 (XI);
- Code of Safe Practice for Solid Bulk Cargoes (BC Code) adopted by IMO by resolution A.434 (IV);
- International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in

Bulk (IBC Code), adopted by the Maritime Safety Committee (MSC) by resolution MSC.4 (48);
- International Code for the Construction and Equipment of Ships Carrying Liquified Gases in Bulk (IGC Code), adopted by MSC resolution MSC.5 (48);
- Code for the Safe Carriage of Irradiated Nuclear Fuel in Flasks on Board Ships.

All ships carrying any non-dangerous cargo has to comply with certain regulations meant to assure the safety of the ship, cargo and crew. Ships carrying dangerous goods have to comply with further regulations in addition to these. Ships subject to further regulations form a large category composed of general cargo ships, container carriers, ro-ro vessels, solid bulk carriers and barge carriers. The category examined here does not include ships carrying liquids and gases in bulk which are governed by different regulations.

4.1 Fire fighting equipment

The most dangerous risks for a ship, her cargo and crew are explosion and fire. Fire does not always lead to explosion, nevertheless it may destroy everything on board ship. Therefore any ship carrying dangerous goods must be able to prevent an explosion and fire or be able to combat such events when they occur.

4.1.1 Fire prevention

The most obvious source of fire on board ship is the electrical equipment. The best way to reduce the risk of fire in an enclosed cargo space is not to fit electrical equipment in such a space. However, this is not possible in cases where it is essential for operational purposes. Nonetheless, if electrical equipment is to be fitted, it must be in accordance with the 1992 Recommendations of the International Electrotechnical Commission on Electrical Installations in Ships (IEC) and be protected against damage from impact. Where it is possible to disconnect

the electrical system it must be done from another compartment or from the engine room. In either case a warning must be hoisted at the place of disconnection. Any penetration of cables through decks or bulkheads must be sealed against the passage of gas or vapour.

Ventilation is a possible and usual way to reduce the risk of fire by preventing the formation of a flammable atmosphere in an enclosed space. The ventilation equipment must be protected against sparks and flames which could ignite a flammable gas air mixture. Thus, both end ventilation openings must be fitted with very fine wire nets.

In the case of large quantities of flammable liquids being carried, due attention must be paid to the bilge pumping. There are two aspects here which must be taken account of. One is the availability of suitable pumping arrangements for large quantities of flammable liquids from the cargo space bilge. The other is the design of the pumping system which must not pass through machinery space where there is a likelihood of ignition.

4.1.2 Fire detection

If the fire can not be prevented, it must be detected as soon as possible. The first minutes are the most important for the prevention of spreading, thus all cargo spaces must be fitted with adequate fixed fire detection and fire alarm systems. Where the detection is realized by using air extracted from the cargo spaces, the detection system must be built in such a way as to prevent the discharge of contaminated air in the space in which the detection apparatus is situated.

4.1.3 Fire fighting

The fire fighting agent, which is available at the ship's discretion, is water. Therefore the ship must be built or equipped in a way which can ensure immediate availability on board of large quantities of water. There are situations when one or more cargo spaces must be flooded or a spill on deck must be washed over board. In both cases copious quantities of water are

needed. But fighting a fire, especially in case of a flammable liquid and regardless of whether or not it is miscible with water, the water will not be used as jet, but sprayed over the fire. Consequently the ship must have sufficient spraying nozzles required in addition to those considered to satisfy the needs of a ship carrying non-dangerous cargoes.

In the case of a ro-ro vessel, each open cargo space having a deck above it and each vessel having a closed cargo space which cannot be sealed must be fitted with a fixed pressure water spraying system for manual operation. The system must be designed so as to protect all parts of that cargo space. Large quantities of water may have an adverse effect upon stability by added weight and free surface. In order to prevent such an occurrence arrangements for drainage and pumping must be made.

A ship carrying dangerous goods must also have, according to SOLAS '74 Convention, chapter II-2, regulation 54, at least 12 kg of dry powder in portable fire extinguishers in addition to the requirements for a ship carrying non-dangerous cargoes.

4.2 Personnel protection

To be able to fight a fire or to stand a spill of toxic gases, the crew must be provided with protective clothing and self-contained breathing apparatus. The same regulation 54 of Chapter II-2 of SOLAS '74 Convention states that an additional four sets of full protective clothing resistant to chemical attack and at least two self-contained breathing apparatus must be provided.

The IMO's Emergency Procedures for Ships Carrying Dangerous Goods, apart from the fact that it is only a guide, does not specify the quantity of each item of emergency equipment to be carried. The decision is the responsibility of the master as the quantity of each item of emergency equipment depends on the amount of dangerous goods being carried, size of ship and the number of crew members.

In the event of people on board being affected by an

accident involving dangerous goods the recommendations of MFAG are, sometimes, vital. Therefore, the ship must be provided with a sufficient quantity of different medicines and medical equipment to enable a skilled crew member to provide appropriate first aid measures.

4.3 Spill fighting

Carrying liquid dangerous cargoes in drums or other kinds of recipients a spill may occur. When it takes place under deck or on deck in the case of a pollutant, use of water is either not possible or not allowed. To deal with such a situation the ship must be provided with absorbent material. A very good one is sawdust, but sawdust must not be used in the case of a flammable liquid. This is also the case for reactive liquids. In such cases the recommended material is the diatomaceous earth which is an inert absorbent. If the spill is not dangerous for the environment the absorbent material used may be disposed overboard. In the case of a pollutant, it must be collected, kept on board in drums or plastic bags and delivered at destination. Therefore, the vessel must be provided with collecting equipment. In the case of damaged drums containing liquid dangerous cargoes the best way to deal with them is to use oversized drums with detachable heads. So this is another item with which the ship must be provided prior to loading.

Having mentioned the equipment, materials and construction arrangements required for a ship intended for carrying dangerous cargoes in packaged form and solid dangerous cargoes in bulk, the necessity of having on board the IMDG and BC Codes, EmS and MFAG must be emphasized.

However, having these on board is not enough. The crew must be trained to apply the requirements and guidelines of the mentioned codes and guides when fighting a fire or a spill. All personnel on board must be trained in the use of protective equipment and must have basic training in the procedures, appropriate to their duties, necessary in emergency conditions.

Crew members involved in cargo operations must be adequately trained in handling procedures. Officers must be trained in such a way as to enable them to deal with leakage, spillage or fire involving the cargo. A sufficient number of them must be instructed and trained in first aid for the cargoes carried.

According to the IMO's Sub-Committee on the Carriage of Dangerous Goods at its 44th session (13), training of dangerous goods transport workers is a matter for national regulations. Therefore, the safety of the transport of dangerous goods lies in the hands of each country's administration which should establish national regulations based upon international conventions, recommendations and guidelines.

4.4 Special requirements for ships carrying explosives

Explosives, due to their sensitiveness, are a type of cargo requiring special conditions for stowage, storage and transport. A ship carrying explosives must be built and equipped so as to meet the safety requirements. When carried by ship, explosives must be protected against heat, sparks and flames, humidity, friction and impact, other cargoes, and ship movements. A ship's spaces meant for explosives must not be subjected to heating and must be as cool as possible during the period the explosives are on board. Therefore, these spaces must be away from any sources of heating such as heating pipes, electrical cables or any other possible source of fire, and be clean and dry. Ventilation is, therefore, very important.

Explosives, depending on the characteristics influencing the risk, are assigned to a specific stowage which is a special arrangement in the ship's hold built to match the requirements posed by such a risk. There are three main stowage arrangements: ordinary stowage, magazine stowage and special stowage. The second category is further divided into three types, namely: A, B and C. All these categories and types are described in detail in the introduction to class 1 in the IMDG Code. Examples of typical arrangements are shown in Appendix 4.1. In the case of

explosives stowed in closed vehicles it is not necessary to have magazine stowage, closed vehicles being considered as such.

Explosives must be stowed as far away from the living quarters and engine room as possible. Explosives must be separated from the living quarters by a fixed steel bulkhead type "A-60" as defined by the SOLAS '74 Convention. The engine room must be separated from a compartment with explosives by a cofferdam consisting of two walls 0.6 metres apart with at least one "A-60" bulkhead. Furthermore, explosives must be stowed at least 3 metres away from such bulkheads.

Cargo spaces must be illuminated by electrical lighting but not by electrical arc. Special measures must be taken when loading or discharging explosives that are sensitive to electromagnetic waves produced by radio transmitters and radar. All electromagnetic wave sources of metric wavelength must not be used during cargo operations unless they are less than 24 W and at least 2 metres away from the explosives (IMDG Code, 1017). Handling equipment used must be very well shielded so as to prevent fire or explosion.

Other equipment items which must be fitted in a hold containing explosives and the adjacent compartments are fixed fire-detection systems and fixed fire-extinguishing systems.

It is well-known that some explosives are extremely sensitive to impact and friction. In cases where the ship carries such explosives, the crew must be able to cope with their spillages. Therefore, it is necessary to have soft footwear, soft brushes and plastic trays apart from the equipment normally required for a ship carrying dangerous goods.

4.5 Special requirements for ships carrying radioactive materials

A ship carrying radioactive materials is any ship having as cargo substances the specific activity of which is greater than, or at least equal to 2 nCi/g, but not a nuclear ship as defined by Chapter VIII of SOLAS '74 Convention.

Radioactive materials listed in the IMDG Code may be carried by any ship complying with the requirements of Chapter II of the SOLAS '74 Convention, as amended, of type 1 ships' survival capability and location of cargo spaces in Chapter 2 of the IBC Code, and of the IMDG Code.

Under normal conditions of transport there is no risk coming from such substances due to the protection offered by the adequate packaging and strict application of regulations prescribed. Fire is the risk that could trigger the main danger by damaging or even destroying the packagings containing radioactive materials. This is taken care of by the SOLAS '74 Convention and IMDG Code requirements.

IMO, through its Sub-Committee on Ship Design and Equipment at its 35th session, has produced a draft Code for the Safe Carriage of Irradiated Nuclear Fuel in Flasks on Board Ships. This Code addresses the new and existing ships of any size which are engaged in the carriage of irradiated nuclear fuel in flasks approved in accordance with the Regulations for the Safe Transport of Radioactive Material of the International Atomic Energy Agency. This type of cargo should be transported in accordance with class 7 of the IMDG Code, schedules 10, 11, 12 or 13. The temperature of spaces containing such cargo must be kept so as not to exceed 55° C by adequate ventilation or refrigeration. The ventilation and refrigeration equipment should be provided in duplicate for each cargo space.

The adequate performance of all equipment on board such a ship is of utmost importance. Therefore, on alternative source of electrical power should be provided to automatically replace the main supply in case the latter is damaged. The alternative source must be located so that it is not affected by the damage that involves the main source. This alternative source must comply with the requirements of the IEC and be able to produce sufficient power for 36 hours.

Ships carrying irradiated nuclear fuel in flasks must be designed and equipped according to the level of specific activity of the substances transported and to the satisfaction of the

administration concerned.

Regardless of the international conventions, recommendations or guidelines, any ship carrying radioactive substances must fully satisfy the national administration of the countries concerned.

4.6 Segregation

Segregation of dangerous goods on board ship is solved by the IMDG and BC Codes through the segregation tables and separation terms. These tables and the definition of terms can be found in Appendix 4.2.

Although the segregation is solved as it can be seen, a new problem occurs in respect of the open-top container ships relating to the clarification of the "on-deck" and "under-deck" stowage and segregation problems. The open-top container ship design also affects the requirements of the SOLAS '74 regulation II-2/53 and 54.

One way to look at the segregation on board such a ship is to consider the application of the segregation table in paragraph 14.4.2 of the General Introduction to the IMDG Code. In this respect, an assumption should be made that there is a deck at the level of the top of the athwartships bulkheads which separates the open-top holds. However, is this a good solution?

Another way to look at is to define new rules for segregation on board such ships.

With regard to open-top holds which are not designated for the carriage of dangerous goods in accordance with SOLAS '74 regulation II-2/52, the United States delegation at the CDG 44 session suggested not to permit dangerous goods containers above the bulkheads in a row or stack of containers adjacent to such a hold. The question at issue is to be answered by the coming CDG sessions. However, instead of the table of segregation of freight containers on board ships contained in section 15.3.2 of the IMDG Code, the table in Appendix 4.3 should be applied as provisional requirements for open-top container ships.

4.7 Environment protection

As more and more dangerous substances in larger and larger quantities are carried by larger and larger ships, the environment is at stake. Public communities are more and more aware of the depreciation of the environment and, therefore, of life.

One of the solutions imposed by the IMO's Marine Environment Protection Committee is the double-hull ships to be used for the carriage of oil which is the greatest threat to the environment. Even if dangerous goods in packaged form are not carried in such large quantities as oil, the effects of an accident in a populated area or in confined waters might cause disasters. No matter how much care is taken in shiphandling, accidents will occur. Therefore, even if today, due to the high cost, the double-hull ship is out of the question as to the possibility of becoming a better solution for the transport of dangerous goods in packaged forms or in solid form in bulk, it might be in the not so very distant future.

CHAPTER 5

NOTIFICATION PROCEDURES, ACCEPTANCE PROCEDURES, DOCUMENTATION AND CHECKS

Transport of dangerous goods by sea requires very close cooperation between ship and Port Authority (P.A).

Every Port Authority must have appropriate regulations which must be observed by all ships carrying dangerous goods and by all involved, one way or another, in the sea and port links of this transportation chain. Successful implementation of this aspect, which in fact consists of a number of activities having as the main aim the safe transport of dangerous goods, depends, actually, upon the information circulated, by communication means, between ship and shore.

This is always realized through notification and acceptance procedures, documentation and checks.

Having in view the importance of regulations related to the transport of dangerous goods in port areas IMO, in 1980, adopted the Recommendations on the Safe Transport, Handling and Storage of Dangerous Substances in Port Areas. In July 1992 the Sub-Committee on the Carriage of Dangerous Goods, in its 44th session, redrafted the above-mentioned Recommendations for a very necessary revision. The new draft has a different lay-out due to a re-arrangement of existing sections and paragraphs and the addition of sections on training and responsibilities. It has also replaced the term `shipper´ by the concept of `cargo interests´ in view of this better covering the operators responsible for pre-shipment procedures.The draft has deleted the word `storage´ because these recommendations are supposed to cover only the short-term keeping of goods within a port.

Therefore, the short-term keeping aspect was included in the definition of cargo-handling. Apart from this, new Recommendations have a reduced coverage having in view that they are addressed only to dangerous cargoes not dangerous substances. The title of such revised recommendations is `Recommendations for the Safe Transport and Handling of Dangerous Cargoes in Port Areas´(including implementation).

5.1 Notification procedures

According to both versions any mode of transport carrying dangerous goods to a port has to give an advance notification not later than 24 hours before the arrival in port. This notification shall contain the information about the dangers posed by cargoes in order to enable the Port Authorities to make proper arrangements to meet the safety requirements for that cargo.

Usually, in the case of maritime mode, notifications are given, in accordance with a Charter Party and/or Bill of Lading, with 7, 5, 3, 2 days and 24 hours prior to arrival in a port and must contain information about cargo to be discharged in that port, including, if it is the case, dangerous goods. For the arrival notification to be effective, carriers shall send it to the Port Authorities well in advance of the arrival of the dangerous goods. The method of communication depends on the time remaining before the dangerous goods are due. When there is sufficient time to transmit a paper document, a copy of the transport documents would be the best procedure. If not, arrival notification shall be sent by telex, cable, computer link or facsimile transmission. In either case, a standard format of message or document assists staff in the port of arrival to use the information more efficiently. A timely ETA enables terminal operators to plan the discharge and storage of the dangerous goods and consignees/forwarders to arrange customs clearance in advance. The absence of such notification might lead to the non-acceptance of the ship in the port/terminal and may cause congestion and demurrage charges.

The notification required by IMO Recommendations shall contain correct and sufficient information which, with a few exceptions, is almost the same in the case of both packaged and bulk dangerous cargoes.

The information contained in the notification given by the carrier in the case of both packaged and bulk cargoes can be divided into two parts:

- one related to the ship, giving the name of the ship and ETA, not later than 24 hours prior to arrival;
- the other related to the cargoes giving:
    - the correct technical name(s), the UN or BC number, the IMDG Code classification, subsidiary risk, Flash Point or F.P.range and the quantity;
    - the compatibility group and the stowage arrangement in case of class 1;
    - the words `RADIOACTIVE MATERIAL´, in case of class 7, if it does not appear in the proper shipping name and the schedule number;
    - stowage position on board for both to be discharged or left;
    - the condition of dangerous cargoes and related equipment in case of any defect which can lead to a hazard;
    - any defect which may affect the safety of navigation;
    - whether a Certificate of Fitness is held for the cargo in the case of bulk dangerous cargoes.

The information required by the Port Authority in the case of a land mode of transport for packaged and bulk dangerous cargoes is as follows:

- the correct technical name, the UN or BC number, the IMDG Code classification (if applicable), the F.P. or F.P.range (as appropriate) the number and type of packages (if applicable);
- the shipper and time of delivery, the ship into which the dangerous cargoes are to be loaded, the ship´s agent and the berth.

Usually the Port Authorities are notified by the ship's agent who is formerly notified by the ship's master, usual the case, or by the ship's agent in the last port of call.

There is also a special situation when the distance between the last port of call and the destination port is covered by the ship in less than 24 hours. Should such a case occur, the master shall estimate the departure time and notify the Port Authorities in the next port in due time.

Where wastes are involved the notification shall be sent by the competent authority of the country of origin or by the exporter through the channel of the competent authority of the country of origin, to the country of final destination.

Receiving the notification, the Port Authority shall inform all concerned in order to make the required and necessary preparations as to insure the safe operation of dangerous goods. These preparations will be analyzed in Chapters 6.

5.2 Acceptance procedures

The acceptance of dangerous goods in a port must be the result of a thorough analysis of the types and amounts of dangerous goods, the proximity of the population to the port, port facilities, educational level of the port personnel, equipment of the emergency services,etc. The dangerous goods coming to a port must be divided according to the danger they present.

One group could be the highly dangerous goods which are not accepted into the port. Being highly dangerous,these goods are not included in the IMDG Code. But the port may accept such goods on different terms than the dangerous goods listed in the IMDG Code. In such a case, notification would have to be sent to the port two or three weeks in advance, accompanied by detailed technical specifications and by a certificate issued by the competent authority of the exporting country, if applicable.

A second possibility would be the acceptance of some highly dangerous goods at special loading/discharging areas only (e.g.

remote berth or at anchorage). Certain explosives, radioactive materials and some dangerous goods in packaging group I would come under this heading. It is understood that these goods would have to be subject to direct delivery.

A third category would be dangerous goods of high or medium danger which could be permitted for handling at any ordinary berth but subject to direct delivery. Within this group could come certain explosives, radioactive materials and some goods of packaging groups I or II. These may, if necessary, be loaded/ discharged on the basis of `last in/first out´.

The fourth group, which is also the last, is the one containing the remaining dangerous goods which would be allowed for storage inside a port area. They should be stored in special areas for a limited period only. The duration can be controlled by the level of high storage costs for such goods.

In addition to the actual danger of the dangerous goods, acceptance conditions should also take into account the quantities of such cargo. For example: the amount of certain explosives and other highly dangerous goods in a port at any one time should be limited. The competent authority shall establish the types and minimum quantity of dangerous goods per type for which prior notification of arrival is required. The competent authority shall, also, delegate the Port Authority

> `to grant exemptions for certain types and/or quantities of dangerous goods, for certain modes of transport and for short voyages.´
>
> (Recommendations ... for Port Areas, 16)

A port may also adopt similar, but less stringent procedures for dangerous goods on board ships which are destined for other ports and which are not handled by the port workers.

Many ports prohibit damaged dangerous goods entering their areas. This is a sensible precaution for goods delivered by land modes and must, in principle, be strictly observed. Otherwise a port will not only burden itself with unnecessary risks, but may also be put into an awkward position because the ship should

refuse such goods.

A different situation occurs when a ship has to discharge damaged dangerous goods. In the case of port rejection the ship is left with its problems which could make the conditions on board unsafe. A port, as a service organization, assists the ship with all reasonable and available means to get rid of damaged dangerous goods and should not refuse the goods without having examined all the possibilities.

Having been completely satisfied as a result of the information received and knowing that the dangerous cargoes can be safely operated, the Port Authority accepts the ship in the port.

5.3 Documentation

Besides the information delivered to the Port Authority, once in port the ship/master has to produce a series of documents relating to dangerous cargoes whether they are to be unloaded in that port or left on board.

It is a well-known fact that the documentation aspect is of great importance in every port of the world. A large variety of forms are now used in ports. They satisfy the port authorities of the country, but are often contrary to the interest of shipowners and ship masters of foreign flags. No passenger can disembark, nor can any cargo be loaded or discharged until the correct forms have been produced. Besides, the forms differ from port to port. Therefore, it is very important to have standardized types of documents circulated in all ports to reduce the unproductive delays and expenses incurred by ships in ports and, in the case of dangerous cargoes, to give the Port Authority the information needed. This aspect has become the concern of IMO which even has an agreement with UNCTAD to avoid duplication of work on ship documentation.

According to the IMDG Code all dangerous goods transported by sea have to be accompanied by special information and a

declaration on behalf of the shipper. The information does not need a separate paper and should be incorporated into other shipping documents. This would decrease the paper work, minimize and harmonize the formalities and ease the information flow. The main aim of a shipping document for dangerous goods is to convey the information relative to the hazards of the goods so that all the parties involved can ensure the safety of that particular transport, of human life and the protection of the environment.

A very important aspect relative to the documents accompanying dangerous goods is the fact of making them valid for all modes of transport. If so, a dangerous goods document issued for the initial mode of transport is valid for subsequent modes in international multimodal and combined transport.

In principle, a port should require, at least the following documents: dangerous goods declaration, container/vehicle packing certificate, dangerous goods list or manifest or stowage plan.

In the case of a document such as the above, or of any other document required by a Port Authority, the emitting party shall use the correct technical name of the dangerous goods, class and, if applicable, division, compatibility group, stowage arrangement and schedule number, the UN or BC number, packaging group and quantity. The document may contain some other information required for certain dangerous substances.

The dangerous goods declaration, as revised by the Sub-Committee on the carriage of dangerous goods, at its forty-second session and adopted by the Maritime Safety Committee at its fifty-ninth session as part of the Amendment (Amdt) 26-91 to the IMDG Code, is a standardized form, for easier applicability, as shown in Appendix 5.1.

It ends with a statement saying

> `that the contents of this consignment are fully and accurately described above by the correct technical name(s) (proper shipping name(s)), and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for

transport according to the applicable international and national government regulations.'

(IMDG Code,0036)

In order to encourage the use of this form before the 1st January 1993 - (implementation date for Amdt.26) - the Sub-Committee has agreed that the new form be circulated as a CDG circular.

This statement together with the information about a certain dangerous goods item may also be incorporated or combined with an existing transport or shipping document.

Another document required in accordance with regulation 5 of Chapter VII of the SOLAS, 1974, as amended and with regulation 4 of Annex III of the MARPOL 73/78, is a list or a manifest of dangerous goods on board a ship. Appendix 5.2 shows such a document. It may have different forms, but contains the same information. This list or manifest must be accompanied by a cargoplan. If not, either one must contain, among the information they give, the stowage location of the dangerous goods. In the case of both dangerous and non-dangerous goods being listed on one document, the dangerous goods must be listed first or otherwise emphasized.

If the cargo is a pollutant or radioactive material or waste, the words 'MARINE POLLUTANT' or 'RADIOACTIVE MATERIAL' or 'WASTE' respectively must be written in these documents in the way required in section 9.3 of the IMDG Code. Wastes shall, in addition to the above documentation, be accompanied by a waste movement document from the point of departure to the point of disposal.

In the case of radioactive materials special procedures should be followed in conformity with IAEA regulations and the IMDG Code section 11 of class 7.

A copy of one of these documents shall be handed, before the departure of the ship, to the person or organization designated by the Port State Authority.

For the packaged dangerous goods being packed into a

secondary containment such as containers, vehicles or other units, there is an additional document, required by the Amdt 26-91 to the IMDG Code, which is the container/vehicle certificate or declaration.

The container packing certificate or vehicle packing declaration must be provided and signed by the person responsible for the packing and securing of dangerous goods in a container or vehicle. Such a certificate/declaration certifies that the container/vehicle offered was clean, dry and in apparent good order; that the dangerous goods have been well packed, marked, labelled, packed into container/vehicle, secured and in sound condition; that no incompatible substances have been packed within container/vehicle. The container/vehicle identification number must also be indicated.

The Maritime Safety Committee, which adopted the amendment to regulation VII/5 of SOLAS`74, containing the requirement for a container/vehicle packing certificate/declaration, decided to ask the Governments to review their national legislation taking into account the necessity of a requirement for such certificate /declaration.

The IMO and ILO, in a joint action, have issued the `Guidelines for packing of cargo in Freight Containers´ containing instructions on:

- how a container/vehicle should be inspected;
- stowage, planning, packing and securing the cargo;
- certification;
- marking, labelling and placarding of container/ vehicle;
- measures to be taken to prevent overloading of container/vehicle.

Since the requirement for container/vehicle packing certificate/declaration is not implemented in all countries, it is difficult and often impossible to obtain a container/vehicle packing certificate/declaration. Then,if such a container goes to a port where the State regulations require the strict application of the IMDG Code, there is the risk for the cargo

being refused. From this comes another, more serious, even dangerous situation which is the risk that a container may not be placarded because it was loaded in a place where the certificate could not be obtained. Such containers can remain undetected during transport and may create dangerous situations in the case of an accident or in the case of depositing it in a place where it was not supposed to stay having in view the risk posed by the cargo within it.

To prevent such events where a container/vehicle packing certificate/declaration is not available, the unit should be not accepted for shipment.

It has been seen, in Chapter 2, that the packagings for dangerous goods have, prior to first use and periodically, to be tested. Should packagings successfully pass the test, the competent authority or its approved inspecting agency shall issue certificates which shall be kept by the competent authority and the owner during the time those means of transport are in service. Two types of certificates are shown in Appendix 5.3.

The certificates, permits or approvals issued by the competent authority or by a delegated organization should be recognized by other countries. In view of this, these certificates, permits or approvals shall at least comply with:

- SOLAS '74, as amended;
- MARPOL 73/78;
- the standards of the IMDG Code.

5.4 Checks

Each port has to supervise the dangerous cargo operations through its safety division which will centralize the port administrative procedures and the flow of the information. The safety division must be kept permanently informed about the application of the precautionary measures and shall make spot checks to detect any breach of the mandatory regulations by those who are supposed to strictly observe them in order to prevent any accident. The checks are designed not only for compliance

testing, but also for helping the competent authorities and those concerned in systematic improvement of safety programs. These spot checks will also keep the workers aware of the dangers that could occur from the risks posed by the cargo unless the rules or recommendations are observed.

The safety division shall be empowered to inspect documents, packages, unit loads and cargo transport units relating to both containment and dangerous goods within it. The transport will not be approved until all deficiencies have been rectified. For the implementation to be efficient, regularly spot checks are not only necessary, but shall result in high level fines unless an adequate level of compliance with the legal provisions is ensured in the case of non-observance of the regulations.

It is quite obvious that checks are designed to, eventually, ensure the safety of dangerous goods transportation.

Regarding the ship-port relations, the checking procedures start once the ship is alongside. The cargo operation should not start unless the carrier and port operators are both satisfied with the safety level of the planned operations. The more dangerous the goods are, the more complex the checking procedures will be.

The IMO Recommendations on the Safe Transport, Handling and Storage of Dangerous Substances in Port Areas, adopted by MSC at its forty-third session in December 1980 and amended in June 1983, include the Ship/shore Safety Check List containing checks which shall be carried out by the parties concerned.

The Check List was reviewed by the Sub-Committee on the Carriage of Dangerous Substances at its forty-forth session in July 1992, but it must await the outcome of discussions by an OCIMF/ICS/IAPH working party which is considering a similar check list for inclusion in the International Safety Guide for Oil Tankers and Terminals (ISGOTT). The new drafted Ship/shore Safety Check List as presented in Appendix 5.4 is divided into six groups:

- part A: Bulk liquids - General
- part B: Bulk liquids - Chemicals

- part C: Bulk Liquefied Gases
- part D: Crude Oil Washing (COW)
- part E: Inert Gas
- part F: Vapor collection systems

There is also an additional part relating to whether tank cleaning operations are planned during the ship's stay at the operation berth and, if so, whether the port authority and terminal have been informed.

The checks are carried out by both parties, either separately or jointly, as required. The procedure ends with the following declaration:

> `We have checked, where appropriate jointly, the items on this check list, and have satisfied ourselves that the entries we have made are correct to the best of our knowledge, and arrangements have been made to carry out repetitive checks as necessary.´
>
> (Recommendations... for Port Areas, 61)

CHAPTER 6

DANGEROUS GOODS IN PORT

The port is probably the most important link in the transportation chain of dangerous goods. Firstly, because it is an interface between inland modes, i.e. road, rail and inland waters, on the one side and sea mode on the other. Secondly, because of the concentration of different classes and large quantities of dangerous goods in a relatively small area which has a great impact on the safety of people and the environment.

The safety of a port has not only to deal with national export cargo which can include cargo coming from neighbouring countries by land in order to be shipped via that port, but also with import cargo coming from different parts of the world.

'Safety or unsafety in the port of loading
is exported to the port of discharge.'
(Stender 1992a, 5)

The continuous increase in quantity and variety of shipments of dangerous goods carried by sea has brought consequences for the ports. In the last three decades ports have been subject to radical changes due to technological transport innovation and the construction of necessary extensions in existing grown ports. Such changes are, ro-ro ships, containerization, terminals for solid, liquid and gas bulk.

The impact caused by these changes and the necessity of regulations for the safe transport of dangerous goods has been different for different ports, especially in comparing the ports from developing and developed countries. In the ports of developing countries, where new and formerly unknown problems are encountered, there is a lack of investment and the situation is sometimes very poor. The ports in developed countries have

adapted to these changes, having set up purposeful management backed by the required legislation.

The port is not only a storage place for dangerous goods but the handling place for the transshipment of such goods and

> 'experience has shown transport accidents which find their cause in cargo transported, occur in most cases at the handling stage.'
>
> (Wardelmann 1992d*, 1)

In order to ensure a safe stay and passage of dangerous goods in a port area the port must set up:

1. terminals and warehouses
2. storage and segregation rules
3. an Emergency Response Plan

Besides these, there are other necessary improvements and changes such as modernizing and adapting administrative and cargo operation procedures, training of port workers, supervisors and safety officers and acquisition of special equipment.

Ports in the world must do their best in setting up or improving the safety requirements by following an international standard. The safety problem posed by this type of cargo demands new and innovative thinking if safety requirements are to be met and if the industry wants to face the future successfully. The IMO has come up in 1980 with the Recommendations on the Safe Transport, Handling and Storage of Dangerous Substances in Port Areas, which have developed from the Recommendations on Safe Practice of Dangerous Goods in Ports and Harbours adopted by resolution A.289(VII) in 1973.

The present Recommendations, as we have seen in Chapter 5, are under revision.

Resolution A.435(XI) urges Governments to use the Recommendations in conjunction with their national requirements and any relevant international recommendations in respect of the safe transport, handling and storage of dangerous substances in their port areas.

6.1 Terminals and warehouses for dangerous goods

Being a service centre the port must have adequate facilities to be able to perform the services required in respect to receiving, handling, storage and segregation and delivering of dangerous goods. These services have to be done in such a way that safety should be ensured during the transition of such cargoes through the port areas, and be delivered together with the goods to the consignees or receiving ports.

The port facilities consist of jetties, pipelines, dangerous goods sheds, container stacking areas, warehouses or terminal areas for dry and liquid bulk cargoes, access and transport roads rail links and waterways in port areas. The management of Dangerous Goods in port is covered by the IMO Recommendations on the Safe Transport, Handling and Storage of Dangerous Substances in Port Areas.

`Port area´, for the scope of this work, is the area or areas, within the land and sea area established by legislation, where dangerous cargoes are transported, handled or kept in order to change the mode of transport.

According to the revised, but not yet adopted Recommendations (9) the following aspects shall be taken into account for the building or upgrading of the port facilities:

- Protection of health, property and environment
- Other hazardous installations in vicinity
- Population density in the area under consideration including vulnerability of the population
- Ease of evacuation or other measures which need to be taken in the event of an accident
- Emergency services and procedures available
- Possibility and probability of an

accident occurring and the effect on health, property and environment, depending on the dangerous cargoes to be transported or handled.'

6.1.1 Location

Ideally a warehouse or terminal storing dangerous substances must be located far from areas with dense population and areas liable to flooding and external sources of danger.

This is done by the proper siting of terminals and warehouses, by regular controls and by limiting developments in the vicinity of existing facilities.

Site planning decisions are taken for then long-term. For the purpose of limiting risks, three steps must be taken according to OECD Environment Monographs No.30 (16):

- the identification of those proposed developments which may increase the risk of an accident or of adverse consequences in the event of an accident;
- assessment of the risk;
- determination of the implication of the risk.'

Location must have easy access for transport and emergency services and must be built on enough stable ground to support strong and safe buildings and roadways. A fire involving dangerous goods that can evolve toxic or noxious fumes could cause a risk to people in the nearby locality. Also, the use of excessive fire fighting water in a fire involving toxic substances may cause overflow in harbour waters, thus contamination with environmental implications. The possibility of such consequences has to be taken into account when planning the location and arrangements for the storage of such substances. Adequate services should be provided including: electricity with emergency supply, portable water and fire-fighting water, drainage preventing the risk of dangerous goods reaching and affecting people.

The layout of the warehouses must be designed as to allow

possible separation of incompatible cargoes by the use of separate buildings, fire walls or other acceptable means. It must also permit the safe movement around it and transport of materials, have sufficient space for working conditions and allow clear access from two sides.

Boundaries

The site and the building must be protected against access by unauthorized people including thieves and terrorists by secure fencing, gates and other security measures since many warehouse fires are the result of purpose action. Measures taken will vary widely particularly between isolated warehouses and those forming part of a complex on a site for warehouses.

The wall or fence which surrounds the site has to be in a good state. The fence must be located so as to provide room for spill insulation and the activation of spill reduction procedures. Outside working hours a watchman and/or use of other security aids must be taken into account.

Access

The number of access gates is calculated so as to ensure efficient operation and will be kept to a minimum. From the security point of view the ideal number of gates is one, but provisions for managing emergencies may require more gates which might be necessary for passage of emergency vehicles from different directions.

Within the site each warehouse shall be securely locked when not in use.

6.1.2 Design of warehouse building

The layout of a warehouse should be designed in accordance with the nature of materials to be stored with adequate provision for emergency exits. If necessary, the floor and the volume for storage can be limited by dividing the warehouse into compartments in order to be able to allow the necessary segregation of incompatible dangerous goods.

The construction materials must be non-flammable and the frame of the building must be steel or reinforced concrete. The design of the building must be able to accommodate any necessary equipment such as fire or smoke detectors, sprinklers, roof and wall vents, lifting and handling equipment, wrapping and handling activities and maintenance facilities. The construction of the building must comply with the national standards.

Walls

External walls may be covered with steel or similar materials when these are not intended to provide fire protection against external risk. In cases where such risk exists, the walls must be of solid construction.

Internal division walls must offer a certain fire protection in terms of resistance and prevention of spreading. The best materials for these purposes are concrete and solid bricks.

Doors

The doors in internal walls, and external walls when required, must be fire resistant and fitted with devices ensuring automatic closure in the event of fire.

Emergency exits other than the main doors must be provided, be clearly marked and of such a design that they provide easy exit in case of emergency. Emergency exits must be easy to open even in the dark or in dense smoke. Escape should be possible from any compartment in at least two directions.

Floors

The floor must be of concrete of adequate thickness to withstand the use of handling equipment and impermeable to liquids so as to allow for easy cleaning and to contain leakage or contaminated fire - fighting water.

Bunding

Fire - fighting water as a consequence of a large fire involving toxic chemicals has to be retained to prevent the

contamination of the environment. This is achieved by bunding. All warehouses storing toxic cargoes must be bunded. For warehouses of brick and concrete bunds must be constructed only near and in addition to ramps across external doorways. In case of warehouses of clad construction it is necessary to construct bund around the internal perimeter of the warehouse.

Roof

Roofs must be of a pitched design to keep out the rain water and be designed in such a way as to allow fumes and heat to be vented in the event of fire.

The supporting structure of the roof must be made of non-combustible materials. The roof must be of light weight and friable so as to fail in the event of fire and therefore to provide release of smoke and heat. Where the roof is of solid construction release of smoke and heat must be provided.

Ventilation

As a working place, the warehouses must be well ventilated to provide adequate working condition and to eliminate the smoke, heat or gases.

Adequate ventilation can be achieved using vents placed in the roof or in the wall just below the roof level and vents placed near the floor.

Lighting and electrical equipment

Where warehouses are operated only during day time and natural lighting is adequate there is no need to install artificial lighting. Many warehouses are operated on this basis and this operation minimizes initial costs and maintenance since there is no need to install special electrical equipment. In such circumstances lighting can be improved by inserting transparent panels in the roof.

Where lighting and other facilities are required, all electrical equipment must be installed and maintained by a qualified electrician. Electrical installations for temporary

purposes should be avoided but, if necessary, they must be installed at an appropriate standard by a qualified person.

All electrical equipment must be positioned so as to avoid accidental damage by cargo handling equipment or contact with water. The equipment must be adequately earthed.

Battery equipment must be well ventilated because of the hydrogen produced during charging. Other auxiliary operations such as shrink-wrapping of packaging, welding, etc. are not allowed to take place in the storage area. If it cannot be avoided, special precautions must be taken.

Heating

It is preferable that warehouses are unheated. If heating is necessary to maintain adequate working conditions or to prevent the freezing of stored cargoes, indirect heating such as steam, hot water or warm air is recommended; the heating source must be located outside the storage area. Radiant electrical heating equipment or portable gas or oil fired units must not be used.

Fire Warning Systems

Such systems must be used wherever appropriate. The recommendations of the fire brigade must be followed.

6.1.3 Outdoor Storage

Where dangerous cargoes are stored outdoors, bunding arrangements and a roof or a cover to protect from sun and rain must be provided. This poses a number of problems:

- outdoor storage of dangerous goods in warm climate areas exposes them to high temperature which may lead to thermal degradation including fire. Therefore the outdoor stored cargoes must be carefully selected;
- to avoid soil contamination, the storage area must be surfaced with cement. Asphalt is no good since it becomes soft in hot climates and in contact with certain solvents;

-the bunded area must be equipped with a drain, controlled valve and underground storage tank.

This kind of storage is recommended for highly flammable liquids, gas cylinders or liquid chlorine.

6.1.4 Terminals

For the location of terminals and loading/unloading facilities it is difficult to give generally applicable design parameters since many factors are relevant such as berth siting, proximity of communities, topography etc. For the layout of the terminal some specific design criteria can be applied.

One of the criteria for the location of a refrigerated gas terminal is its safe accessibility for the gas carriers. The location of the terminal shall also be judged with respect to its interaction with the surrounding environment under both normal operating and emergency conditions.

The most important events which influence the design and the layout of a terminal are:

-spill of product
-the release of hydrocarbon vapours
-the impact of the ignition on the above, i.e. fire, subsequent heat radiation and possible shock waves

The terminal should provide a well-lit and clear area along the berth occupied by the ship. The terminal security system must be designed and used to restrict unauthorized people from getting on board the ship.

6.1.5 Warehouse and Terminal Management

The safety of all activities is of utmost importance. Managerial responsibility must be delegated only to adequately trained and qualified persons. The safe performance of warehouse and terminal management shall be periodically monitored by senior managers who are committed to safety.

The handling, movement and storage of goods present certain hazards. Therefore, the necessary information about their properties is required to help those who are in charge of safety.

Knowledge of the packing and labelling of received or despatched goods is required. Racking, stacking and segregation of dangerous goods has to be arranged in accordance with their properties.

Safe procedures for normal work and for abnormal conditions have to be prepared and all employees informed of them. At the same time employees must be thoroughly trained in their practice. Emergency drills must be carried out periodically as a joint exercise with the local emergency services (fire, police, ambulance).

Safe arrangements must be made for periods when no work is performed or nobody is there (nights, weekends, holidays).

Safe working conditions must be introduced to avoid accidents. These include maintenance work, the investigation and reporting of incidents and accidents. Appropriate protective clothing and equipment must be provided together with emergency equipment such as fire extenguishers etc. First-aid boxes and other medical equipment must be available for treating injuries and arrangements must be made for regular and emergency medical assistance.

Good housekeeping must be encouraged to minimize the chances of providing sources of ignition, of blocking access to and for emergency equipment, of falling over unexpected obstacles, etc.

In general, good warehouse and terminal management has to give an example to the employees to follow and provide safe conditions for them to work. In this way, a safe, well-motivated and efficient workforce will be obtained.

6.2 Storage and segregation of dangerous goods in port

These two operations, are so much interlinked that in fact they overlap. The storage and segregation are designed in such a way as to ensure the safety of environment, people and cargo itself. Correct separation will also minimize the requirement to bund and install protected electrical equipment.

In a port, except for ships, the dangerous goods are stored

in warehouses, outdoors and terminals. The question whether open air or warehouse storage is more advantageous has to be answered in connection with various factors like climatic and average weather conditions, types and quantities of dangerous goods normally shipped, available facilities etc. Certain goods require open-air storage (e.g. gases), while others need protection from strong sun rays (e.g. certain plastic packagings). Some explosives require magazine storage and certain dangerous goods need to be kept under controlled temperature conditions. Freight containers, tanks and receptacles should be protected from the weather if extremes of temperature are likely to affect them. The effects of non-compatibility must also be taken into account. Therefore, consideration must be given to the conditions of storage and the provision of safety features such as fire protection and security procedures.

There are many combinations of open, half-open or totally enclosed storage systems in use. Whichever is selected, it must guarantee a high degree of safety and, at the same time, it must also facilitate operational procedures. Some ports of developing countries consider that the storage of dangerous goods in one area is very dangerous because of mixture of substances which might have an explosive effect. These ports prefer to distribute dangerous goods over the port, not randomly, but according to established systems. Others prefer to store all dangerous goods in one area separated by classes according to the recommendations of the IMDG Code.

Developing countries are advised to allocate special areas because they do not have the facilities of the industrialized port and, consequently, cannot implement a safe system. The port personnel are not well trained in this subject and, therefore, the required security may not be achieved.

When dangerous goods are stored in special areas or in warehouses, segregation of different classes has to be taken into account. The segregation adopted by the IMDG Code for stowage on board ship gives useful advice and should be used for this purpose. Converted and adapted requirements for use in port with

suggestions for minimum storage distances are given in Appendix 6.1.

Particular care has to be taken when dangerous goods of class 1 and class 7 are stored in a port. These classes must have totally separated storage areas with special facilities and special supervision. Radioactive materials stored in port should be segregated in accordance with the segregation requirements given in the Annex 3 of the IMO Recommendations and shown in Appendix 6.2. Regarding radioactive materials, storage and segregation must take into account two aspects, i.e. segregation from persons and segregation to prevent criticality.

The first aspect is resolved by keeping the packagings or containers at a certain distance from persons so as the radiation level at all points inside that distance is less than 7.5 Sv/h. Information and guidance on this matter should be sought from national competent authorities or from the recommendation of International Commission on Radiological Protection (ICRP).

The second aspect deals with criticality. This can be prevented by not exceeding the total number of transport indices allowed for packagings or freight containers stacked together or by keeping the radiation level under certain values.

Harbours generally are not suitable for the safe storage of explosives in ships or vehicles. Therefore there is a requirement for the ships or the vehicles to leave the port area as soon as possible after the ship or vehicle has been loaded with explosives. This is not the case where the harbour master has agreed otherwise.

6.2.1 Warehouses

There are relatively few purpose-built warehouses and those which exist are usually under the management control of the supplier.

In most warehouses segregation can be based only on broad general classes of dangerous goods and cannot answer every question regarding safe combination for multi-product storage. On the other hand, trying to take too many details into account,

could work against the practicality of operations.

Some alleviations of segregation procedures might be allowed where only small quantities are involved, but only after consultation of an expert.

Therefore, the recommendations regarding segregation can only be considered as general guidance. The warehouse manager must take into account the probable consequences of storing cargoes having either one or more dangerous characteristics in different situations which imply many variables. The warehouse managers must keep contact with suppliers, ensure that information and documents are properly noted and handled and, when in doubt, must seek expert advice or additional information.

In general, less stringent requirements are sufficient for shore-based operations, since the potential hazard situation is smaller than on board ship.

In cases where ports do not handle large quantities of dangerous goods and there is the intent to store them in a warehouse, but only for a short period of time, it can be seen in Appendix 6.3 that almost all classes can be accommodated within one warehouse.

Related to safe storage and segregation are the following:

- a plan must be drawn showing the location and quantities of the stored dangerous goods with their hazards and location of available emergency and fire-fighting equipment, access and escape routes;
- a clear space must be left between all walls and the nearest packs and between block stacks to access for inspection, free movement of air and fire fighting;
- dangerous goods must be arranged so that forklifts and other handling or emergency equipment are not obstructed. All gangways and truck routes must be clearly marked on the floor;
- stacking heights must not exceed three metres unless racking is provided. As a rule, dangerous goods must not be stacked to a height which could cause damage to the lower tiers.

6.2.2 Outdoors

Outside storage should be considered for highly flammable liquids, and gas cylinders. Of course, other dangerous goods may be stored outdoors too, but in these cases they must be protected against rain water or snow and sun rays.

Segregation requirements are based on the IMDG Code requirements with some alleviations, taking into account the fact that open air offers more safety than a closed space, e.g. warehouses and ships. The above-mentioned requirements apply also in the case of outdoor storage.

The dangerous goods stored outdoors must be carefully checked for leakage so as to avoid contamination of the drainage system. At the same time independent drainage systems must be considered for different incompatible classes.

6.2.3 Container Terminals

Containers Terminals may, also be considered as outdoor storage. The difference is that the container itself provides secondary protection for the cargo stored within it and this is an advantage of the transport of dangerous goods in containers from the safety point of view. Nevertheless, only very few packaging alleviations are permitted in the case of dangerous goods loaded in containers.

On the other hand containerisation has made the shipment of dangerous goods more unknown and subsequently more dangerous since many shippers do not label the containers properly especially when they cannot get a container packing certificate.

As a principle, when a container with dangerous goods arrives in port it is considered as one observing all requirements related to packaging, marking, labeling, stowing and securing of packagings within it, as well as the marking and labelling of the container itself. This, nevertheless, must not prevent the port from carrying out on the spot checks.

The stacking of containers with dangerous goods in the terminal follows different systems from terminal to terminal. Containers may either be stacked in a special yard or distributed

over the whole storage area or a mixed system. In the last case the containers with dangerous goods are distributed every second row, but only at the ends of rows, taking into account the likelihood of damage occurrence of the containers stacked at the corners of the stacking area where the handling equipment, e.g. trailers, has to turn.

Containers with dangerous goods of class 1 and class 2 require separate stacking areas which must be remotely located and well supervised.

There are ports, e.g. public ports, where dangerous goods are not allowed to be stored. In such ports the containers with dangerous goods must arrive at the quay immediately before departure of the ship to have them loaded on board, respectively leave the port immediately after discharging. As a rule, such containers must be the last to be loaded and the first to be discharged. Where, under certain circumstances, it might be necessary to store dangerous goods in containers overnight in the port area, written permission from the Port Authority is necessary. The Port Authority will also decide quantities allowed, location of storage and precautions to be taken.

6.2.4 Road vehicles

Road vehicles carrying dangerous goods which have to wait before being driven into the ship must have a safe parking area assigned by the berth operator or the port authority if the former is not able to do so. Such designated areas should allow for suitable segregation where vehicles carrying incompatible dangerous goods have to be parked in the same area. Such vehicles must be kept away from warehouses, offices and parking areas used by other vehicles.

The driver must remain with the vehicle unless the vehicle is parked in an area designated as a parking area, but he is not permitted to park his vehicle, whether he stays with it or not, where it is dangerous to do so.

6.2.5 Chemical terminals

In most ports the regulations define maximum storage time and quantities allowed up to prohibition of storage.

Sometimes, long-term storage is necessary. This is the case with large quantities of bulk dangerous goods when port chemical industries are concerned. Here, clearly marked distinction must be made within the terminal between waterside and landside ports. Although one port's competence extends only over its side, competencies must be interlocking.

Where smaller quantities of dangerous goods are involved and they do not undergo industrial processing in the port, distinction has to be made between:

- highly dangerous goods, which must not be even temporarily stored within the port; and
- other dangerous goods, which, depending on the extent of the risk they pose, may be allowed to be stored from temporary to a specific period.

6.3 Transfer of dangerous goods within the port

Since the port is an interface, in the transport chain between sea mode on the one side and land, rail and inland water modes on the other, it is the place where the regulations pertaining to those different systems meet. The port is also the place where

> 'accidents statistics show that the majority of accidents involving dangerous goods occur.'
>
> (Dalian Seminar 1985, 8)

Therefore, one very important aspect of the movement of dangerous goods is the transfer of such goods within the port.

Unfortunately there are not many ports in the world where specific regulations are set up with respect to the movement of dangerous goods from one place to another within the port.

Those which have such regulations are mainly private ports. The worst situation appears to be in the ports of developing

countries where there a is lack of appropriate regulations for dangerous goods in general as well as a lack of expertise required to set up such regulations.

As a general approach to the rules-designing process for the movement of dangerous goods within the port, it should be considered that as

> `the dangerous substances may arrive at the port by rail, road or sea, the legislation applying to each mode of transport may therefore apply whilst the dangerous substances are in the port.´
>
> (Alexander 1992, 513)

It is well-known that, as a general rule, the dangerous goods which are the first to be taken care of are those posing the greatest threat. This is the case with explosives and radioactive materials. When these are moved, special measures are taken.

In the case of radioactive materials the IAEA Regulations shall apply. Explosives also require special regulations which are usually set up by the Ministry of Defence. The port authority must maintain a record of the quantity of explosives handled and moved within the port area. When explosives which have deteriorated and, therefore, could increase the hazard, are to be transported, special conditions must be considered and agreed before the transport takes place.

> `Such special conditions should be agreed in writing between the designated port officer and the responsible person having charge of the explosives.´
>
> (IMO 1992, 47)

When dangerous goods are moved, roads for general traffic should be avoided if possible in order to reduce the risk of collision and the consequences.

Before any kind of dangerous goods are moved, the freight containers, portable tanks and vehicles used will be thoroughly inspected regarding their physical conditions, i.e. for damages

affecting their strength and for the presence of any sign of leakage of contents. They must also have the documents and plates required by the International Convention for Safe Containers, 1972 and the IMDG Code.

The vehicles carrying flammable cargoes should have fire-fighting appliances and protective equipment for those accompanying the transport to enable them to protect themselves and fight against fire until the fire-fighting team arrives.

The driver of a vehicle transferring dangerous goods should be provided with the proper means of rapid communication with the emergency services. This will reduce the time between the moment of an accident and an intervention, which might be very important.

Dangerous goods subject to transfer will be inspected for leakage and damage. Special measures must be taken in the case of damaged packages.

Dangerous goods which are going to be loaded on board a ship will be moved in such a way as to arrive at the berth at the time of loading in order not to be exposed to any accident while waiting.

When transferring and handling dangerous goods, weather conditions must be taken into account. Dangerous goods must not be handled in weather conditions which may seriously increase the risk.

A very important aspect when transferring dangerous goods is the training of personnel undertaking such duties. Each person must receive detailed training concerning specific transport and handling requirements for dangerous goods which are applicable to the function that person performs. Training should consist of, i.a., proper use of package handling, emergency response, general dangers presented by the various classes of dangerous goods. Such training must be periodically supplemented with retraining.

6.4 Contingency plan

An emergency resulting from the storage or carriage of

dangerous goods may vary from a minor escape during day-to-day handling to a major disaster such as fire in a warehouse for explosives, escape of flammable gases which can cause an explosion or damage to a tank carrying toxic gas. Incidents may affect vessels underway or alongside, or anchored, shore installations, warehouses, vehicles and packaging handled at the berth.

Bearing in mind the danger posed by dangerous goods, before such goods are handled in the port area, port authorities must prepare an effective emergency plan setting up the measures to be taken in the event of an accident involving dangerous goods. The emergency plan must cover the whole port area and must take into account any local or facility emergency plan already in existence. It is implied that every facility within the port area has to design its own emergency plan in correlation with the port emergency plan.

The plan has to cover any type of emergency concerned with the handling, carrying or storage of dangerous goods. It has to be easy to read and understood and its content must be notified to those responsible for putting it into effect. No matter how perfect a plan is considered, it

> 'does not replace good judgement and experience in an emergency; however, it augments those qualities significantly.'
>
> (US/DOT, 1993, 6.2)

Dangerous goods in port areas are part of a large spectrum of hazardous substances produced, handled and carried within the boundary of a country. Therefore the contingency planning for dangerous goods is part of a national contingency plan. The government is responsible for setting up and implementing the contingency planning legislation. At the same time, the government must appoint a National Emergency Response Committee (NERC) which consists of representatives of national agencies such as environmental, health, transportation, emergency and other relevant agencies.

The NERC, in its turn, will appoint, supervise and

coordinate the Emergency Planning Committees (EPC) at a lower level following the administrative division of the country and will be responsible for taking civil action against facility owners or operators who fail to comply with the requirements in force.

The EPC must include:

- local officials
- law enforcement officials, civil defence workers and fire-fighters
- first-aid, health, hospital, environmental and transportation workers
- representatives of community groups and the news media
- owners and operators of industrial plants, port facilities
- users of dangerous chemicals such as hospitals, farms, business etc.

Since the EPC's members represent the community, they should be familiar with factors which affect public safety, the environment and the economy.

In selecting the members of an EPC that will be responsible for planning, three considerations are most important:

- the members must have the ability, commitment, authority and resources to do the job;
- the EPC must possess or have access to a wide range of expertise relating to the community, its facilities and transportation systems;
- the members must be able to work cooperatively with one another.

The EPC's initial task is to develop an emergency plan. The plan must be reviewed annually, tested and updated. The EPC must have other responsibilities besides developing an emergency response plan such as: receiving reports and notifications from facilities and making this information available to the public upon request. The EPC should have the authority to request additional information from facilities for its own planning purposes or on behalf of others and take civil action against

facilities if they fail to provide the information required.

The EPC can most effectively carry out its responsibilities as a community forum by educating the public about risks and need of response.

The facility must immediately notify the EPC above it of an accident within its jurisdiction. The facility's owner or operator must also name an employee as facility coordinator and that person must participate in the planning process at the next level above .

6.4.1 Planning Process

After the EPC members have been selected, a leader must be chosen. At the same time, the procedures for managing the planning process must be established.

In selecting an EPC leader, five factors are of major importance according to US/EPA (1987, 15):

- the degree of respect held for the person by groups with an interest in dangerous goods;
- availability of time and resources;
- the person's history of working relationships with concerned community agencies and organizations;
- the person's management and communication skills; and
- the person's existing responsibilities related to emergency planning, prevention, and response.'

The EPC must establish the procedures for monitoring and approving the planning tasks.

Once the planning group members and their leader have been chosen, the EPC can begin to plan.

The major tasks for the planning group are:

1. Review of existing plans, which prevents overlapping and inconsistency, provides useful information and ideas and facilitates the coordination with other plans;

2. **Hazards analysis**, which includes hazards identification, vulnerability analysis and risk analysis;

3. **Assessment of preparedness, prevention and response capabilities**, which identify existing prevention measures and response capabilities and judge their sufficiency;

4. **Development of the plan.**

1. Review of Existing Plans

Before starting any other work, EPC has to review all existing emergency plans in order to minimize work by using an existing plan and to ensure proper correlation with other related plans. To be able to identify existing plans it is necessary to consult organizations such as fire department, police department, transport agencies, public health agencies etc.

2. Hazards analysis

Hazard analysis provides the information to set priorities and the necessary documentation to support planning and response efforts.

Hazards analysis consists of three components:

a. Hazard identification

b. Vulnerability analysis

c. Risk analysis

Sometimes it is too difficult, too time consuming and not desirable to develop a complete hazards analysis and examine all hazards, vulnerabilities and risks. Instead of that, EPC may simply identify the nature and location of hazards in the community. Deciding what is really needed and what can be afforded is an important step in the hazards analysis process especially for smaller communities which have less expertise and less resources.

a. Hazards identification

This provides information on the facility and transport situations that have the potential to cause injury to life or damage to property and the environment due to an accident

involving dangerous goods.

The outcome of the hazards identification process indicates

- the types and quantities of dangerous goods located or transported through a community;
- The location of dangerous goods facilities and routes;
- the nature of the hazards posed by dangerous goods.

The committee dealing with the port area must look at storage, handling and transport of dangerous goods within the port area and adjacent communities.

b. Vulnerability analysis

'Vulnerability is defined as the susceptibility of an asset or group of assets to an adverse action or potential action through which the effectiveness of the asset is reduced or eliminated. Vulnerability is a key component in the overall assessment of risk.'

(Stafford 1992,14)

Vulnerability analysis identifies what is susceptible to damage in the event of an accident involving dangerous goods. It provides information on:

- the extent of vulnerable zone and the factors influencing it such as quantity of dangerous goods involved or wind direction;
- the size or types of population (e.g. residents, employees, students etc) which is expected to be in within the vulnerable zone;
- the property (e.g., homes, offices) and support systems (e.g., water, power, etc)that may be damaged;
- the environment that may be affected.

The vulnerability analysis must summarize information about all hazards considered to be major in the hazards identification.

c. Risk analysis

The risk analysis establishes the probability of damage in the community due to an accident involving dangerous goods. The risk analysis provides information on:

- the probability for an accident to occur;
- the type of damage to people, property and environment.

3. Capability assessment

This step is supposed to evaluate preparedness, prevention and response resources and capabilities. The resources involved in an emergency preparedness and response plan are:

a. facility resources
b. transport resources
c. community resources

a. Facility resources analysis shows the level of facility preparedness to respond in the event of an accident occuring. These resources include:

- possibilities for reducing the quantity of dangerous goods stored or handled at the facility;
- studies which have been conducted by the facility to ensure a high standard of safety;
- on-site emergency equipment and trained personnel available to provide on-site initial response;
- emergency medical care on-site;
- emergency contact for the site: person's name, position and 24-hour telephone number;
- employee evacuation plan;
- communication systems to connect the facility with local emergency services and surrounding community;
- auxiliary power systems.

b. Transport resources analysis gives the transport capacity of the transporters in the area and the level of compliance with national regulations regarding safe transport of dangerous goods. To analyze the transport resources, the emergency committee has

to check:

- whether transport shipping papers identify dangerous goods, their physical and chemical characteristics and control techniques;
- whether transport has proper placards;
- whether there are standard operating procedures;
- whether there is an emergency contact person;
- whether and what equipment and cleanup capabilities are available;
- whether the transport has first-aid equipment;
- whether there is a safety training plan for operators;
- whether there is an emergency response equipment inspection plan.

c. **Community resources** analysis identifies the community capability to deal with its share of an accident. This will consist of:

- fire-department;
- police-department;
- emergency medical service;
- public health agency;
- environmental agency;
- public transportation department;
- other local community resources such as schools, communications, public utilities.

Besides the existence of these organizations the community resources analysis identifies the level of preparedness of these organizations in terms of:

- expertise
- communications;
- equipment and materials available;
- emergency response teams;
- training of intervening personnel;
- public awareness;
- emergency transportation network;
- emergency response plan.

4. Developing the emergency response plan

When the emergency committee has reviewed the existing plans, completed a hazards analysis and assessed the preparedness, prevention and response capabilities, it can begin to write an emergency plan if one does not exist, or revise existing plans.

An emergency plan must include at least the following:

a. Identification of facilities covered by the emergency plan, routes to be used for the transport of dangerous goods and other facilities which could contribute to risk due to their proximity to the facility.

This section of the plan is a summary of local conditions which make an emergency plan necessary. Information will be derived from the hazards identification and analysis. This section will also contain maps showing storage facilities, population centres, environmentally sensitive areas, location of response resources and the transport routes;

b. Methods and procedures to be followed by facility owners and operators and local emergency and medical personnel who must respond to an emergency. These can be generally named as response functions and include:

- notification of response agencies
- chain of command and control
- communications systems among responders
- warning systems and emergency public notification
- health and medical services
- resources to be used
- protection of citizens (e.g. evacuation procedures)
- list of task for fire-fighters and rescue personnel
- list of task for law enforcement personnel in control points to help the movement of responders toward the scene and of evacuees away from the scene
- ongoing incident assessment
- others;

c. Designation of a community emergency coordinator and

facility emergency coordinators who are responsible for implementing the plan.

This section lists the organizations and officials responsible for planning and prevention, implementing the plan during the accident, cleaning up and restoration. The role of each organization/official must be clearly described and who is in charge;

d. Procedures for notification by the facility emergency coordinator and the community emergency coordinator of the person or persons designated in the emergency plan and of the public about the accident.

An effective notification necessitates a 24-hour emergency response hotline. Normally, the organization which operates the emergency response hotline will inform other emergency services. At the same time the public must be informed and, if necessary, alerted.

This section must also contain precise information about the alerting signals in case of an emergency and is of utmost importance since the speed of response is crucial;

e. Methods for determining the probability of an incident and the area or population to be affected.

Information necessary in this section is taken from the hazards analysis. The analysis consists of determining where the hazards probably will occur, what places would be affected and, knowing what dangerous goods are involved, what conditions might exist during an emergency. Assumptions are made regarding what would happen in case of an accident involving dangerous goods;

f. A description of emergency equipment in the community and the person responsible for such equipment.

This section includes the list of resources that will be needed and where the equipment and vehicles are located. A distinction must be made between the resources which are already available and what still must be provided.

g. Evacuation plans, including provisions for precautionary evacuation and alternative traffic routes.

Evacuation is probably the most challenging part of a

response to an accident involving dangerous goods. The plan must identify under what circumstances evacuation would be necessary. If schools are located in the risk zone, the plan must specify the place to where students are to be evacuated. Special attention must also be paid to evacuating hospitals.

This section must also contain maps showing the evacuation routes.

h. Training plans, including schedules for training local emergency response and medical personnel.

Training might be theoretical and/or practical so that equipment is used, communication system is tested and simulation exercise involving injured people is included.

i. Methods and schedules for exercising the emergency plan.

Exercises or drills are important in making a plan functional and update. Accidents are simulated and after the plan is tested, it must be revised and retested until the planning group is sure the plan is ready. The public should be involved in simulation or, at least, informed about these exercises.

6.4.2 Continuing planning

An emergency plan must be evaluated and kept up-to-date by reviewing the actual responses, simulation exercises, and by regularly collecting of new data. The emergency plan must reflect any changes in available technology, response capabilities, laws, road configurations, population change, emergency telephone numbers etc.

A functional exercise tests and evaluates the capability of one or more functions. Exercises are most beneficial when they are followed by a meeting of all participants to analyze the strengths and weaknesses of the plan.

An emergency plan must be reviewed after each incident, since every incident is an evaluation of the plan.

Training is another important part of an emergency plan. Everyone occupying a position in a plan must have appropriate training. The training could be a short briefing on specific roles and responsibilities or a seminar on the plan or on

emergency planning and response. Training must be carried out to ensure capability.

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Emergency planning for a full range of possible incidents is not always required. Each community may develop a plan according to its own situation taking into account the size of the community, the level of danger and the level for preparedness; resources are another important factor. Therefore, there is no single right way to write a plan.

From experience we can see that serious accidents can occur in port areas in spite of efforts to prevent them. They can cause loss of life, injuries and damages. Fortunately it is possible to reduce the potential for accidents by effective action at the time. A thorough consideration of implementing measures to reduce the occurrence of an incident could bring success.

As the majority of accidents involving dangerous goods occur in port or in confined waterways and port approaches, implementation of technical measures regarding ships, rail wagons and vehicles access into or movement within the port, is more than necessary. These measures will reduce the occurrence of accidents and will also help a great deal the success of an emergency plan.

As the danger posed by dangerous goods in bulk is greater than in the case of packaged ones, the awareness is high in case of the former and safety requirements relating to are covered by international conventions and national regulations generally observed. Packaged dangerous goods are a few steps behind, a situation that requires more concern and involvement. Safety in port will be partially covered by coming IMO Recommendations on the Safe Transport and Handling of Dangerous Substances in Port Areas and the ILO Code of Practice on Safety and Health in Dock Work.

Contingency planning in port must take into account all

modes of transport which meet there. The best covered is the sea mode. IMO has produced the Emergency Procedures for Ships Carrying Dangerous Goods (EmS) and the Medical First-Aid Guide (MFAG) which, together, deal with any emergency occurring from dangerous goods on board. An EmS Schedule and a MFAG table are shown in Appendix 6.4. SOLAS '74 Convention in article 54 of Chapter II-2 specifies the construction characteristics and equipment required in the case of ships carrying dangerous goods in packaged form. These requirements are shown in Chapter 4 of this work.

The guidelines given by EmS are also applicable to a port if not entirely, at least partially. Since the port is serviced by different emergency orientated organizations the workers have to deal with an emergency in the first minutes only until the emergency services arrive at the site of the accident. No doubt these first minutes are most important especially in the case of fire. If a fire can be contained in the first minutes of its occurrence the consequences would be very much reduced.

The most important equipment which a port must be provided with is the fire-fighting equipment. Among many other devices, one is the international shore connection, required also by the classification societies.

The port must also have a sufficient amount of spillage collection materials such as diatomacious earth and tools for application and collection. Booms to limit the area affected and to contain the spillage are also needed.

For the protection of personnel, self-contained breathing apparatus and protection equipment are necessary.

In order to be able to deal with damaged drums containing liquid dangerous goods the port must have available open-top oversized drums which can be used to accommodate the damaged ones. Handling equipment is also necessary.

An effective emergency plan requires close co-operation between the port authority and the emergency services. These emergency services might have an emergency plan of one kind or another which, fitted within a larger plan, can help.

Writing an emergency plan is not enough. A port might have a sophisticated and detailed written plan but, if the plan has not been recently tested and revised, this port might be less prepared that it thinks it is for a possible accident.

An efficient emergency plan necessitates close co-operation between the Port Authority and the public. Therefore, the Port Authority must inform the public about accidents or even possible accidents. The more the public knows about the hazards in the area, the better prepared it will be to face an accident. In this way safety will be improved. The most efficient way to have the public informed is the existence of a low which requires the industry and others to make available to the public information on potential hazards in their facilities. This can be achieved by developing a public information programme to educate citizens about safety procedures during an accident.

To convey information to the public and to co-operate efficiently with emergency services communication is a very important aspect. Without proper communication systems the plan will not work. Communication systems are analysed in Chapter 7.

Taking into account the amount of information needed and the speed with which an accident can extend, a computerized system is necessary.

From this short analysis it can be seen that to have a well-written emergency plan work, good-will, co-operation and training are needed. Although people are more and more aware of these needs, the law is the best way of achieving a working emergency response plan.

CHAPTER 7

TRAINING AND INFORMATION DISSEMINATION

Carriers of dangerous goods are sometimes confronted with accidents arising from the risks posed by such cargoes.

According to A. Mel Gajraj (1988, 28)

> `an accident is an unforeseen event for which adequate safety measures have not been designed.´

Transport accidents, which are more frequent than those occuring during the storage operations, are much more difficult to prevent and deal with. They sometimes occur faraway from sources of expert knowledge. Changes in transport technologies, together with the fact that there are special terminals built in specific places operated under strict conditions to accommodate ships carrying environmentaly sensitive cargoes, have created a high level of awareness among the personnel involved in this type of activity. All these changes, requiring new attitudes and approaches, have raised problems in many countries especially in developing countries which lack expertise.

7.1 Training

7.1.1 Need for training

The provision of equipment and facilities and awareness of people, no matter how good they are, are not sufficient to prevent or deal with an accident. Therefore, the prevention of accidents and their management in the field of dangerous goods implies another dimension which is training.

Bearing in mind that accidents can cause large-scale disasters sometimes affecting more than one country, training, as part of prevention and response, is of international concern.

The IMO attempts to solve such problems in two ways. Firstly, by adopting international requirements which are to be implemented at the international and national levels. Secondly, by providing practical assistance and advice to countries, particularly developing countries, for the improvement of training programmes.

The IMO through its STCW Convention - regulations V/1, V/2 and V/3 - prescribes mandatory minimum requirements for the training and qualifications of masters, officers and any other crew members having responsibility for loading, discharging and care in transit or the handling of cargo in oil, chemical or liquefied gas tankers.

Resolutions 10, 11 and 12, adopted by the Conference on Training and Certification of Seafarers held in London from 14 June to 7 July 1978 and convened in association with the International Labour Organization (ILO), contain recommendations on training and qualifications of officers and ratings of oil, chemical and liquefied gas tankers.

Another Resolution - 13 - adopted by the same Conference, considering that there is an urgent need for internationally agreed arrangements for the training of officers and ratings of ships carrying dangerous and hazardous cargoes other than in bulk, invites the IMO to study this problem as a matter of urgency.

As a result of these recommendations, in November 1983, the IMO adopted the Resolution A.537(13) which contains recommendations on training of officers and ratings responsible for cargo handling on ships carrying dangerous and hazardous substances in solid form in bulk, and in packaged form.

Actually all organizations dealing with dangerous goods are interested and try to develop training policies for the personnel involved in the manufacturing, handling, storing and transporting of such goods. Since almost all of these organizations have developed its own policy, there is now an international demand for co-ordinated action and, as a result, for standardized modules of instruction covering the subject.

Bearing in mind that each mode of transport has its own regulations which differ from the regulations of the other modes of transport, the training of the personnel does not follow the same pattern. More than that, where two modes of transport are interlinked the personnel involved has to be trained so as to be able to fulfil the requirements of both modes.

The most complex situation probably is in ports where all modes of transport, except air, meet. There might ever be situations where an airport is situated in the vicinity of a port. Employees at all levels, including managers, must receive safety and health orientation training as part of the initial training intended to create safety consciousness and commitment. Warehouse and terminal operators must receive specific training for hazard identification and corrective measures, basic emergency procedures and proper dangerous goods handling procedures. Operators or managers must take all measures to ensure that all workers receive appropriate training under both normal and abnormal conditions.

Training is intended to create the high level of awareness necessary not only to prevent accidents, but also to enable a quick and effective response in the event of an accident. Arrangements have to be made to ensure that training needs at all levels are properly identified and form part of a plan for identification of needs. At the same time records must be kept of training carried out to appropriately satisfy the identified needs.

Employees must be motivated and educated to recognize safety as a top priority. They are more conscientious in their implementation of safety systems and procedures if their training makes it clear why the various systems and procedures are required. The training must also make it clear what they are required to do.

Safety performance and behaviour has to be considered an essential component of every employee's performance and training is essential to allow them to fulfil their job's safety requirements. Therefore, training must be given before

undertaking normal duties and be considered part of the employee's job.

7.1.2 Personnel to be trained

Transport of dangerous goods by sea, as any shipping activity, is dependent on the quality of personnel employed, and the security relies heavily on the human factor. The human factor, including both positive and negative aspects of human behaviour, is applicable to all personnel involved. Therefore, management must take into account the possibility that human error can occur and act in such a way that its effects can be minimized. Hence comes the necessity to train the personnel involved in one way or another, in the transport of dangerous goods. Training must be considered part of the personnel's job.

By and large, personnel can be divided into three groups:

1. Ship's crew members who, according to the resolutions 10, 11, 12 and 13 of the STCW, and IMO resolution A.537(13) must have a certain knowledge in the field of dangerous goods to be able to carry out their duties of transport of such cargoes in a safe manner;

2. Port personnel, which is by far the largest group, consists of:

- dockers
- terminal and warehouse operators
- managers
- drivers for vehicles carrying dangerous goods and those involved in rail wagon movement
- members of emergency response teams
- inspectors

This personnel should be trained according to the IMO Recommendations on the Safe Transport, Handling and Storage of Dangerous Goods in Port Areas presently under revision and the Guiding Principles established by the Environment Committee of the Organization for Economic Co-operation and Development.

3. Personnel involved in packing dangerous goods in containers which should be trained to meet the requirements of the IMO/ILO Guidelines for Packing Cargo in Freight Containers or Vehicles.

The training of personnel involved in the transport of dangerous goods must also be regulated by the national legislation of each country.

Due to the division of work and differences in level of responsibility the training must take into account further subdivision of the personnel which requires the design of different types of courses.

According to Brunings (1992e, 4)

> `grouping of trainees into four different types or levels will make the training organization more practical.´

These `target groups´ should be:

> `- senior managers
> - middle management
> - safety and special - purpose personnel, and
> - dock-workers.´ (6)

7.1.3 Ways of training

As can be seen from the previous paragraph adequate training requires different courses for the different categories of personnel. Apart from this, the way people are trained depends upon the general education level.

The most stringent problems are faced by the developing countries where productivity has priority over safety as a consequence of lack of funds. Besides, these countries have not the necessary expertise to deal with the increasing needs for trained personnel.

In order to help these countries, IMO has founded the World Maritime University (WMU), based in Malmoe, Sweden, one of whose aims is to provide advanced training in the field of safe transport of dangerous, hazardous and harmful cargoes by sea. IMO

at the suggestion of different countries, and assisted by the Norwegian Government, has also designed model courses in the light of the requirements of the STCW and other conventions related to ship safety and the prevention of pollution. These courses can be organized in developed countries as well as in developing ones using expertise from the former if needed.

The International Labour Organization has also helped developing countries by setting up training centres in a number of ports.

Another international organization involved in training is the United Nations' Commission for Transport and Development (UNCTAD), through the TRAINMAR project which has developed training modules. These modules are used by developing countries after being adapted to the local conditions.

The different categories of personnel and conditions in ports posed by the handling of packaged dangerous goods and of bulk dangerous substances, particularly the liquefied gases and liquid petroleum products and petrochemicals, may require theoretical instruction, skills based training at the actual place of work or combination of both as appropriate. Examples of training courses are given in Appendix 7.1. Simulated deviations from the normal situation and the ways to cope with them should be included.

It is important that the training of the supervisors takes place, at least partly, together with workers to ensure understanding of everyone's functions in different situations of emergency.

Since training is essential for workers to fulfil their job requirements safely, it should be given before starting normal duties. Training must be considered part of the personnel's job and repeated regularly.

The most efficient way to train personnel coming from different companies is in groups rather than separately and in groups rather than individually, where appropriate. This is the best way to promote positive and co-operative group behaviour essential in maintaining the safety of the port area.

Trainees should be trained to think, while performing their job, how to carry it out most safely rather than mechanically. Training is more efficient if it makes clear for the trainees what they are required to do and why.

7.1.4 Content of training programmes

Each course is designed in such a way as to meet the requirements posed by the types of cargoes and the category of personnel.

Broadly speaking any course must cover:

- characteristics of the goods
- correct handling, transport and storing procedures
- hazard identification and the necessary corrective measures
- basic emergency procedures

Prior to designing a course, the training needs must be properly identified, then training needs must form part of the programme. The course has to be designed so that the training needs are appropriately satisfied.

Training of the ship personnel should be based on the requirements of the STCW Convention, IMO Resolution A.537(17) and national legislation. What such courses should contain can be seen in Appendix 7.2. The maritime courses reflect the requirements of the IMO international conventions governing ship safety and the prevention of pollution and they are aimed to increase the knowledge and expertise of a ship's personnel.

When it comes to port personnel, this requires a wide range of programmes due to the differences in categories of personnel, levels of knowledge, types of cargoes and local conditions.

A general approach to this matter is shown in Appendix 7.1.

Safety aspects should be part of the initial training given to all new employees to lay the foundation to a commitment to safety.

In addition to the facility - specific training, personnel and in particular the members of the committee should attend training courses on health and safety.

Education and training programmes must be modified to reflect changes in technology, terminal or warehouse layout and procedures.

A very important source of information is the accidents themselves. Accident analysis will provide trainees with valuable knowledge of how to prevent accidents or how to deal with them to reduce the consequences. Therefore, efficient accident reporting and the use of case-studies are very important elements in the updating process of the training programmes. This can be done by storing the details of the accidents in a computer data base facility with free access to those interested.

Trainees must be encouraged to participate at safety workshops or discussions to share their experiences. Companies should share between them experiences related to human errors and training should focus on human errors, particularly the causes and prevention of such errors.

Checking and inspection results are another source of information which should be used in training.

7.1.5 Training personnel

One of the key elements of the training is the trainer. Availability of trainers is a great advantage for a country and, therefore, lack of sufficient expertise might lead to the impossibility of training for a developing country since training abroad is sometimes prohibitive due to lack of funds. The best and most cost effective solution is the training of the trainer and WMU provides a very good opportunity for developing countries.

Training requires different levels of expertise according to the level of the category of personnel which has to be trained. If a programme requires a high quality lecturer with a good reputation and international experience, other programmes may need lecturers with good skills for the practical side of the course.

Since training is a specialized skill, the trainer must be a good communicator to be able not only to present information

to trainees, but to induce and develop safety consciousness and commitment.

The trainer must have the necessary knowledge that in conjunction with other specialists will enable him to develop a satisfactory course. Those involved in such activities can be:

- persons from safety organizations - e.g. fire, police, health, army, etc;
- specialists - e.g. toxicologist, biologist, engineer, etc;
- persons from community organizations.

In order for a programme to be efficient it has to have, apart from the information and structure, a didactic form which will enable the trainer to transmit and the trainees to receive the required knowledge.

Besides the training given to trainees, every employee having a supervisory job, has to instruct those in his team how to carry out their tasks safely. To achieve this, the supervisors must receive training in communication techniques, accident investigation, reporting procedures and leadership.

7.1.6 Conclusions

In order for training to be effective, employees and their representatives need to be involved in its development, testing and subsequent revision. An efficient way to carry out the training needs is on the job training. This may be supplemented by external training, e.g. through unions.

Records must be kept of safety - related courses for employees including managers, supervisors, inspectors. The effectiveness of safety education and training must be regularly assessed to ensure that all employees can carry out their duties in a safe manner.

To see whether the training is efficient, attention must be paid to some form of feedback. This can include direct job observation or more complex methods such as simulation tests.

Safety training should be included in the education systems at both university and undergraduate school to create an adequate

level of awareness among people in general, which will, in the long term, be very efficient in the promotion of safety matters.

7.2 Information dissemination

Port management as well as any management dealing with dangerous substances needs proper and clear information in order to be able to ensure safety at the required standards.

The information that safety management has to deal with can be grouped or classified in different ways. One way is to divide the information into three main streams depending on source and destination.

7.2.1 Inward information

Any mode of transport bringing dangerous goods into a port shall send advance information at least 24 hours before the arrival of the goods in the port area. In the case of radioactive substances the information must be sent 7 days in advance. These periods of time and information required are considered to be necessary in order for the port to be able to deal with such cargoes in a safe manner. This type of information is analyzed in detail in Chapter 5.

The information sent by the modes of transport are required by the port. The ship must keep a strict inventory and location of dangerous substances on board and make the information available to the emergency services if necessary. This information can be found in the cargo list or manifest and cargo plan. Another way to get inward information is the participation of the port in the process of the exchange of information. This information has as sources other ports, terminals or facilities dealing with dangerous substances. This type of information is dealt with in paragraph 7.2.4.

7.2.2 Internal flow of information

The information received by the port for dangerous cargoes must be centralized, through the port administrative procedures

and the internal flow, around the safety department and then distributed to all those concerned and supposed to ensure safe operation within their areas of responsibility.

Operators of warehouses, terminals and facilities must inform workers of the general hazards to which they may be exposed. They must obtain information on the procedures to be used for the safe handling of all substances circulated within their area. The information has to be kept up-to-date and disseminated in such a way that it can be easily understood by employees. Each employee must be aware of the fact that the safety of his colleagues depends on his responsible activity. An efficient working system requires a two-way channel for communication of information between managers or operators and employees.

Safety departments will not only centralize and distribute the information but check if it is applied or observed. It will also, based on the information received, initiate special procedures if it is necessary. The safety department of the port must be permanently kept informed even by those who eventually apply the information at their working site. The internal flow of information is, therefore, a two-way channel.

7.2.3 Outward information

Outward information is by far the largest stream of information flow due to the many destinations it is sent.

In the case of exports, the port has to provide the ship with the information about the dangerous goods which are to be loaded and the consignees in the destination ports.

If the port participates in the process of exchange of information with other ports, it has to share with the others the information it possesses.

The most substantial part of information is that provided to different response organizations (e.g. fire brigade, hospital) and to the public. A port must keep a summary of dangerous substances which are in the port at any time and make it available to the emergency services in the event of a need to

intervene.

A great deal of information must be provided to the community living in the vicinity of a port, terminal or facility presenting a potential danger for it. The public is more and more concerned about the risks posed by dangerous substances and the available possibilities to reduce such risks. Furthermore, in many cases, the public does not trust the decision which does not take into account its view in respect to the most appropriate way for elimination or reduction of the risk. The practice has shown that information means awareness, translated, when necessary, into participation which helps the emergency response operation very much.

The provision of information to the public is a legal requirement in many countries, especially developed ones. For example, the European Community's Council, in the Directive on the Major Accident Hazards from June 1982, states that persons who could be affected by accidents involving hazardous substances should be adequately informed about the possible risks and safety measures. The French law on the Prevention of Major Risks states that citizens have the right to be informed about the hazards they are subject to and the preventive measures. The United Kingdom's regulations establish that persons who may be affected by a hazard must be informed about the risks and measures to be taken in the event of an accident. In the United States the Emergency Planning and Community Right-To-Know Act from 1986 states the right of the public to certain information relating to hazards and to have representatives in emergency planning.

The information which the public is entitled to can be divided into two categories, viz. information provided without, respectively upon request.

The first category includes:

- the name of the substance which could affect the population in case of an accident, class and its principal dangerous characteristics;
- the identification of the terminal, warehouse or facility;

- the way the supplementary information can be obtained;
- details about the warning system;
- how the population must behave;
- the source of information after an accident, e.g. radio.

This information must be provided to the public in a way that makes it easily read and understood, and needs to be repeated periodically.

The second category contains additional information which helps people understand the necessity for guidance to protect human health and environment, etc.

7.2.4 Exchange of information

A very important aspect of safety management is the exchange of information between ports, terminals and facilities in one country and between countries.

Exchange of information helps the competent authority and the public to better assess the risks and to take the appropriate measures for the prevention of the accidents and the limitation of damage. Sharing information avoids the duplication of effort in developing safety technologies and related research. Information can be exchanged on identification of hazardous sites, risks, emergency plans, communication arrangements, equipment available, instruction given to exposed populations, etc.

In the event of an accident with transfrontier effects it will be necessary to transmit information without delay to enable the competent authority in the neighbouring country to take appropriate measures.

When it comes to developing countries, there is often a lack of communication between authorities on both sides of the frontier. In certain cases lack of such communication could lead to diplomatic claims. Therefore, the existence of an information system between countries might, apart from the clear advantage of dealing with accident, promote better relations between them.

The IMO, through MSC/Circ. 559 of 20th June 1991, invites the governments to exchange information on incidents involving dangerous goods and marine pollutants in packaged form on board ships and in port areas, and approves the "Form" for reporting such incidents. This can be seen in Appendix 7.3.

7.2.5 Communication

Effective communication is the key to public awareness and to a successful emergency response and, therefore, it must be clear, credible and consistent. A good communication system ensures the effectiveness of the dissemination of information to all concerned.

Effective communication requires co-ordinated actions of participating parties,such as local officials, workers' representatives, experts, safety services, community representatives and the media. The duties of each party must be established in the communication plan.

To ensure effective communication, the communicator must be carefully selected from among the parties listed above. To this end, necessary knowledge, skills, authority and credibility must be required.

Workers at terminals, warehouses and facilities must play an important role in communicating with the public since they are the most aware and are interested in protecting themselves and their families.

For effective communication with the public, effective internal communication within the port is a prerequisite. Two-way channels for communication between management and workers are essential.

Messages must be clear and provide appropriate and comprehensive information. Care must be taken for the information not to be overwhelming.

Attention must be paid to the timing of any communication and to the updating necessary as well as to the testing and feedback in order to make the corrective adjustments.

CHAPTER 8

NATIONAL REGULATIONS FOR PORT AREAS

8.1 Need for Regulations

The first and most important aim of any Regulations relating to dangerous goods is the safety of life, the environment and the means of transport. As the largest quantities of dangerous goods are carried by sea, this mode of transport is the most threatening to life and the environment. Being carried by ships, these dangerous goods are passing through one or more ports where the sea mode is interfaced with road, rail and inland-water modes of transport. Therefore, the regulations relating to the passage of dangerous goods through ports are of utmost importance. The port, as the connecting link in the transport chain, is in a difficult situation as to which mode regulations it should follow. In spite of all efforts to unify them, there are still considerable differences. Since, by far, the largest quantity of dangerous goods are carried by ships, the port regulations are closer to this mode of transport.

Regulations covering dangerous goods must have three basic goals:

- to limit the frequency and severity of accidents
- to prevent adverse effects from accidents
- to mitigate the consequences of accidents.

A country wanting to regulate the transport of dangerous goods, must take steps to develop or promote suitable legislative, regulatory or administrative measures, in line with internationally agreed standards, to allow these three basic goals to be met. Therefore, it is necessary to have a suitable framework of planning legislation at the government level to set

at least basic standards valid all over the country. This means that there has to be a law. This law, according to Stender(1992a, 3), has to be quite general in order to be valid whatever changes occur, bearing in mind the complicated and time-consuming procedures required for changing the law.

Since the harmonization of legislation relating to the transport of dangerous goods is the hottest issue today, such a law must cover all modes of transport. It is well-known that the change from one mode of transport to the other - an operation always taking place in a port - if accompanied by the change of applicable legislation, is time and money-consuming. Therefore, a common law would be welcome.

The law has to include the definition of dangerous goods and of the transport. These two aspects will make clear, to all those involved, which goods are to be considered dangerous and what the transport covers in the whole operation of the management of dangerous goods.

The law should also include the allocation of competency which will prevent the duplication of work and the existence of too many responsible parties for one operation. These parties might hamper each other.

As there are special situations when the regulation in force cannot apply, the regulatory authority has to grant exemptions. Therefore, the law must give rules for granting exemptions to deal with such occurrences.

During the transport of dangerous goods there are many cases of non-compliance with the regulations. Accidents can occur as a consequence, sometimes with devastating results. To enforce the law in order to prevent accidents, it must provide for the prosecution of offenders.

Since the law only offers the general framework for the intended regulations, it must give power to a Regulatory Authority to set, publish and enforce safety standards for the transport of dangerous goods by different modes of transport.

8.2 Back-up Organizations

The Regulatory Authority, which could either be the ministry or the department of transport, needs advice in the rulemaking process. It can come from a Standing Advisory Committee consisting of members coming from different ministries, departments and organizations involved in the management of dangerous goods, such as:

- Departments of Transport, Environment, Agriculture and Fishery, Defence, Health, etc.;
- Port, Shipping, Insurance, Chemical Companies;
- Different Associations.

The Standing Advisory Committee should consider and advise on dangerous goods problems from the technical and shipping aspects, including precautions required to prevent or limit harmful effects to the environment which may result from incidents at sea. It should also give the Government all possible assistance and support it in the work in IMO and other international organizations as well as in bilateral or multilateral relations with organizations belonging to other Governments.

The Regulatory Authority needs to be supported by a number of other back-up authorities.

One is the **Laboratory** where new substances, before being offered for transport, are tested and classified according to the criteria set up by the UN Committee of Experts. It should also carry out research as to establish other relevant tests and criteria, and identify hazardous characteristics of the goods.

The **Poison Treatment Centre** is another such organization. The results of its work together with those coming from the Laboratory should be used by the Regulatory Authority in establishing threshold limits and lethal doses for poisonous substances.

In order for the regulations to be easily implemented, the Regulatory Authority needs the services of a **Training Centre** which should conduct specialized courses for different categories

of personnel involved in the transport of dangerous goods. This aspect is detailed in Chapter 7.

Since the dangerous goods are carried also in packaged forms, there must be an organization establishing the requirements to be met by the packaging intended to be used in the transport of such substances. A **Packing Test Institute** will test a certain number of each type of packagings according to the state and characteristics of each dangerous substance. The means of transport in packaged forms is described in Chapter 2.

Another authority which plays an important role in the safe transport of dangerous goods is the **Fire Division** that not only fights the fires but also establishes the fire-fighting standards to be met during the movement of such goods. Its role in contingency planning and emergency response is important as well.

The **Water Police** is typical of the organization helping the Regulatory Authority to effectively implement the regulations. This is done by pro-active, i.e. planned, and reacting controls and inspections. The latter is a reactive visit in response to accidents, complaints and other indicators that management is inadequate. The enforcing authority has to seek to ensure a proper balance between the two methods. Where regulations are not applied, sanctions may be used. Apart from the punitive aspect, the control has to find out the weaknesses of the regulations and propose improvements where necessary.

In its work, the Water Police needs to co-operate with the **Port Authority** which itself should establish a **Safety Department**. This department centralizes all information relating to dangerous goods in the port at that moment or coming to it, and takes the necessary steps to insure safe handling, storage or transit of such goods through its area of responsibility. The Port Authority through its Safety Department provides the feedback and information required by the regulatory authority in the writing regulations process.

One of the most important organization in the process of management of dangerous goods is a **National Reporting Centre** provided with a **computerized telecommunication system** that is

capable of receiving, storing and retrieving data concerning all daily shipments of dangerous goods. It is also capable of identifying dangerous goods being transported by any mode of transport and can provide information to facilitate responses to accidents involving the transport of such goods.

In the rule making process, the Regulatory Authority should co-operate with the **National Atomic Energy Agency** and the **Department of Defence** who have control of radioactive materials and explosives respectively.

8.3 Regulatory Authority

The Regulatory Authority must:

- set safety goals or objectives;
- adopt regulations and/or guidelines concerning safety measures and safety standards;
- apply a licensing system;
- exercise supervision and carry out inspections;
- ensure the development, implementation and testing of emergency preparedness plans.

As the international organizations may be important initiators of new national legislation, the Regulatory Authority should participate in the work of such organizations and make efforts in order to try and encourage co-ordination and ensure that different international organizations do not adopt conflicting approaches.

Regulations may be defined in very precise terms by specifying detailed requirements of design, construction and lay-out of warehouses, terminals and facilities, operating procedures and so on. When writing the regulations, the Regulatory Authority should bear in mind the fact that there are local situations better known by the local authority and, therefore, leave it to the management's discretion to determine how these situations can be best dealt with. Nevertheless, the Port Authority should adapt its regulations at the closest possible level to classification and recommendations suggested

by the UN Committee of Experts in the so-called Orange Book.

The Regulatory Authority must take into account that transport in general, and transport of dangerous goods in particular, is not simply a national problem. Dangerous goods are crossing borders and are the concern of other countries whose territories are transited. Therefore, it is necessary to have identical regulations for national and international segments of the transport operation. Nevertheless, certain deviations in the national part are sometimes inevitable.

Port regulations for the transport of dangerous goods are not intended for port safety only, i.e. land,buildings and equipment. They must also protect the people working there, ships and environment, may it be water, land or air. As the scope of the regulations is to make the handling of dangerous goods in the port safe, they have to address all the port users for their respective area of work and responsibility.

8.4 Sources of Information

When writing the regulations, the Regulatory Authority should consider all possible sources of information. These should be the adopted international regulations, national law and existing national and local regulations. There are also numerous international recommendations and guidelines which can be taken into consideration as possible sources of information. One source has already been mentioned - UN Recommendations on the Transport of Dangerous Goods. Another one is the IMO Recommendations on the Safe Transport, Handling and Storage of Dangerous Substances in the Port Areas, presently under revision. The latter is mostly related to port regulations.

Other sources emanating from IMO are:

- Chapter VII of SOLAS 1974 Convention
- IMDG, BC Codes, and
- Annex III to MARPOL 73/74 Convention,

as the ones relating to dangerous goods in packaged forms.

Bearing in mind that the port has to deal with oil, gases,

chemicals in bulk as well as wastes and garbage, the respective codes and annexes to MARPOL 73/74 Convention are other sources of information to be referred to by the Regulatory Authority in developing port regulations.

As IMO Recommendations are dealing with dangerous goods in port areas they can serve as a

> 'standard framework for use in the preparation of port regulations to ensure the safe transport, handling and storage of dangerous goods in port areas.'
>
> (IMO Recommendations, 7)

So, the Recommendations should be adapted to the local or national conditions which will not result in a totally uniform set of regulations. Due to these specific conditions, regulations may not be identical for any two ports.

8.5 Port Regulations for Dangerous Goods

Having the necessary background for writing the Port Regulations, the setting up process can start.

These Regulations are intended for the control of carriage, loading, unloading and storage of dangerous goods in port and port areas. The Regulations can be divided into a number of parts each of which regulates a specific activity.

Part 1 - Interpretation and Application

The regulations of this part should define the meanings of terms used in the Regulations. The key element of this part is the definition of "dangerous goods". In addition to defining the terms used, the regulations of this part make clear to whom or which the Regulations apply.

Part 2 - Entry of Dangerous Goods into Port Areas

This part should identify and regulate the procedures required to be carried out by anybody intending to bring dangerous goods into a port or port areas and should give the Port Authority the powers of prohibition, removal and regulation

relating to dangerous goods.

The Port Authority and berth operators need to know in advance which dangerous goods, and in what quantities, are going to enter the port. The notification is required even if the vessel or any means of transport carrying dangerous goods passes through the port or port areas. There may also be occasions, for instance in an emergency, when the master or the operator of any means of transport is exempted from giving notice.

Although the Port Authority has the powers of prohibition and removal relating to dangerous goods, these powers should be limited to dangerous goods which cause concern, because of their conditions or of their packaging, of creating a risk to health and safety. Entry procedures for dangerous goods coming from sea, land or inland waters are described in Chapter 5.

Part 3 - Marking and Navigation of Vessels

The regulations of this part should specify the marks required to be shown by a vessel or barge carrying dangerous goods into a port. Due to the risk posed by certain substances, vessels carrying such goods should be required to be kept in a mobile state to be ready to be moved in the event of an emergency. Provisions for communications, such as radio communication,should be contained within the port.

Part 4 - Handling of Dangerous Goods

This part should impose duties on every person who handles a dangerous substance in a port or port areas to do so safely and to take all necessary precautions to avoid fire or explosion.

These regulations should also impose duties upon employers and berth operators to ensure that persons handling dangerous goods are properly trained.

This part should contain provisions relating, for example, to:

- the handling of packaged dangerous goods
- the use of tools and equipment
- the railways in port areas

- the weather precautions
- the prohibited areas
- the repair work

Part 5 - Liquid Dangerous Substances in Bulk

This part should impose duties relating to the carriage, loading and unloading of dangerous goods in bulk. They should require that the vessels used for this purpose are suitable and that suitable precautions are taken. They should also identify the operations which are prohibited without prior permission from the Port Authority or berth operator.

Part 6 - Packaging and Labelling

This part should contain general requirements designed to ensure the adequacy of packaging used for dangerous goods. One way of complying with the requirements of this part is to use packaging which complies with the standards prescribed in the Recommendations of the UN Committee of Experts on the Transport of Dangerous Goods or in Annex I of the IMDG Code.

In the case of radioactive materials the packagingss should satisfy the packaging requirements contained in the IAEA Regulations for the Safe Transport of Radioactive Materials.

The requirements relating to labelling could be met by using the labelling system prescribed by the IMDG Code.

Part 7 - Storage and Segregation of Dangerous Goods

The regulations of this part should regulate the storage and segregation of:

- dangerous goods in packaged forms
- solid dangerous goods in bulk
- liquid dangerous goods in bulk
- liquefied gases in bulk.

While on board ship the regulations regarding segregation are very clear, ashore there are different philosophies and opinions. Those writing the regulations must always give priority to safety. Storage and segregation are analyzed in Chapter 6.

Part 8 - Explosives

This part should impose requirements relating to the security of explosives as this is of extreme importance. The regulations should also contain requirements for safety precautions and for the keeping of records. This regulation should state the need for a licence in order to bring explosives into the port areas. The regulations should also identify the authority issuing such a licence. .

Part 9 - Radioactive Materials

These substances should also need a licence for entry into the port areas. The regulations should state the compliance with the requirements of the IAEA Regulations.

Part 10 - Emergency Procedures and Accident Reporting

This part should require the Port Authority which handles dangerous goods in its areas to prepare an emergency plan for dealing with those dangerous goods before such goods enter the port. There must also be a provision as to the need for keeping the plan up-to-date.

These regulations should also require the carrier and the berth operator to report any accident and untoward incident.

Requirements for rapid communications are to be contained in this part too.

These matters are detailed in Chapters 6 and 7.

Part 11 - Miscellaneous and General

This part should contain regulations to empower the Port Authority to make bylaws relating to dangerous goods, but such bylaws must not duplicate or conflict with these Regulations. In other words such bylaws must at least maintain the original level of safety.

This part should also identify the enforcing authorities stating clearly the area of responsibility for each one.

The regulations of this part should provide for a defence in the case of contraventions of certain of the Regulations and

for exemption to be granted where appropriate. There should also be provisions for repeals, revocations and modifications.

* *
*

All appropriate parts of these Regulations should contain the detailed obligations of those involved in the management of dangerous goods in port areas, i.e. masters and other carriers, employers, berth, terminal and warehouse operators, and the Port Authority.

Port Regulations for dangerous goods should also contain the Ship/Shore Safety Check List of the IMO Recommendations on the Safe Transport, Handling and Storage of Dangerous Substances in Port Areas, shown in Appendix 5.4.

New Port Regulations for dangerous goods need to be discussed with all port users and port related bodies. Port Regulations must satisfy the safety requirements of port, carrier, may it be ship, vehicle or rail wagon, labour and environment. After finalization and implementation a period of grace should be allowed before measures are taken against offenders. Close co-operation is necessary between the Port Authority and the enforcing bodies. Enforcement ensures compliance. Efficient and effective enforcement of the Regulations is important for two main reasons. First, experience shows that there will always be people or companies creating unacceptable risks for the environment or their employees for reasons of profit or expediency. Secondly, enforcement is important for supporting those who make efforts to get things right. Everybody must know that those who fail to do so will be heavily penalized for their failure.

CONCLUSIONS

The dangers inherent in the carriage of dangerous goods have grown with the passage of time and the development of new technologies. An ever-increasing number of dangerous goods are moved across the world at the present time. For many of these goods, the ship provides the most feasible mode of transport. The maritime industry has an international character and the maritime trade cannot be conducted within the strict confines of any given state or in isolation. Therefore, the entire world community is involved, if not because of the transport itself, at least because of the impact dangerous goods have on day-to-day life.

The accidents caused by dangerous goods are of great concern due to the disastrous consequences that sometimes happen. As a result, the world community, through different national and international organizations, is continuously working on regulating the transport of dangerous goods in order to reduce the number of accidents, to prevent the adverse effects and to mitigate the consequences of an accident that could not be prevented. Therefore, the result of the community's efforts is the "REGULATIONS" which have to cover all facets of the process of transport of dangerous goods.

"Regulations" must be APPLIED!

When a dangerous substance is offered for transport it has, first, to be identified as a dangerous substance. "Regulations" have taken care of this problem. They offer the user the IMDG Code with the alphabetical and numerical indexes.

Once a substance has been identified as dangerous, it has to be enclosed within packagings complying with the requirements of the "Regulations".

The packaging containing the dangerous substance must be

marked and labelled according to the "Regulations".

The substance cannot be transported if it is not accompanied by the documents required by the "Regulations".

The packaging must be stored and segregated from packagings containing other dangerous substances by following the rules prescribed by the "Regulations".

Once ready for shipment, the means of transport, be it ship, vehicle or rail wagon, must be built and equipped according to the requirements of the "Regulations".

The handling, stowage and segregation aboard the means of transport must be carried out in a manner prescribed by the "Regulations".

"Regulations" provide the environment for SAFE transport.

Unequivocally, safe transport is good business. While the costs of safety cannot be clearly separated from the total cost of running a transport business, it is agreed that the potential costs due to accidents are significantly higher than the cost of making an operation safe.

In spite of all the precautions taken, accidents may occur. The fact that accidents do occur does not necessarily mean failure. Efforts must be made to learn from accidents.

It should be realized that any transport activity is dependent on the quality of personnel employed and that accidents, with a potential for undesirable effects, rely heavily on the human factor.

Therefore, employees at all levels, including managers, must be educated to recognize safety as a top priority; be trained to know and apply the "Regulations" and to understand the lessons to be learned from accidents.

Since accidents may affect population, it is necessary that people understand the risks posed by potentially dangerous activities and be prepared to deal with emergency situations. Experience has shown that community awareness is of great help in preventing and fighting an accident. People become aware through proper information and communication which should be a shared responsibility between those running a potentially

dangerous activity and the public authorities.

Training, information and communication become reality through law. Once there is reality, life is safer.

Law means "Regulations". Even if, at present, the "Regulations" applied by different modes of transport lack uniformity, they mean SAFETY.

HARMONIZATION will make the transport of dangerous goods even SAFER.

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5.7 The following types and codes of packaging are assigned:

Type	Material	Category	Code	Paragraph
1. Drums	A. Steel	non-removable head	1A1	7.1
		removable head	1A2	
	B. Aluminium	non-removable head	1B1	7.2
		removable head	1B2	
	D. Plywood		1D	7.4
	G. Fibre		1G	7.6
	H. Plastics	non-removable head	1H1	7.7
		removable head	1H2	
2. Barrels	C. Wooden	bung type	2C1	7.5
		slack type (removable head)	2C2	
3. Jerricans	A. Steel	non-removable head	3A1	7.3
		removable head	3A2	
	H. Plastics	non-removable head	3H1	7.7
		removable head	3H2	
4. Boxes	A. Steel	–	4A1	7.13
		with liner	4A2	
	B. Aluminium	–	4B1	7.13
		with liner	4B2	
	C. Natural wood	ordinary	4C1	7.8
		with sift-proof walls	4C2	
	D. Plywood	–	4D	7.9
	F. Reconstituted wood	–	4F	7.10
	G. Fibreboard	–	4G	7.11
	H. Plastics	expanded	4H1	7.12
		solid	4H2	

Type	Material	Category	Code	Paragraph
5. Bags	H. Woven plastics	without inner lining or coating	5H1	
		sift-proof	5H2	7.15
		water resistant	5H3	
	H. Plastics film	-	5H4	7.16
	L. Textile	without inner lining or coating	5L1	7.14
		sift-proof	5L2	7.14
		water resistant	5L3	
	M. Paper	multiwall	5M1	7.17
		multiwall, water resistant	5M2	
6. Composite packagings	H. Plastics receptacle	in steel drum	6HA1	7.18
		in steel crate or box	6HA2	7.18
		in aluminium drum	6HB1	7.18
		in aluminium crate or box	6HB2	7.18
		in wooden box	6HC	7.18
		in plywood drum	6HD1	7.18
		in plywood box	6HD2	7.18
		in fibre drum	6HG1	7.18
		in fibreboard box	6HG2	7.18
		in plastics drum	6HH1	7.18
		in solid plastics box	6HH2	7.18
	P. Glass, porcelain or stoneware receptacle	in steel drum	6PA1	7.19
		in steel crate or box	6PA2	7.19
		in aluminium drum	6PB1	7.19
	(continued on next page)	in aluminium crate or box	6PB2	7.19

Type	Material	Category	Code	Paragraph
6. Composite packagings *(continued)*	P. Glass, porcelain or stoneware receptacle *(continued)*	in wooden box	6PC	7.19
		in plywood drum	6PD1	7.19
		in wickerwork hamper	6PD2	7.19
		in fibredrum	6PG1	7.19
		in fibreboard box	6PG2	7.19
		in expanded plastics packaging	6PH1	7.19
		in solid plastics packaging	6PH2	7.19

6. MARKING

6.1 Introductory notes

6.1.1 The marking indicates that the packaging which bears it corresponds to a successfully tested design type and that it complies with the provisions of this Annex which are related to the manufacture, but not to the use, of the packaging. In itself, therefore, the mark does not necessarily confirm that the packaging may be used for any substance. The type of packaging (e.g. steel drum), its maximum capacity or mass, and any special requirements are specified for each substance or article elsewhere in this Code.

6.1.2 The marking is intended to be of assistance to packaging manufacturers, reconditioners, packaging users, carriers and regulatory authorities. In relation to the use of a new packaging, the original marking is a means for its manufacturer to identify the type and to indicate those performance test requirements that have been met.

6.1.3 The marking does not always provide full details of the test levels, etc. and these may need to be taken further into account, e.g. by reference to a test certificate, test reports or register of successfully tested packagings. For example, a packaging having an X or Y marking may be used for substances to which a packaging group having a lesser degree of danger has been assigned, with the relevant maximum permissible value of the relative density* determined by taking into account the factor 1.5 or 2.25 indicated in the packaging test requirements in section 8 as appropriate, i.e. group I packaging tested for products of relative density 1.2 could be used as a group II packaging for products of relative density 1.8 or group III packaging of relative density 2.7, provided, of course, that all the performance criteria can still be met with the higher relative density product.

* Relative density (d) is considered to be synonymous with specific gravity (SG) and will be used throughout this text.

6.2 Each packaging should bear markings which are durable, legible and of such a size relative to the packaging as to be readily visible and to show:

(a) The United Nations packaging symbol

This must not be used for any purpose other than certifying that a packaging complies with the relevant requirements of this Annex. For embossed metal packagings the capital letters "UN" may be applied as the symbol.

(b) The code number designating the type of packaging according to section 5.

(c) A code in two parts:

(i) a letter designating the packaging group or groups for which the design type has been successfully tested:

X for packaging groups I, II and III

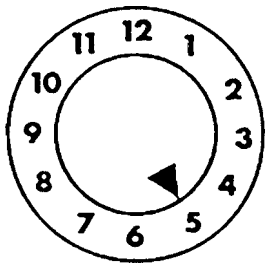
Y for packaging groups II and III

Z for packaging group III only;

(ii) the relative density, rounded off to the first decimal, for which the design type has been tested for packagings, without inner packagings, intended to contain liquids; this may be omitted when the relative density does not exceed 1.2. For packagings intended to contain solids or inner packagings, the maximum gross mass in kg.

(d) Either a letter "S" denoting that the packaging is intended for the transport of solids or inner packagings, or where a hydraulic pressure test has been successfully passed, the test pressure in kPa rounded off to the nearest 10 kPa.

(e) The last two digits of the year during which the packaging was manufactured. Packagings of types 1H and 3H should also be appropriately marked with the month of manufacture; this may be marked on the packaging in a different place from the remainder of the marking. An appropriate method is:



(f) The State authorizing the allocation of the mark, indicated by the distinguishing sign for motor vehicles in international traffic.

(g) The name of the manufacturer or other identification of the packaging specified by the competent authority.

6.3 Every reusable packaging liable to undergo a reconditioning process which might obliterate the packaging markings should bear the marks indicated in 6.2(a) to (e), in a permanent form (e.g. embossed) able to withstand the reconditioning process.

6.4 Marking should be applied in the sequence of the subparagraphs in 6.2, for example see 6.7. Any additional markings authorized by a competent authority must still enable the parts of the mark to be correctly identified with reference to 6.2.

6.5 After reconditioning a packaging, the reconditioner should apply to it, in sequence, a durable marking showing:

(h) The State in which the reconditioning was carried out indicated by the distinguishing sign for motor vehicles in international traffic.

(i) The name or authorized symbol of the reconditioner.

(j) The year of reconditioning; the letter "R"; and for every packaging successfully passing the leakproofness test in 3.12, the additional letter "L".

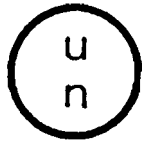
6.6 The marking referred in 6.5 should be applied near the marking referred to in 6.2, and may replace that of 6.2(f) and (g) or be in addition to that marking.

6.7 Examples of markings for NEW packagings:

(un)	4G/Y145/S/83	as in 6.2 (a), (b), (c), (d) and (e)	For a new fibreboard box
	NL/VL823	as in 6.2 (f) and (g)	
(un)	1A1/Y1.4/160/83	as in 6.2 (a), (b), (c), (d) and (e)	For a new steel drum to contain liquids
	NL/VL824	as in 6.2 (f) and (g)	
(un)	1A2/Y150/S/83	as in 6.2 (a), (b), (c), (d) and (e)	For a new steel drum to contain solids, or inner packagings
	NL/VL825	as in 6.2 (f) and (g)	
(un)	4HW/Y136/S/83	as in 6.2(a), (b), (c), (d) and (e)	For a new plastics box of equivalent specifications
	NL/VL826	as in 6.2 (f) and (g)	

6.8 Examples of markings for RECONDITIONED packagings:

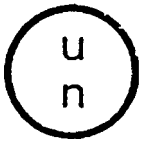
(un)	1A1/Y1.4/160/83	as in 6.2 (a), (b), (c), (d) and (e)
	NL/RB/85 RL	as in 6.5 (h), (i) and (j)



1A1/Y1.4/160/83 as in 6.2 (a), (b), (c), (d) and (e)

NL/VL824 as in 6.2 (f) and (g)

NL/BB/85 RL as in 6.5 (h), (i) and (j)



1A2/Y150/S/83 as in 6.2 (a),)b), (c), (d) and (e)

USA/RB/85 R as in 6.5 (h), (i) and (j)

Note: The markings, for which examples are given in 6.7 and 6.8, may be applied in a single line or in multiple lines provided the correct sequence is respected.

CERTIFICATE OF PACKAGING PERFORMANCE

Issued on behalf of the Department of Transport,
Civil Aviation Authority and the Health and Safety Executive by
The Research Association for the Paper and Board, Printing and Packaging Industries (Pira)

THE DEPARTMENT OF TRANSPORT

Randalls Road, Leatherhead, Surrey KT22 7RU England.
Telephone (0372) 376161. Telex 929810. Fax (0372) 377526
Registered Number: 252163 England Limited Liability

Certificate Serial number: 0259

References: QA/UN/P ira/147
Issue: 02
Test Station: 0991

Issue date: 6 March 1990

Issued to: Super Canco Ltd
Canco House
Knightsbridge Road
London
S.W.1

SPECIMEN

UN packaging type code: 1A1

Description of packaging: 210 L, 1.2/1.2 mm thick non-removable head steel drum with one 2" and one 3/4" Tri-sure closure in the head and one 2" closure in the body.
Closure torque : 2" with rubber gasket 30 Nm /3/4" rubber gasket 10 Nm
2" wth plastics gasket 40 Nm /3/4" plastics gasket 15 Nm

It is certified that samples of the design type described above has been tested in accordance with the provisions of the United Nations Recommendations on the Transport of Dangerous Goods, Chapter 9 and successfully met the criteria described in paragraphs 9.7.3 to 9.7.6 at the following test levels:

Test		Intensity
Drop to paragraph	9.7.3	1.2 m
Air leakage to paragraph	9.7.4	30 kPa
Hydraulic pressure to paragraph	9.7.5	200 kPa
Stack to paragraph	9.7.6	3 m @ r.d. 1.9

Packagings of the sample specifications may bear the marking:

u
n

1A1/Y/200/*
GB/0259

* To be replaced by year of manufacture

Signed

R M Castle, Chief Officer (Dangerous Goods)

GENERAL INTRODUCTION

5. CLASSIFICATION

Regulation 2 of part A of chapter VII of the International Convention for the Safety of Life at Sea, 1974, as amended, sets out the various classes of dangerous goods. For the purposes of this Code, however, it has been found necessary to subdivide a number of these classes and to define and describe in greater detail the characteristics and properties of the substances, materials and articles which would fall within each class or division. Moreover, in accordance with the criteria for the selection of marine pollutants for the purposes of Annex III of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), a number of dangerous substances in the various classes have also been identified as substances harmful to the marine environment (MARINE POLLUTANTS).

5.1 Class definitions

5.1.1 *Class 1 - Explosives*

5.1.1.1 Class 1 comprises:

.1 explosive substances,* except those which are too dangerous to transport or those where the predominant hazard is one appropriate to another class;

.2 explosive articles, except devices containing explosive substances in such quantity or of such a character that their inadvertent or accidental ignition or initiation during transport shall not cause any effect external to the device either by projection, fire, smoke, heat or loud noise; and

.3 substances and articles not mentioned under .1 and .2 which are manufactured with a view to producing a practical, explosive or pyrotechnic effect.

5.1.1.2 Transport of explosive substances which are unduly sensitive, or so reactive as to be subject to spontaneous reaction, is prohibited.

5.1.1.3 For the purposes of this Code the following definitions apply:

.1 An explosive substance is a solid or liquid substance (or a mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not evolve gases.

.2 A pyrotechnic substance is a substance or a mixture of substances designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative self-sustaining exothermic chemical reactions.

.3 An explosive article is an article containing one or more explosive substances.

.4 A mass explosion is one which affects almost the entire load virtually instantaneously.

5.1.1.4 Class 1 is unique in that the type of packaging frequently has a decisive effect on the hazard and therefore on the assignment to a particular division. Where multiple hazard classifications have been

* A substance which is not itself an explosive but which can form an explosive atmosphere of gas, vapour or dust is not included in class 1.

assigned, they are listed in the individual schedule. The correct hazard division is determined in accordance with the latest version of the United Nations Recommendation on Transport of Dangerous Goods, Tests and Criteria (Test Manual).

5.1.1.5 The five hazard divisions of class 1 are:

Division 1.1 *Substances and articles which have a mass explosion hazard*

Division 1.2 *Substances and articles which have a projection hazard but not a mass explosion hazard*

Division 1.3 *Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard*

This division comprises substances and articles:

.1 which give rise to considerable radiant heat; or

.2 which burn one after another, producing minor blast or projection effects or both.

Division 1.4 *Substances and articles which present no significant hazard*

This division comprises substances and articles which present only a small hazard in the event of ignition or initiation during transport. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

NOTE: Substances and articles in this division so packaged or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder fire-fighting or other emergency response efforts in the immediate vicinity of the package, are in compatibility group S.

Division 1.5 *Very insensitive substances which have a mass explosion hazard*

This division comprises substances which have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

NOTE: The probability of transition from burning to detonation is greater when large quantities are carried in a ship. As a consequence, the stowage requirements for explosive substances in division 1.1 and for those in division 1.5 are identical.

1.2 *Class 2 — Gases: compressed, liquefied or dissolved under pressure*

Because of the difficulty in reconciling the various main systems of regulation, definitions in this class are of a general nature to cover all such systems. Moreover, since it has not been found possible to reconcile two main systems of regulation in respect of the differentiation between a liquefied gas exerting a low pressure at a certain temperature and a flammable liquid, this criterion has been omitted; both methods of differentiation are recognized.

GENERAL INTRODUCTION

This class comprises:

.1 *Permanent gases*
Gases which cannot be liquefied at ambient temperatures;

.2 *Liquefied gases*
Gases which can become liquid under pressure at ambient temperatures;

.3 *Dissolved gases*
Gases dissolved under pressure in a solvent, which may be absorbed in a porous material;

.4 *Deeply refrigerated permanent gases* — e.g. liquid air, oxygen, etc.

In the cases .1, .2 and .3 above, the gases are normally under pressure.

For stowage and segregation purposes class 2 is subdivided further, namely:

Class 2.1 — Flammable gases*

Class 2.2 — Non-flammable gases

Class 2.3 — Poisonous gases

5.1.3 *Class 3 — Flammable* liquids*

These are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (e.g. paints, varnishes, lacquers, etc., but not including substances which, on account of their other dangerous characteristics, have been included in other classes) which give off a flammable vapour at or below 61°C (141°F) closed cup test (corresponding to 65.6°C (150°F) open cup test).

In this Code, class 3 is subdivided further, namely:

Class 3.1. Low flashpoint group of liquids having a flashpoint below −18°C (0°F), closed cup test;

Class 3.2. Intermediate flashpoint group of liquids having a flashpoint of −18°C (0°F) up to but not including 23°C (73°F), closed cup test;

Class 3.3. High flashpoint group of liquids having a flashpoint of 23°C (73°F) up to, and including, 61°C (141°F), closed cup test.

Substances which have a flashpoint above 61°C (141°F), closed cup test, are not considered to be dangerous by virtue of their fire hazard. Where the flashpoint is indicated for a volatile liquid it may be followed by the symbol "c.c", representing determination by a closed cup test, or by the symbol "o.c.", representing an open cup test. A reference to these tests is given in section 6 of this General Introduction.

* "Inflammable" has the same meaning as "flammable".

GENERAL INTRODUCTION

5.1.4 *Class 4 — Flammable solids*
Substances liable to spontaneous combustion
Substances which, in contact with water, emit flammable gases

In this Code, class 4 deals with substances other than those classed as explosives, which, under conditions of transport, are readily combustible, or may contribute to a fire or cause one. Class 4 is subdivided further, namely:

Class 4.1. Flammable solids. The substances in this class are solids possessing the properties of being easily ignited by external sources, such as sparks and flames, and of being readily combustible, or of being liable to contribute to a fire or cause one through friction. This class also covers substances which are self-reactive, i.e. liable to undergo at normal or elevated temperatures a strong exothermic decomposition caused by excessively high transport temperatures or by contamination.

Class 4.2. Substances liable to spontaneous combustion. The substances in this class are either solids or liquids possessing the common property of being liable spontaneously to heat and to ignite.

Class 4.3. Substances which, in contact with water, emit flammable gases. The substances in this class are either solids or liquids possessing the common property, when in contact with water, of evolving flammable gases. In some cases these gases are liable to spontaneous ignition.

.1.5 *Class 5 — Oxidizing substances (agents) and organic peroxides*

In this Code, class 5 deals with oxidizing substances (agents) and organic peroxides. Class 5 is subdivided further, namely:

Class 5.1. Oxidizing substances (agents). These are substances which, although in themselves not necessarily combustible, may, either by yielding oxygen or by similar processes, increase the risk and intensity of fire in other materials with which they come into contact.

Class 5.2. Organic peroxides. Organic substances which contain the bivalent -O-O- structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. Organic peroxides are thermally unstable substances, which may undergo exothermic self-accelerating decomposition. In addition, they may have one or more of the following properties:
be liable to explosive decomposition;
burn rapidly;
be sensitive to impact or friction;
react dangerously with other substances;
cause damage to the eyes.

1.6 *Class 6 — Poisonous (toxic)* and infectious substances*

In this Code, class 6 is subdivided further, namely:

Class 6.1. Poisonous (toxic) substances.* These are substances liable either to cause death or serious injury or to harm human health if swallowed or inhaled, or by skin contact.

---

* "Toxic" has the same meaning as "poisonous".

Class 6.2. Infectious substances. These are substances containing viable micro-organisms or their toxins which are known, or suspected, to cause disease in animals or humans. *Note:* "Biological products" and "diagnostic specimens" are not considered to be dangerous goods provided they do not contain, or are reasonably believed not to contain, an infectious substance, and do not contain other dangerous goods.

5.1.7 *Class 7 — Radioactive materials*

In this Code, class 7 comprises materials which spontaneously emit a significant radiation and of which the specific activity is greater than 70 kBq/kg (2nCi/g).

5.1.8 *Class 8 - Corrosives*

In this Code, class 8 comprises substances which are solids or liquids possessing, in their original state, the common property of being able more or less severely to damage living tissue. The escape of such a substance from its packaging may also cause damage to other cargo or to the ship.

5.1.9 *Class 9 - Miscellaneous dangerous substances and articles*

In this Code class 9 comprises:

.1 substances and articles not covered by other classes which experience has shown, or may show, to be of such a dangerous character that the provisions of part A of chapter VII of the International Convention for the Safety of Life at Sea, 1974, as amended, should apply; and

.2 substances not subject to the provisions of part A of chapter VII of the aforementionned Convention, but to which the regulations of Annex III of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), apply.

5.1.10 *Non-classified materials*

A list of materials hazardous only in bulk (MHB) is included in section 24 of this General Introduction.

5.2 **Classification of substances, mixtures and solutions with multiple hazards**

5.2.1 The table of precedence of hazard characteristics in 5.2.7 should be used as a guide in determining the class of a substance, mixture or solution having more than one hazard, when it is not specifically listed by name in this Code. For substances, mixtures or solutions having multiple hazards which are not specifically listed by name, the most stringent packaging group denoted to the respective hazard of the goods takes precedence over other packaging groups, irrespective of the precedence of hazard table in 5.2.7.

5.2.2 The precedence of hazard table indicates which of the hazards should be regarded as the primary hazard. The class which appears at the intersection of the horizontal line and the vertical column is the primary hazard and the remaining class is the subsidiary hazard. The packaging groups for each of the hazards associated with the substance, mixture or solution should be determined by reference to the appropriate criteria. The most stringent of the groups so indicated should then become the packaging group of the substance, mixture or solution.

5.2.3 The proper shipping name (see subsection 7.1 of this General Introduction) of a substance, mixture or solution when classified in accordance with 5.2.1 and 5.2.2 should be the most appropriate N.O.S. (not otherwise specified) entry in this Code for the class shown as the primary hazard.

5.2.7 Precedence of hazard table

Class and packaging group	4.2	4.3	6.1,I Dermal	6.1,I Oral	6.1 II	6.1 III	8,I Liquid	8,I Solid	8,II Liquid	8,II Solid	8,III Liquid	8,III Solid
3 I			3	3	3	3	3	-	3	-	3	-
3 II			3	3	3	3	8	-	3	-	3	-
3 III			6.1	6.1	6.1	3*	8	-	8	-	3	-
4.1 II**	4.2	4.3	6.1	6.1	4.1	4.1	-	8	-	4.1	-	4.1
4.1 III**	4.2	4.3	6.1	6.1	6.1	4.1	-	8	-	8	-	4.1
4.2 II		4.3	6.1	6.1	4.2	4.2	-	8	-	4.2	-	4.2
4.2 III		4.3	6.1	6.1	6.1	4.2	-	8	-	8	-	4.2
4.3 I			6.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.3 II			6.1	4.3	4.3	4.3	8	8	4.3	4.3	4.3	4.3
4.3 III			6.1	6.1	6.1	4.3	8	8	8	8	4.3	4.3
5.1 I***			5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
5.1 II***			6.1	5.1	5.1	5.1	8	8	5.1	5.1	5.1	5.1
5.1 III***			6.1	6.1	6.1	5.1	8	8	8	8	5.1	5.1
6.1 I, Dermal							8	6.1	6.1	6.1	6.1	6.1
6.1 I, Oral							8	6.1	6.1	6.1	6.1	6.1
6.1 II, Inhalation							8	6.1	6.1	6.1	6.1	6.1
6.1 II, Dermal							8	6.1	8	6.1	6.1	6.1
6.1 II, Oral							8	8	8	6.1	6.1	6.1
6.1 III							8	8	8	8	8	8

For hazards not shown in this table, see 5.2.5.

* 6.1 for pesticides.

** Substances of class 4.1 other than self-reactive substances.

*** There are at present no established criteria for determining packaging groups for liquids in class 5.1. For the time being, the degree of hazard is to be assessed by analogy with listed substances, allocating the substance to packaging group I, great, II, medium, or III, minor danger.

\- Denotes an impossible combination.

Figure 4.1: SCHEME OF PROCEDURE FOR CLASSIFYING A SUBSTANCE OR ARTICLE

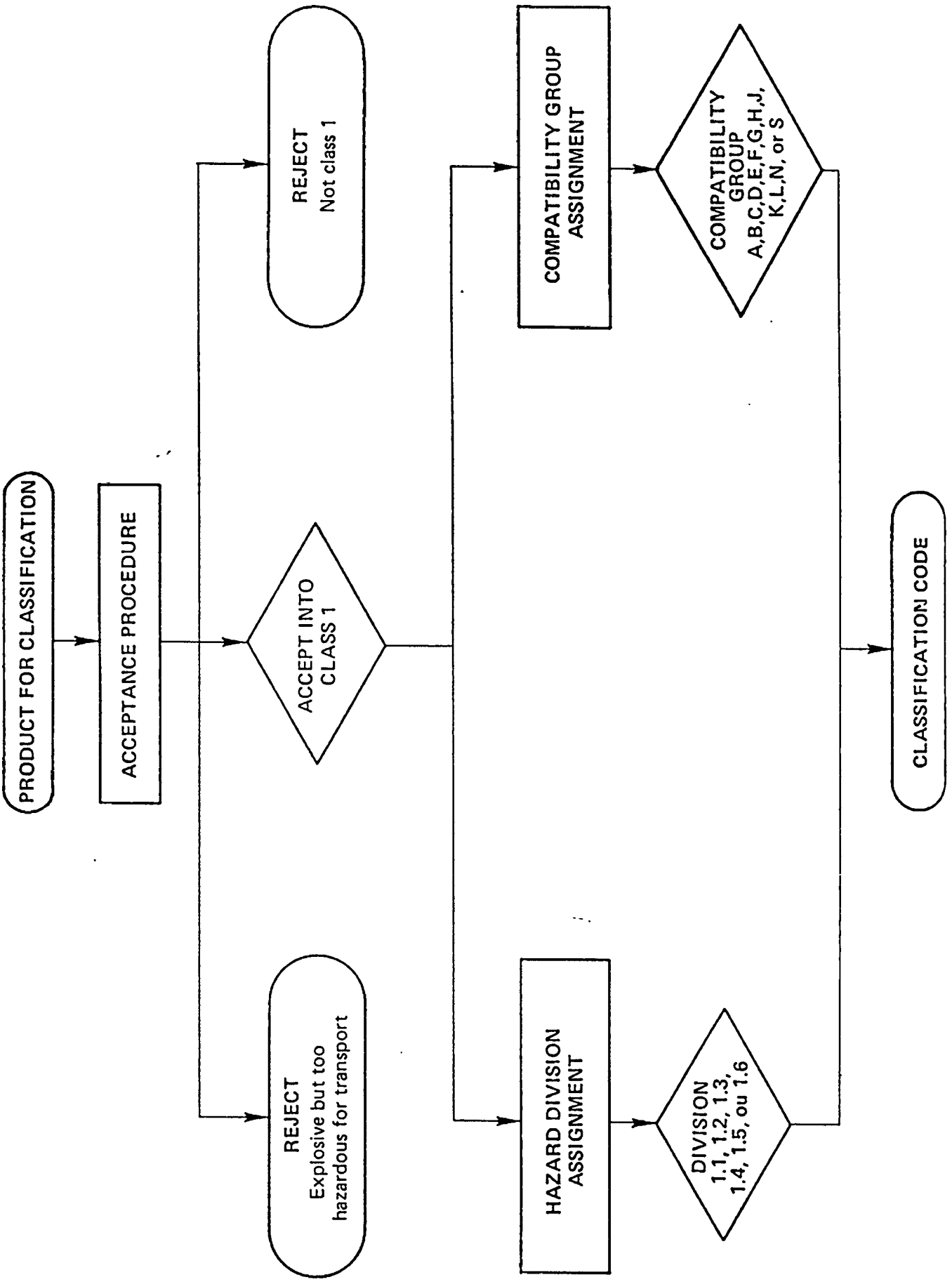


Figure 1.1

DATA SHEET FOR SUBSTANCES SUBMITTED TO THE UNITED NATIONS FOR NEW OR AMENDED CLASSIFICATION

Submitted by ..... Date ...

Supply all relevant information including sources of basic classification data
Data should relate to the product in the form to be transported
State test methods
Answer all questions - if necessary state "not known" or "not applicable" - If data is not available in the form requested, provide what is available with details
Delete inappropriate words

SECTION 1. SUBSTANCE IDENTITY

1.1 Chemical name

1.2 Chemical formula

1.3 Other names/synonyms

1.4.1 UN number ..... 1.4.2 CAS number .....

1.5 Proposed classification for the Recommendations

1.5.1 proper shipping name (13.8 */)

1.5.2 class/division ..... subsidiary risk(s) .....

packing group .....

1.5.3 proposed special provisions, if any

1.5.4 proposed packing method

SECTION 2. PHYSICAL PROPERTIES

2.1 Melting point or range ..... °C

2.2 Boiling point or range ..... °C

2.3 Relative density at :

2.3.1 15 °C .....

2.3.2 20 °C .....

2.3.3 50 °C .....

---

*/ This and similar references are to chapters and paragraphs in the Recommendations of the United Nations Committee of Experts on the Transport of Dangerous Goods.

2.4 Vapour pressure at :

2.4.1 50 °C ..... kPa

2.4.2 65 °C ..... kPa

2.5 Viscosity at 20 °C (1.10*/) ..... m^2/s

2.6 Solubility in water at 20 °C ..... g/100 ml

2.7 Physical state at 20 °C (1.10 and 1.15 */) solid/liquid/gas

2.8 Appearance at normal carriage temperatures, including colour and odour
.....
.....

2.9 Other relevant physical properties .....

SECTION 3. FLAMMABILITY

3.1 Flashpoint ..... °C oc/cc (5.4 */)

3.2 Autoignition temperature ..... °C

3.3 Flammability range (LEL/UEL) ..... %

3.4 Is the substance a flammable solid ? yes/no

3.4.1 If yes, give details (also complete 4.5.1 and 4.5.2 if relevant) (1.21 */)

SECTION 4. CHEMICAL PROPERTIES

4.1 Does the substance require inhibition/stabilization or other treatment such as nitrogen blanket to prevent hazardous reactivity ?
yes/no

If yes, state .....

4.1.1 Inhibitor/stabilizer used .....

4.1.2 Alternative method .....

4.1.3 Time effective at 55 °C .....

4.1.4 Conditions rendering it ineffective .....
.....

4.2 Does the substance react with water ? yes/no

4.2.1 If yes, state effects .....
.....
.....

4.3 Does the substance have explosive properties ? (4 */) yes/no

4.3.1 If yes, give details .....
.....
.....

4.4 Does the substance have oxidizing properties ? (1.22 */) yes/no

4.4.1 If yes, give details .....
.....
.....

4.5 Is the substance an organic peroxide ? (1.22 */) yes/no

If yes, or if in 3.4 the answer is yes, state

4.5.1 proposed control temperature (11.3.5 */) ..... °C

4.5.2 proposed emergency temperature (11.3.5 */) ..... °C

4.6 Corrosivity (8*/) to :

4.6.1 mild steel ..... mm/year at °C

4.6.2 aluminium ..... mm/year at °C

4.6.3 other packaging materials
(specify) ..... mm/year at °C
.....

4.7 Other relevant chemical properties .....
.....

SECTION 5. HARMFUL BIOLOGICAL EFFECTS

5.1 LD 50, oral (6.3 - 6.5 */) ..... mg/kg Animal species .....

5.2 LD 50, dermal (6.3 - 6.5 */) ..... mg/kg Animal species .....

5.3 LC 50, inhalation (6.3 - 6.5 */) ..... mg/litre Exposure time .... hours

or ... ml/m^3 Animal species .....

5.4 Saturated vapour concentration at 20 °C (6.4.3 */) .... ml/m^3

5.5 Skin exposure (8 */) results Exposure time ..... hours/minutes
Animal species : .....

5.6 Other data .....
.....

5.7 Human experience .....
.....

SECTION 6. SUPPLEMENTARY INFORMATION

6.1 Recommended emergency action

6.1.1 Fire (include suitable and unsuitable extinguishing agents)
.....

6.1.2 Spillage

6.2 Is it proposed to transport the substance in :

6.2.1 Intermediate Bulk Containers (16 */) ? yes/no

6.2.2 Multimodal tanks (12 */) ? yes/no

If yes, give details in Sections 7 and/or 8.

SECTION 7. INTERMEDIATE BULK CONTAINERS, (IBCs) (only complete if yes in 6.2.1)

7.1 Proposed type(s) .....

SECTION 8. MULTIMODAL TANK TRANSPORT (only complete if yes in 6.2.2)

8.1 Description of proposed tank (including IMO tank type if known)
.....
.....
.....

8.2 Minimum test pressure .....

8.3 Minimum shell thickness .....

8.4 Details of bottom openings, if any .....
.....

8.5 Pressure relief arrangements .....

8.6 Degree of filling .....

8.7 Unsuitable construction materials .....

APPENDIX 3

EXAMPLES OF PORTABLE MAGAZINES

(See definition in paragraph 5.1.3 of this introduction)

Figure 1 – Example of a wooden portable magazine
(Diagrammatic, not to scale)

1. All boards used in construction (see diagram) are 25 × 200 mm. All timber used is softwood.

2. The lid is locked by inserting "A" under "B" and fixing a locking device into the hasp and staple.

3. The hasp and staple are fixed to the magazine using a nut and bolt, the nut attached on the inside. The bolt is then cut and burred over.

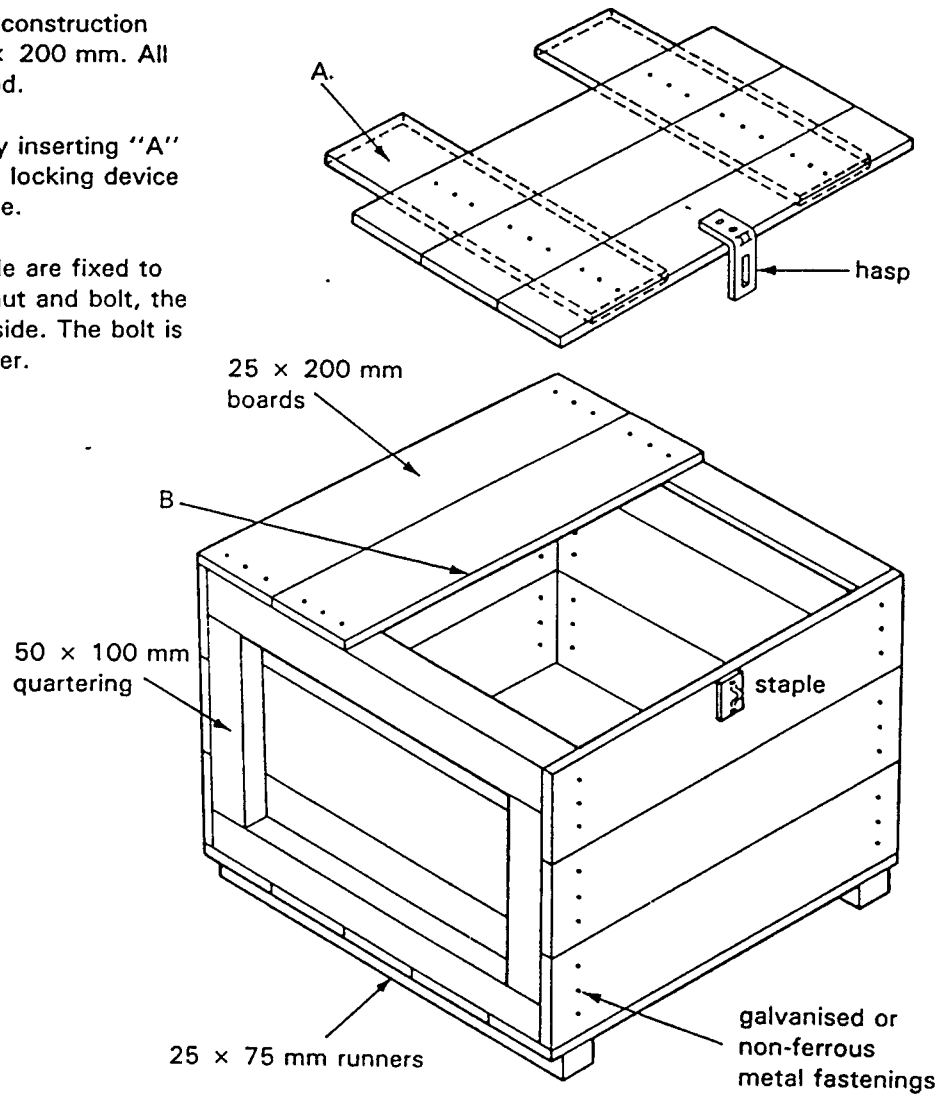
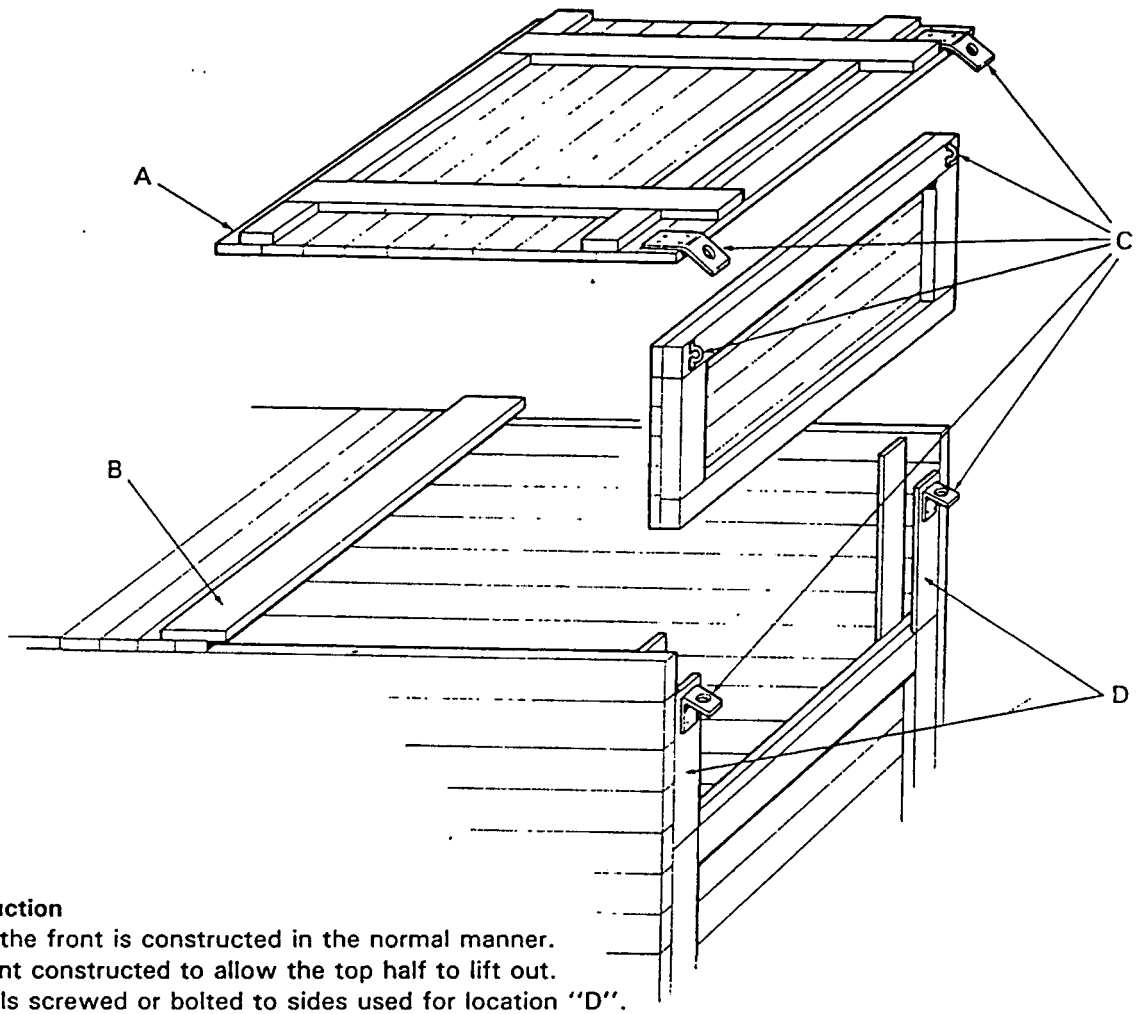
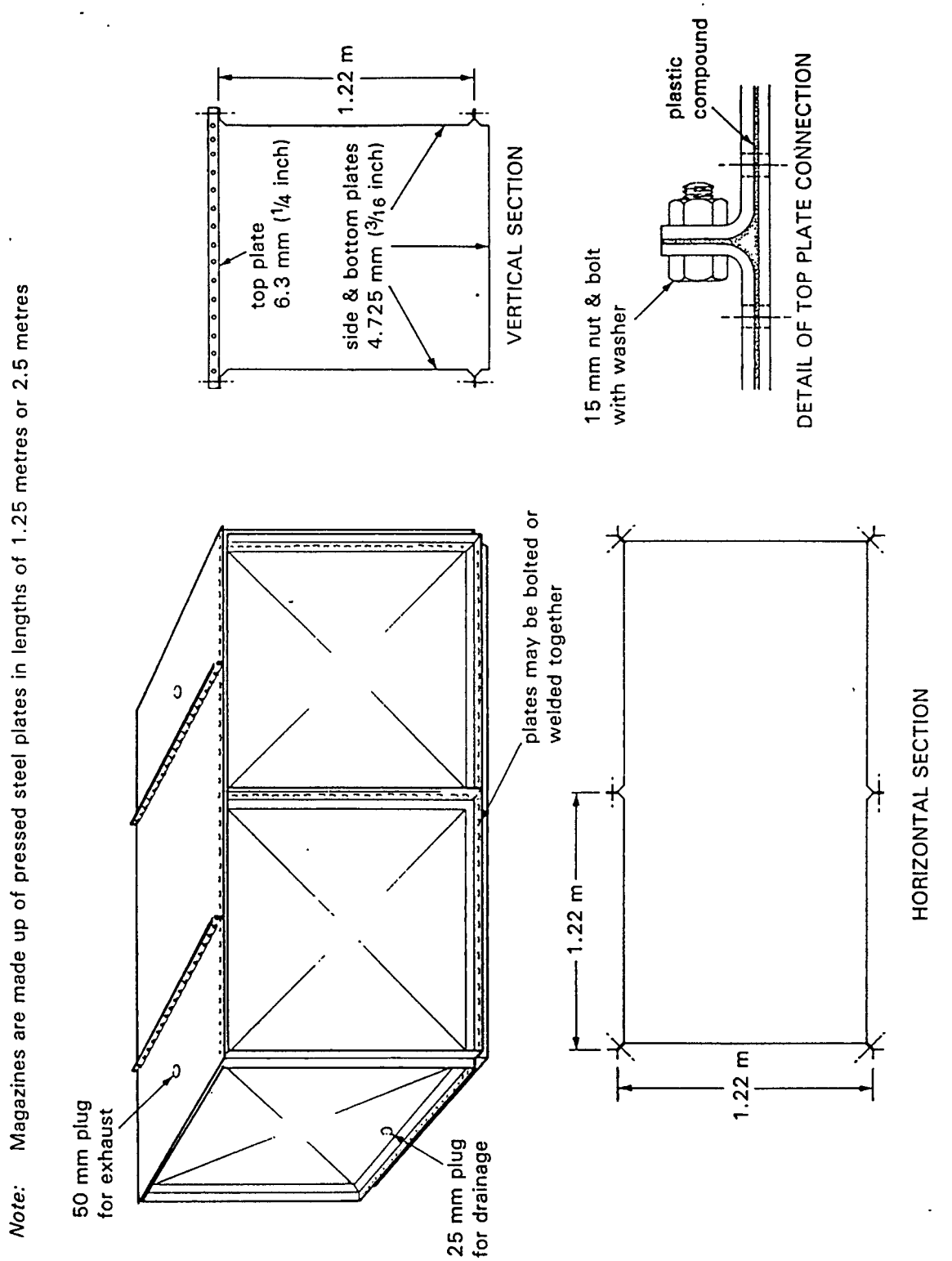


Figure 2 – Example of a portable magazine with removable front



Construction
All but the front is constructed in the normal manner. The front constructed to allow the top half to lift out. Channels screwed or bolted to sides used for location "D". The top is located in the normal manner with edge "A" sliding under "B". Both top and removable front retained and locked with padlocks through hasps and staples "C" or some other suitable method.

Figure 3 – Example of a portable steel magazine – fabricated



Note: Magazines are made up of pressed steel plates in lengths of 1.25 metres or 2.5 metres

Figure 4 – Example of a portable steel magazine, commercial pattern

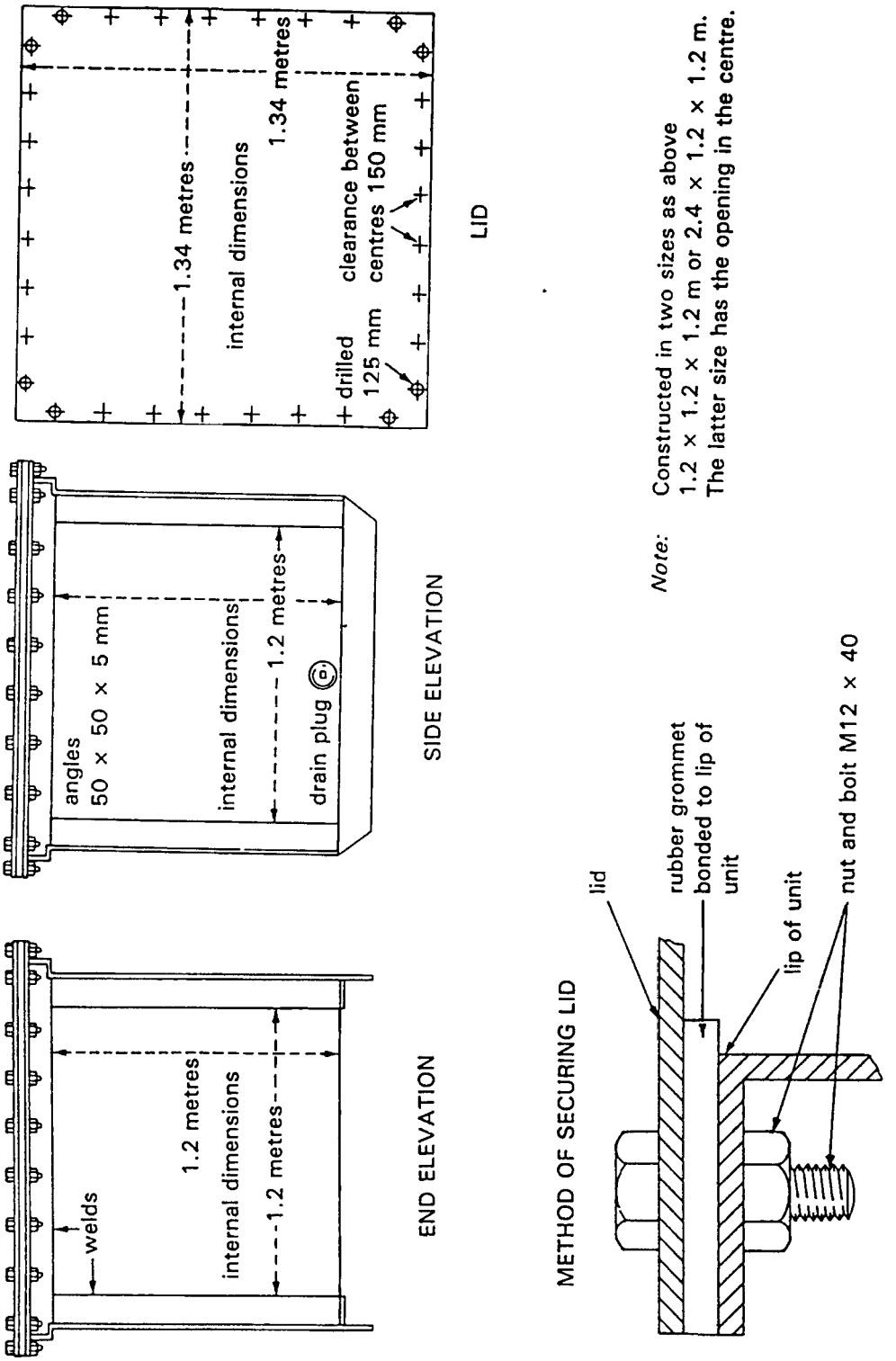
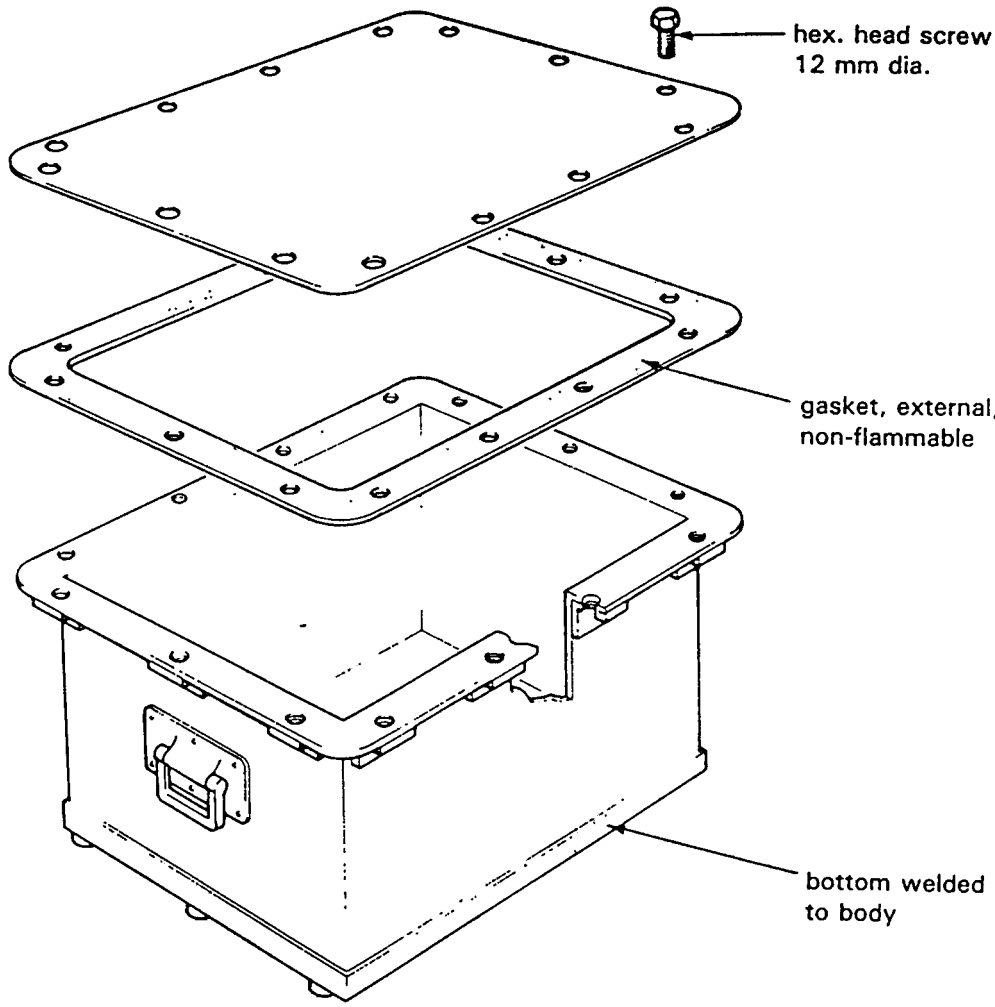
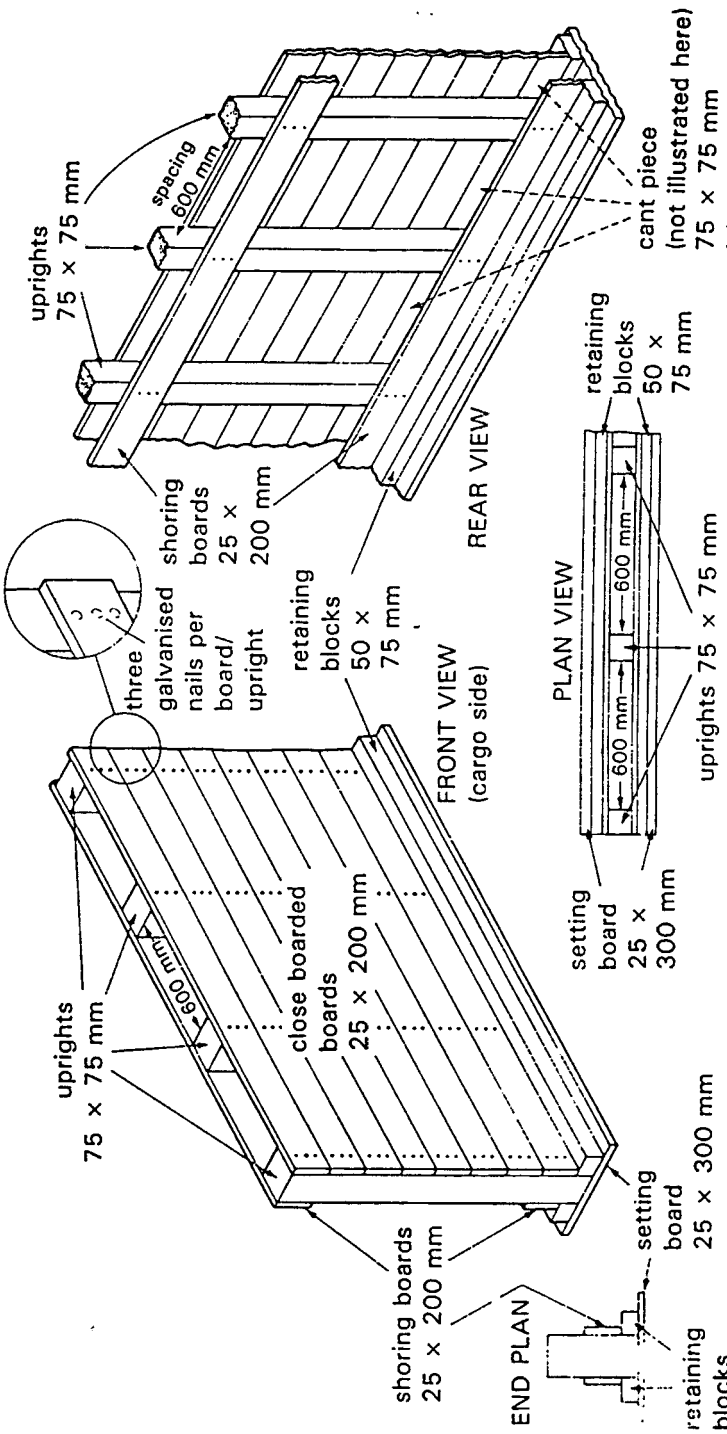


Figure 5 – Example of a portable steel magazine, military pattern



APPENDIX 4

Figure: Example of the construction of a magazine bulkhead (or sidewall)
(See paragraph 5.4.3.3 of this introduction)



1. Standard strength requirements.
Close boarded magazine bulkheads may be constructed as per diagram. The timber normally used is softwood, neither the type nor sizes of timber quoted are mandatory. Other timber or materials (e.g. plywood not less than 18 mm thick) may be used as approved.

2. Fastenings.
All fastenings used in the construction of magazine bulkheads should be of galvanised or non-ferrous metal materials.

3. Construction.
The setting board should be placed on the deck and the uprights cut to ensure that a tight fit is maintained deck to deckhead, spacing should be 600 mm between uprights, up to a height of 2.4 m. For heights in excess of this, spacing is reduced to 450 mm. Any gaps between the boards should be covered with timber strips 12 x 50 mm.

(Pages 1031 to 1100 have been reserved for future amendments)

GENERAL INTRODUCTION

15.1.16 **Segregation table**

The following table shows the general requirements for segregation between the various classes of dangerous goods.

SINCE THE PROPERTIES OF SUBSTANCES OR ARTICLES WITHIN EACH CLASS MAY VARY GREATLY, THE INDIVIDUAL SCHEDULES SHOULD ALWAYS BE CONSULTED FOR PARTICULAR REQUIREMENTS FOR SEGREGATION AS THESE TAKE PRECEDENCE OVER THE GENERAL REQUIREMENTS.

SEGREGATION SHOULD ALSO TAKE ACCOUNT OF A SINGLE SUBSIDIARY RISK LABEL.

CLASS		1.1 1.2 1.5	1.3	1.4	2.1	2.2	2.3	3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7	8	9
Explosives	1.1, 1.2, 1.5	*	*	*	4	2	2	4	4	4	4	4	4	2	4	2	4	X
Explosives	1.3	*	*	*	4	2	2	4	3	3	4	4	4	2	4	2	2	X
Explosives	1.4	*	*	*	2	1	1	2	2	2	2	2	2	X	4	2	2	X
Flammable gases	2.1	4	4	2	X	X	X	2	1	2	X	2	2	X	4	2	1	X
Non-toxic, non-flammable gases	2.2	2	2	1	X	X	X	1	X	1	X	X	1	X	2	1	X	X
Poisonous gases	2.3	2	2	1	X	X	X	2	X	2	X	X	2	X	2	1	X	X
Flammable liquids	3	4	4	2	2	1	2	X	X	2	1	2	2	X	3	2	X	X
Flammable solids	4.1	4	3	2	1	X	X	X	X	1	X	1	2	X	3	2	1	X
Spontaneously combustible substances	4.2	4	3	2	2	1	2	2	1	X	1	2	2	1	3	2	1	X
Substances which are dangerous when wet	4.3	4	4	2	X	X	X	1	X	1	X	2	2	X	2	2	1	X
Oxidizing substances	5.1	4	4	2	2	X	X	2	1	2	2	X	2	1	3	1	2	X
Organic peroxides	5.2	4	4	2	2	1	2	2	2	2	2	2	X	1	3	2	2	X
Poisons	6.1	2	2	X	X	X	X	X	X	1	X	1	1	X	1	X	X	X
Infectious substances	6.2	4	4	4	4	2	2	3	3	3	2	3	3	1	X	3	3	X
Radioactive materials	7	2	2	2	2	1	1	2	2	2	2	1	2	X	3	X	2	X
Corrosives	8	4	2	2	1	X	X	X	1	1	1	2	2	X	3	2	X	X
Miscellaneous dangerous substances and articles	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Numbers and symbols relate to the following terms as defined in this section:

1 – "Away from"
2 – "Separated from"
3 – "Separated by a complete compartment or hold from"
4 – "Separated longitudinally by an intervening complete compartment or hold from"
X – The segregation, if any, is shown in the individual schedules
* – See subsection 6.2 of the introduction to class 1 for segregation within class 1

15.1.17 For the purposes of the segregation requirements for the various modes of carriage by sea this section has been subdivided as follows:

15.2 Segregation of packages

15.3 Segregation of freight containers on board container ships

15.4 Segregation of cargo transport units on board roll-on roll-off ships

15.5 Segregation on board barge-carrying ships

15.6 Segregation between bulk materials possessing chemical hazards and dangerous goods in packaged form.

15.2 Segregation of packages

15.2.1 *Applicability*

15.2.1.1 The requirements of this subsection apply to the segregation of:

.1 packages containing dangerous goods and stowed in the conventional way;

.2 dangerous goods within cargo transport units (as listed in 7.4.1 of this General Introduction); and

.3 dangerous goods stowed in the conventional way from those packed in such cargo transport units.

15.2.2 *Segregation of packages containing dangerous goods and stowed in the conventional way*

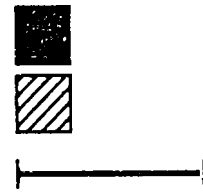
15.2.2.1 Definitions of the segregation terms

Legend

(1) Reference *package* .....

(2) *Package* containing incompatible goods .....

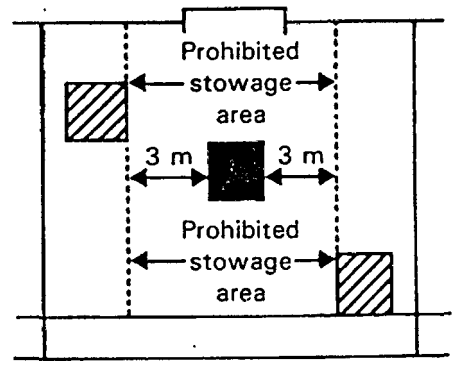
(3) Deck resistant to fire and liquid .....



NOTE: Full vertical lines represent transverse bulkheads between cargo spaces (compartments or holds) resistant to fire and liquid.

15.2.2.1.1 *Away from:*

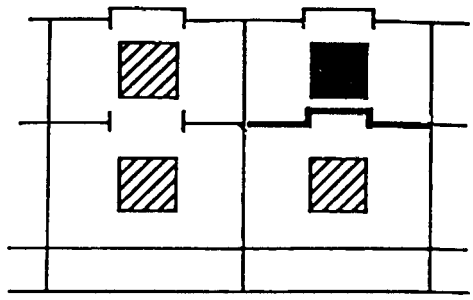
Effectively segregated so that the incompatible goods cannot interact dangerously in the event of an accident but may be carried in the same compartment or hold or on deck provided a minimum horizontal separation of 3 metres projected vertically is obtained.



GENERAL INTRODUCTION

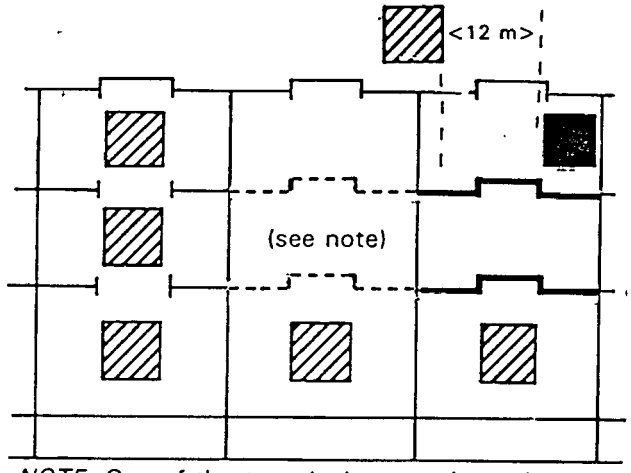
15.2.2.1.2 *Separated from:*

In different compartments or holds when stowed under deck. Provided the intervening deck is resistant to fire and liquid, a vertical separation, i.e. in different compartments, may be accepted as equivalent to this segregation. For "on deck" stowage, this segregation means a separation by a distance of at least 6 metres horizontally.



15.2.2.1.3 *Separated by a complete compartment or hold from:*

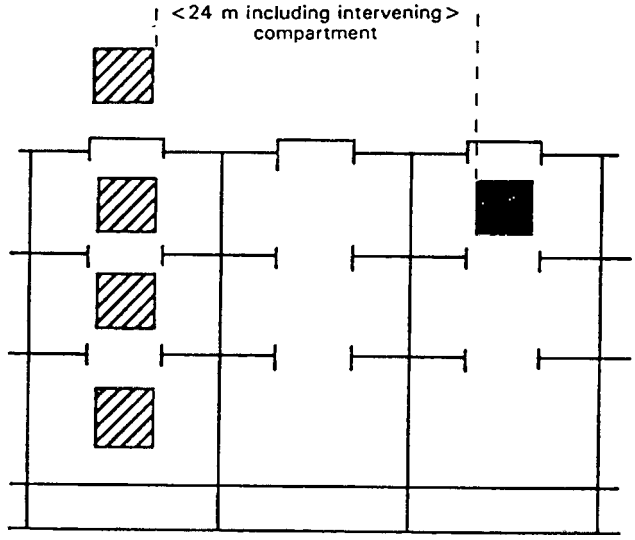
Means either a vertical or a horizontal separation. If the intervening decks are not resistant to fire and liquid, then only a longitudinal separation, i.e. by an intervening complete compartment or hold, is acceptable. For "on deck" stowage, this segregation means a separation by a distance of at least 12 metres horizontally. The same distance has to be applied if one package is stowed "on deck", and the other one in an upper compartment.



NOTE: One of the two decks must be resistant to fire and liquid.

15.2.2.1.4 *Separated longitudinally by an intervening complete compartment or hold from:*

Vertical separation alone does not meet this requirement. Between a package "under deck" and one "on deck" a minimum distance of 24 metres including a complete compartment must be maintained longitudinally. For "on deck" stowage, this segregation means a separation by a distance of at least 24 metres longitudinally.



15.2.3 *Segregation in cargo transport units*

15.2.3.1 Dangerous goods which have to be segregated from each other should not be carried in the same cargo transport unit. However, dangerous goods which should be segregated "away from" each other may be carried in the same cargo transport unit with the approval of the competent authority. In such cases an equivalent standard of safety must be maintained.

15.6 **Segregation between bulk materials possessing chemical hazards and dangerous goods in packaged form**

15.6.1 *Applicability*

15.6.1.1 Unless otherwise required in this section or in the individual schedules, segregation between bulk materials and dangerous goods in packaged form should be in accordance with the following table.

15.6.1.2 *Segregation table*

Bulk materials (classified as dangerous goods)	Dangerous goods in packaged form: CLASS	1.1 1.2 1.5	1.3	1.4	2.1	2.2 2.3	3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7	8	9
Flammable solids	4.1	4	3	2	2	2	2	X	1	X	1	2	X	3	2	1	X
Substances liable to spontaneous combustion	4.2	4	3	2	2	2	2	1	X	1	2	2	1	3	2	1	X
Substances which, in contact with water, emit flammable gases	4.3	4	4	2	1	X	2	X	1	X	2	2	X	2	2	1	X
Oxidizing substances (agents)	5.1	4	4	2	2	X	2	1	2	2	X	2	1	3	1	2	X
Poisonous (toxic) substances	6.1	2	2	X	X	X	X	X	1	X	1	1	X	1	X	X	X
Radioactive materials	7	2	2	2	2	2	2	2	2	2	1	2	X	3	X	2	X
Corrosives	8	4	2	2	1	X	1	1	1	1	2	2	X	3	2	X	X
Miscellaneous dangerous substances and articles	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Materials hazardous only in bulk (MHB)		X	X	X	X	X	X	X	X	X	X	X	X	3	X	X	X

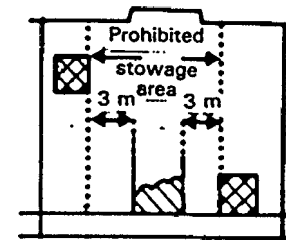
Numbers and symbols relate to the following terms, as defined in 15.6.1.3:

1 — "Away from"
2 — "Separated from"
3 — "Separated by a complete compartment or hold from"
4 — "Separated longitudinally by an intervening complete compartment or hold from"
X — The segregation, if any, is shown in the individual schedules in this Code or the individual entries in the Code of Safe Practice for Solid Bulk Cargoes

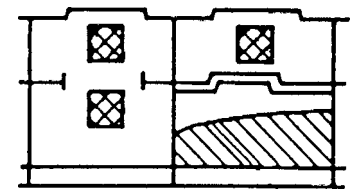
GENERAL INTRODUCTION

15.6.1.3 *Definitions of the segregation terms*

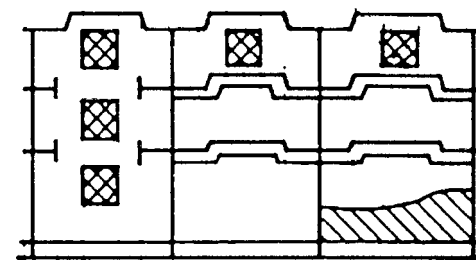
1 *Away from:*
Effectively segregated so that incompatible materials cannot interact dangerously in the event of an accident but may be carried in the same hold or compartment or on deck provided a minimum horizontal separation of 3 metres projected vertically is provided.



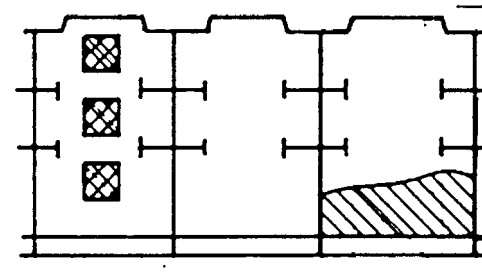
2 *Separated from:*
In different holds when stowed under deck. Provided an intervening deck is resistant to fire and liquid, a vertical separation, i.e. in different compartments, may be accepted as equivalent to this segregation.



3 *Separated by a complete compartment or hold from:*
Means either a vertical or a horizontal separation. If the decks are not resistant to fire and liquid, then only a longitudinal separation, i.e. by an intervening complete compartment, is acceptable.



4 *Separated longitudinally by an intervening complete compartment or hold from:*
Vertical separation alone does not meet this requirement.

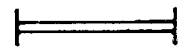


X No general segregation required: The individual schedules in this Code and the individual entries in the Code of Safe Practice for Solid Bulk Cargoes should be consulted.

Legend

Reference bulk material 

Incompatible package 

Deck resistant to liquid and fire 

Note: Vertical lines represent transverse watertight bulkheads between cargo spaces.

15.4.2 Table of segregation of cargo transport units on board ro-ro ships

SEGREGATION REQUIREMENT		HORIZONTAL					
		CLOSED VERSUS CLOSED		CLOSED VERSUS OPEN		OPEN VERSUS OPEN	
		ON DECK	UNDER DECK	ON DECK	UNDER DECK	ON DECK	UNDER DECK
"AWAY FROM" 1	FORE AND AFT	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	AT LEAST 3 METRES	AT LEAST 3 METRES
	ATHWART-SHIPS	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	AT LEAST 3 METRES	AT LEAST 3 METRES
"SEPARATED FROM" 2	FORE AND AFT	AT LEAST 6 METRES	AT LEAST 6 METRES or ONE BULKHEAD	AT LEAST 6 METRES	AT LEAST 6 METRES or ONE BULKHEAD	AT LEAST 6 METRES	AT LEAST 12 METRES or ONE BULKHEAD
	ATHWART-SHIPS	AT LEAST 3 METRES	AT LEAST 3 METRES or ONE BULKHEAD	AT LEAST 3 METRES	AT LEAST 6 METRES or ONE BULKHEAD	AT LEAST 6 METRES	AT LEAST 12 METRES or ONE BULKHEAD
"SEPARATED BY A COMPLETE COMPARTMENT OR HOLD FROM" 3	FORE AND AFT	AT LEAST 12 METRES	AT LEAST 24 METRES + DECK	AT LEAST 24 METRES	AT LEAST 24 METRES + DECK	AT LEAST 36 METRES	TWO DECKS or TWO BULKHEADS
	ATHWART-SHIPS	AT LEAST 12 METRES	AT LEAST 24 METRES + DECK	AT LEAST 24 METRES	AT LEAST 24 METRES + DECK	AT LEAST 36 METRES	PROHIBITED
"SEPARATED LONGITUDINALLY BY AN INTERVENING COMPLETE COMPARTMENT OR HOLD FROM" 4	FORE AND AFT	AT LEAST 36 METRES	TWO BULKHEADS or AT LEAST 36 METRES + TWO DECKS	AT LEAST 36 METRES	AT LEAST 48 METRES INCLUDING TWO BULKHEADS	AT LEAST 48 METRES	PROHIBITED
	ATHWART-SHIPS	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED

NOTE: ALL BULKHEADS AND DECKS SHOULD BE RESISTANT TO FIRE AND LIQUID

15.3.2 Table of segregation of freight containers on board container ships

SEGREGATION REQUIREMENT	VERTICAL			HORIZONTAL						
	CLOSED VERSUS CLOSED	CLOSED VERSUS OPEN	OPEN VERSUS OPEN		CLOSED VERSUS CLOSED		CLOSED VERSUS OPEN		OPEN VERSUS OPEN	
					ON DECK	UNDER DECK	ON DECK	UNDER DECK	ON DECK	UNDER DECK
"AWAY FROM" 1	ONE ON TOP OF THE OTHER PERMITTED	OPEN ON TOP OF CLOSED PERMITTED OTHERWISE AS FOR OPEN VERSUS OPEN	*NOT* IN THE SAME VERTICAL LINE *UNLESS* SEGREGATED BY A DECK	FORE AND AFT	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	*ONE* CONTAINER SPACE	*ONE* CONTAINER SPACE *OR ONE* BULKHEAD
				ATHWART-SHIPS	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	*ONE* CONTAINER SPACE	*ONE* CONTAINER SPACE
"SEPARATED FROM" 2	*NOT* IN THE SAME VERTICAL LINE *UNLESS* SEGREGATED BY A DECK	AS FOR OPEN VERSUS OPEN		FORE AND AFT	*ONE* CONTAINER SPACE	*ONE* CONTAINER SPACE *OR ONE* BULKHEAD	*ONE* CONTAINER SPACE	*ONE* CONTAINER SPACE *OR ONE* BULKHEAD	*ONE* CONTAINER SPACE	*ONE* BULKHEAD
				ATHWART-SHIPS	*ONE* CONTAINER SPACE	*ONE* CONTAINER SPACE	*ONE* CONTAINER SPACE	*TWO* CONTAINER SPACES	*TWO* CONTAINER SPACES	*ONE* BULKHEAD
"SEPARATED BY A COMPLETE COMPARTMENT OR HOLD FROM" 3				FORE AND AFT	*ONE* CONTAINER SPACE	*ONE* BULKHEAD	*ONE* CONTAINER SPACE	*ONE* BULKHEAD	*TWO* CONTAINER SPACES	*TWO* BULKHEADS
				ATHWART-SHIPS	*TWO* CONTAINER SPACES	*ONE* BULKHEAD	*TWO* CONTAINER SPACES	*ONE* BULKHEAD	*THREE* CONTAINER SPACES	*TWO* BULKHEADS
"SEPARATED LONGITUDINALLY BY AN INTERVENING COMPLETE COMPARTMENT OR HOLD FROM" 4	PROHIBITED			FORE AND AFT	MINIMUM HORIZONTAL DISTANCE OF 24 METRES	*ONE* BULKHEAD *AND* MINIMUM HORIZONTAL DISTANCE OF 24 METRES*	MINIMUM HORIZONTAL DISTANCE OF 24 METRES	*TWO* BULKHEADS	MINIMUM HORIZONTAL DISTANCE OF 24 METRES	*TWO* BULKHEADS
				ATHWART-SHIPS	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED

* CONTAINERS NOT LESS THAN 6 METRES FROM INTERVENING BULKHEAD

NOTE: ALL BULKHEADS AND DECKS SHOULD BE RESISTANT TO FIRE AND LIQUID

Table of segregation of freight containers for open-top container ship holds

SEGREGATION REQUIREMENT	VERTICAL			HORIZONTAL							
	CLOSED VERSUS CLOSED	CLOSED VERSUS OPEN	OPEN VERSUS OPEN		CLOSED VERSUS CLOSED		CLOSED VERSUS OPEN		OPEN VERSUS OPEN	
					ON DECK	UNDER DECK	ON DECK	UNDER DECK	ON DECK	UNDER DECK
"AWAY FROM" 1	ONE ON TOP OF THE OTHER PERMITTED	OPEN ON TOP OF CLOSED PERMITTED OTHERWISE AS FOR OPEN VERSUS OPEN	NOT IN THE SAME VERTICAL LINE	FORE AND AFT	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	ONE CONTAINER SPACE	ONE CONTAINER SPACE OR ONE BULKHEAD
				ATHWART-SHIPS	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	NO RESTRICTION	ONE CONTAINER SPACE	ONE CONTAINER SPACE
"SEPARATED FROM" 2	NOT IN THE SAME VERTICAL LINE	AS FOR OPEN VERSUS OPEN		FORE AND AFT	ONE CONTAINER SPACE	ONE CONTAINER SPACE OR ONE BULKHEAD	ONE CONTAINER SPACE	ONE CONTAINER SPACE OR ONE BULKHEAD	ONE CONTAINER SPACE AND NOT ABOVE SAME HOLD	ONE BULKHEAD
				ATHWART-SHIPS	ONE CONTAINER SPACE	ONE CONTAINER SPACE	TWO CONTAINER SPACES	TWO CONTAINER SPACES	TWO CONTAINER SPACES AND NOT ABOVE SAME HOLD	ONE BULKHEAD
"SEPARATED BY A COMPLETE COMPARTMENT OR HOLD FROM" 3				FORE AND AFT	ONE CONTAINER SPACE AND NOT ABOVE SAME HOLD	ONE BULKHEAD	ONE CONTAINER SPACE AND NOT IN OR ABOVE SAME HOLD	ONE BULKHEAD	TWO CONTAINER SPACES AND NOT ABOVE SAME HOLD	TWO BULKHEADS
				ATHWART-SHIPS	TWO CONTAINER SPACES AND NOT ABOVE SAME HOLD	ONE BULKHEAD	TWO CONTAINER SPACES AND NOT ABOVE SAME HOLD	ONE BULKHEAD	THREE CONTAINER SPACES AND NOT ABOVE SAME HOLD	TWO BULKHEADS
"SEPARATED LONGITUDI-NALLY BY AN INTERVENING COMPLETE COMPARTMENT OR HOLD FROM" 4	PROHIBITED			FORE AND AFT	MINIMUM HORIZONTAL DISTANCE OF 24 m AND NOT ABOVE SAME HOLD	ONE BULKHEAD AND MINIMUM HORIZONTAL DISTANCE OF 24 M*	MINIMUM HORIZONTAL DISTANCE OF 24 m AND NOT ABOVE SAME HOLD	TWO BULKHEADS	MINIMUM HORIZONTAL DISTANCE OF 24 m AND NOT ABOVE SAME HOLD	TWO BULKHEADS
				ATHWART-SHIPS	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED	PROHIBITED

***

* Containers not less than 6 m from intervening bulkhead.

Note: All bulkheads and decks should be resistant to fire and liquid.

W/0128N/EWP

IMO DANGEROUS GOODS DECLARATION

This fo... meets the requ...ments of SOLAS 1974, chapter VII, regulation 5; MARPO... .3/78, Annex II, ..gulation 4; and the IMDG Code, General Introduction, section 9.

1 Shipper
WORLD MARITIME UNIVERSITY
MALMÖ, SWEDEN

2 Reference number(s)
MSA/GMPE 100;0093/8

3 Consignee
INTERNATIONAL MARITIME ORGANIZ.
4 ALBERT EMBANKMENT
LONDON SE 1 7SR, ENGLAND

4 Carrier
HAPAG-LLOYD A.G. HAMBURG

Container packing certificate/vehicle declaration

DECLARATION

It is declared that the packing of the container~~/vehicle~~ has been carried out in accordance with the General Introduction, IMDG Code, paragraph 12.3.7 ~~xxxxxx~~

TO BE COMPLETED FOR SHIPMENTS IN CONTAINERS OR VEHICLES

5 Name/status, company/organization of signatory
H. EVERYBODY, DIRECTOR
WORLD MARITIME UNIVERSITY

Place and date MALMÖ, 1 SEPTEMBER 1993

Signature on behalf of packer

6 Ship's name and voyage no. MALMÖ EXPRESS, 333 **Port of loading** MALMÖ

8 Port of discharge LONDON, TILBURY DOCKS

7 Instructions or other matter
FCL
UNDER DECK STOWAGE REQUIRED

Marks & nos. If applicable, identification or registration number(s) of the unit	Number and kind of packages, proper shipping name/correct technical name*, IMO hazard class/division, UN No., packaging group**, flashpoint (in °C c.c.)**, control and emergency temperature**, identification of the goods as MARINE POLLUTANT**, EmS No. and MFAG Table No.***	Gross mass (kg), net quantity/ mass**
WMU 1-100	100 6PA1 CUPRIETHYLENEDIAMINE, SOLUTION, IMO 8/6.1/II, UN 1761, MARINE POLLUTANT, EmS 8-06, MFAG 320, (IMDG 8154/25-89), 9240	
101-150	50 1A1 DRUMS ACETONE IMO 3.1/II, UN 1090, FP -20 °C c.c., EmS 3-06, MFAG 300, (IMDG 3102/25-89), 14000	
		23240

In 40' FREIGHT CONTAINER
HAL/CONT 038597 C

9 Goods delivered as:
- ☐ Breakbulk cargo
- ☒ Unitized cargo
- ☐ Bulk packages in

Type of unit: (container, ~~trailer, xxxx vehicle, etc~~)

- ☐ Open
- ☒ Closed

Insert "X" in appropriate box

* Proprietary/trade names alone are not sufficient. If applicable: (1) the word "WASTE" should precede the name; (2) "EMPTY UNCLEANED" or "RESIDUE - LAST CONTAINED" should be added; (3) "LIMITED QUANTITY" should be added.
** When required in paragraph 9.3 of the General Introduction to the IMDG Code.
*** When required.

10 ADDITIONAL INFORMATION (In certain circumstances special information/certificates are required: see IMDG Code, General Introduction, paragraphs 9.7.1/9.7.2)

DECLARATION

I hereby declare that the contents of this consignment are fully and accurately described above by the correct technical name(s) (proper shipping name(s)), and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to the applicable international and national government regulations.

11 Name/status, company/organization of signatory
H. EVERYBODY, DIRECTOR
WORLD MARITIME UNIVERSITY

Place and date MALMÖ, 1 SEPTEMBER 1993

Signature on behalf of shipper

Printed by the International Maritime Organization

BULK COAL CARGOES

DECLARATION BY SHIPPER

For the guidance of ships' masters in their application of the IMO Code of Safe Practice for Solid Bulk Cargoes

To the Master

SS/MV.....

Port of Loading.....

The commodity to be shipped on your vessel is.....

.....

and the following properties have been ascertained by the use of recognised international procedures as specified in the IMO Bulk Cargoes Code.

PHYSICAL PROPERTIES:

Transportable Moisture Limit:

(Check one below as appropriate)

☐ This commodity is not considered a cargo which may liquify during the voyage

OR

☐ This commodity may liquify. The TRANSPORTABLE MOISTURE LIMIT is .....%

The average moisture content for this cargo is .....

Estimated Stowage Factor (Cubic Foot/Tonne).....

Angle of Repose .....°

CHEMICAL PROPERTIES

REFER ITEM 1. IMO CODE (Reprinted on Reverse of this Form)
The IMO Code of Safe Practice (see reverse) should be followed.

IMO CATEGORY FOR OCEAN TRANSPORT PURPOSES.....

EMERGENCY PROCEDURES:-

Refer IMO Code of Safe Practice Solid Bulk Cargoes.

It is certified that for the Bulk coal cargo nominated on this certificate reasonable care has been taken to ensure the relevant information attendant upon its marine transportation has been properly described and that the information given is based upon the latest available experience.

Signature..... Signature.....

by or on behalf of Master
acknowledging receipt of this information.

by or on behalf of.....
(name and address of consignor)

Date .....

TRANSOCEAN
SWEDISH TRANSOCEAN LINES

LIST OF DANGEROUS GOODS

Vessel	Voy. No.	Nationality	Official No.	Port of loading	Date of sailing	Date of issue	Page

We, the undersigned agents of the above vessel, hereby declare and certify, that the vessel has loaded at this port the undermentioned dangerous goods

Port of discharge Place of delivery	B/L No.	Unit Nos.; Marks and Nos.	Number and kind of packages; Description of inner/outer packing; Kind of units	Commodity (Correct technical name and description of goods)	Gross weight/ meas of cargo kg/m³	Net contents weight/meas kg/m³/l	Flash point °C	Class/Category IMCO Class and Page No.	UN No.	Suez	DGR No.	Stowage

CONTAINER/VEHICLE PACKING CERTIFICATE

It is certified that:–

1 The container/vehicle was clean, dry and appeared fit to receive the goods.

2 No incompatible substances have been packed within the freight container/vehicle except where this is permitted by the Merchant Shipping (Dangerous Goods) Regulations 1981 as currently amended.

3 Where packages or receptacles have been packed into a container/vehicle they were in sound condition.

4 All packages have been properly stowed and secured and where necessary suitable securing materials used.

5 The packages are clearly marked with a distinctive label or stencil of the label and the container/vehicle is clearly marked with labels to indicate the nature of the danger to which the goods give rise. Where the vehicle is a road tank vehicle or the goods are contained in a portable tank or tank container the label or marking shall in addition indicate the correct technical name of the goods.

6 The Dangerous Goods in this container/vehicle are those accepted by the carrier against the reference as identified in box 7 overleaf.

7 Where this Dangerous Goods Note is used as a Container/Vehicle Packing Certificate only, not a combined document, a Dangerous Goods Declaration signed by the shipper or supplier has been issued/received to cover each dangerous goods consignment packed in the container.

8 Where the Dangerous Goods Note applies to a road tank vehicle, or tank container, closures and valves have been properly closed and the correct ullage space left.

THE SIGNATURE GIVEN OVERLEAF IN BOX 17 MUST BE THAT OF THE PERSON CONTROLLING THE CONTAINER LOADING OPERATION. AFTER THE CONTAINER/VEHICLE HAS BEEN PACKED THE CERTIFICATE MUST BE GIVEN TO THE DRIVER ON COLLECTION AND PRESENTED TO THE CONTAINER/VEHICLE OPERATOR UPON DELIVERY.

DECLARATION

The company preparing this note declares that, to the best of their belief the goods have been accurately described, their quantities, weights and measurements are correct, and at the time of despatch they were in good order and condition.

TRANSOCEAN
SWEDISH TRANSOCEAN LINES

FARLIGT GODS

CONTAINERPACKNINGSCERTIFIKAT FORDONSDEKLARATION

Den som ansvarar för packning/lastning av farligt gods i en enhet, t ex container, flak, trailer eller andra fordon avsedda för sjötransport, skall lämna detta certificat.

DANGEROUS GOODS

CONTAINER PACKING CERTIFICATE VEHICLE DECLARATION

Those responsible for the packing of dangerous goods into a unit e.g. a container, flat, trailer or other vehicle intended for sea transport should provide this Certificate.

Unit number/Enhet nummer

Type of unit (container, trailer, tank container etc)/Typ av enhet

LIST OF DANGEROUS GOODS
packed in this unit:

FÖRTECKNING ÖVER FARLIGT GODS,
som packats/lastats i denna enhet:

No. & Type of packages Antal & typ av förpackning	Proper shipping name/correct technical name Tekniskt riktig benämning	IMO Class	UN Number	IMDG Code page/side	Gross weight kg Brutto vikt, kg

Härmed intygas att vid packning/lastning i ovanstående enhet

- enheten var ren, torr och uppenbart lämplig för avsett gods.
- Innehåller skeppningen gods av klass 1, avdelning 1.1 eller 1.2 skall enheten vara av den standard som specificeras i punkt 5.5.1 i inledningen till klass 1.
- inga oförenliga varor enligt IMDG-kodens anvisningar packats/lastats i enheten.
- alla kolli har inspekterats med avseende på yttre skador och endast intakta, oskadade förpackningar har packats/lastats.
- alla kolli har packats/lastats och säkrats på ett tillförlitligt sätt i enheten.
- enheten och varje förpackning har vederbörligen markts med ratta etiketter och texter.
- När fast koldioxid (torr-is) används för kyländamål, enheten utvändigt är markt eller etiketterad på väl synlig plats på dörrgaveln med följande text:
  "FARA. INNEHÅLLER CO_2 — GAS (TORRIS). VENTILERA NOGGRANT FORE INTRADE."
- det intyg som fordras i paragraf 9.4 i IMDG-koden* har erhållits för varje parti, som packats/lastats i enheten.

It is hereby certified that when packing above unit

- the unit was clean, dry and apparently fit to recive goods.
- if the consignments include goods of Class 1, Division 1.1 or 1.2, the unit is structurally serviceable as defined in paragraph 5.5.1 of the introduction to Class 1.
- no incompatible substances have been packed into the unit.
- all packages have been externally inspected for damages and only sound packages packed.
- all packages have been properly packed in the unit and secured.
- the unit and packages are properly marked and labelled.
- when solid carbon dioxide (dry ice) is used for cooling purposes, the unit is externally marked or labelled in a conspicuous place at the door end, reading:
  "DANGEROUS CO_2 — GAS (DRY ICE) INSIDE. VENTILATE THOROUGHLY BEFORE ENTERING".
- the Dangerous Gods Declaration required in subsection 9.4* of the International Maritime Dangerous Goods Code has been received for each dangerous goods consignment packed in the unit.

* Avsändaren skall intyga antingen i skeppshandlingarna eller i en särskild förklaring att det gods som han lämnar till transport är riktigt förpackat och märkt samt i behörigt skick för transport (Dangerous Goods Declaration)

* The shipper should certify, either on the shipping papers or in a separate declaration, that the goods which he offers for shipment have been properly packaged, marked, labelled and are in proper condition for carriage (Dangerous Goods Declaration)

Stowage onboard/Stuvning ombord

Place and date of issue/Plats och datum

Name and signature/Namn och signatur

To 34 2.000 89-03

This Appendix comprises the Ship/Shore Safety Check List, Guidelines relating to the Check List and a specimen letter for issue by the terminal representative to masters of tankers at terminals.

SHIP/SHORE SAFETY CHECK LIST

Ship's Name _____

Berth _____ Port _____

Date of Arrival _____ Time of Arrival _____

INSTRUCTIONS FOR COMPLETION

The safety of operations requires that all questions should be answered affirmatively ☑ If an affirmative answer is not possible, the reason should be given and agreement reached upon appropriate precautions to be taken between the ship and the terminal. Where any question is not considered to be applicable a note to that effect should be inserted in the remarks column.

☐- the presence of this symbol in the columns 'ship' and 'terminal' indicates that checks shall be carried out by the party concerned.

The presence of the letters A and P or R in the column 'Code' indicates the following:

A- the mentioned procedures and agreements shall be in writing and signed by both parties.

P- in the case of a negative answer the operation shall not be carried out without the permission of the Port Authority.

R- indicates items to be revisited at intervals not exceeding that agreed in the declaration.

General	Ship	Terminal	Code	Remarks
1. Is the ship securely moored?	☐	☐	R	
2. Are emergency towing wires correctly positioned.	☐	☐	R	
3. Is there safe access between ship and shore?	☐	☐	R	
4. Is the ship ready to move under its own power?	☐	☐	PR	
5. Is there an effective deck watch in attendance on board and adequate supervision on the terminal and on the ship?	☐	☐	R	
6. Is the agreed ship/shore communication system operative?	☐	☐	AR	
7. Have the procedures for cargo, bunker and ballast handling been agreed?	☐	☐	AR	

General	Ship	Terminal	Code	Remarks
8. Has the emergency shutdown procedure been agreed?	☐	☐	A	
9. Are fire hoses and fire fighting equipment on board and ashore positioned and ready for immediate use?	☐	☐	AR	
10. Are cargo and bunker hoses/arms in good condition, properly rigged and appropriate for the service intended?	☐	☐		
11. Are scuppers effectively plugged and drip trays in position, both on board and ashore?	☐	☐	R	
12. Are unused cargo and bunker connections properly secured with blank flanges fully bolted?	☐	☐		
13. Are sea and overboard discharge valves, when not in use, closed and visibly secured?	☐	☐		
14. Are all cargo and bunker tank lids closed?	☐	☐		
15. Is the agreed tank venting system being used?	☐	☐	AR	
16. Are hand torches of an approved type?	☐	☐		
17. Are portable VHF/UHF transceivers of an approved type?	☐	☐		
18. Are the ship's main radio transmitter aerials earthed and radars switched off?	☐			
19. Are electric cables to portable electrical equipment disconnected from power?	☐	☐		
20. Are all external doors and ports in the accommodation closed?	☐	☐	R	
21. Are air conditioning intakes which may permit the entry of cargo vapours closed?	☐	☐		
22. Are smoking requirements being observed?	☐	☐	R	
23. Are naked light requirements being observed?	☐	☐		
24. Is there provision for an emergency escape possibility?	☐	☐		

General	Ship	Terminal	Code	Remarks
25. Are sufficient personnel on board and ashore to deal with an emergency?	☐	☐	R	
26. Are adequate insulating means in place in the ship/shore connection?	☐	☐		
27. Have measures been taken to ensure sufficient pumproom ventilation?	☐			
28. Is the ship capable of "closed loading" and is this to be complied with if applicable?	☐	☐	R	
29. Are ship emergency fire control plans located externally?	☐	☐		

If the ship is fitted or required to be fitted with an Inert Gas System the following questions must be answered.

Inert Gas System	Ship	Terminal	Code	Remarks
30. Is the Inert Gas System fully operational and in good working order?	☐	☐	PR	
31. Have the fixed and portable oxygen analysers been calibrated and are they working properly?	☐		R	
32. Are all cargo tank atmospheres 8% or less oxygen content by volume and with positive pressure?	☐	☐	PR	
33. Are all the individual tank IG valves (if fitted) correctly set and locked?	☐		R	
34. Are all the persons in charge of cargo operations aware that in the case of failure of the Inert Gas Plant, discharge operations are to cease and the terminal to be advised?	☐			

If the ship is fitted with, and intends to Crude Oil Wash (COW) the following questions must be answered.

Crude Oil Washing	Ship	Terminal	Code	Remarks
35. Is the Pre-Arrival Crude Oil Washing Checklist, as contained in the approved Crude Oil Washing Manual, satisfactorily completed?	☐	☐		
36. Is the Crude Oil Washing Checklist for use before, during and after Crude Oil Washing, as contained in the approved Crude Oil Washing Manual, available and agreed to be used?	☐	☐	R	

RECOMMENDED MINIMUM SEGREGATION DISTANCES OF DANGEROUS GOODS AT TERMINALS AND IN WAREHOUSES IN PORT AREAS

The following table shows the general requirements for segregation between the various classes of dangerous goods.

SINCE THE PROPERTIES OF SUBSTANCES OR ARTICLES WITHIN EACH CLASS MAY VARY GREATLY, THE INDIVIDUAL SCHEDULES SHOULD ALWAYS BE CONSULTED FOR PARTICULAR REQUIREMENTS FOR SEGREGATION AS THESE TAKE PRECEDENCE OVER THE GENERAL REQUIREMENTS.

SEGREGATION SHOULD ALSO TAKE ACCOUNT OF A SINGLE SUBSIDIARY RISK LABEL.

CLASS		1.1 1.2 1.5	1.3	1.4	2.1	2.2	2.3	3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7	8	9
Explosives	1.1, 1.2, 1.5	*	*	*	4	2	2	4	4	4	4	4	4	2	4	2	4	X
Explosives	1.3	*	*	*	4	2	2	4	3	3	4	4	4	2	4	2	2	X
Explosives	1.4	*	*	*	2	1	1	2	2	2	2	2	2	X	4	2	2	X
Flammable gases	2.1	4	4	2	X	X	X	2	1	2	X	2	2	X	4	2	1	X
Non-toxic, non-flammable gases	2.2	2	2	1	X	X	X	1	X	1	X	X	1	X	2	1	X	X
Poisonous gases	2.3	2	2	1	X	X	X	2	X	2	X	X	2	X	2	1	X	X
Flammable liquids	3	4	4	2	2	1	2	X	X	2	1	2	2	X	3	2	X	X
Flammable solids	4.1	4	3	2	1	X	X	X	X	1	X	1	2	X	3	2	1	X
Spontaneously combustible substances	4.2	4	3	2	2	1	2	2	1	X	1	2	2	1	3	2	1	X
Substances which are dangerous when wet	4.3	4	4	2	X	X	X	1	X	1	X	2	2	X	2	2	1	X
Oxidizing substances	5.1	4	4	2	2	X	X	2	1	2	2	X	2	1	3	1	2	X
Organic peroxides	5.2	4	4	2	2	1	2	2	2	2	2	2	X	1	3	2	2	X
Poisons	6.1	2	2	X	X	X	X	X	X	1	X	1	1	X	1	X	X	X
Infectious substances	6.2	4	4	4	4	2	2	3	3	3	2	3	3	1	X	3	3	X
Radioactive materials	7	2	2	2	2	1	1	2	2	2	2	1	2	X	3	X	2	X
Corrosives	8	4	2	2	1	X	X	X	1	1	1	2	2	X	3	2	X	X
Miscellaneous dangerous substances and articles	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

LEGEND

* = Only substances and articles of class 1, division 1.4, should be permited for temporary storage in the port; they should be kept separated from all other cargoes.

Numbers and simbols relate to the following terms:

IN PORT AREAS

1 = Minimum distance of 3 m.
2 = Minimum distance of 10 m.
3 = Minimum distance of 30 m.

4 = In different warehouses or separated by fire resistant walls.

X = Consult individual IMDG Code schedules and segregate accordingly.

ON BOARD SHIPS

1 = "Away from"
2 = "Separated from"
3 = "Separated by a complete compartment or hold from"
4 = "Separated longitudinaly by an intervening complete compartment or hold from"
X = The segregation, if any, is shown in the individual schedules of the IMDG Code

REMARKS

- Class 6.2 should not be permitted for storage in port areas.
- For segregation of class 7 see appendix 3 of the IMO Recommendations on the Safe Transport, Handling and Storage of Dangerous Substances in Port Areas.
- Dangerous goods with poisonous (toxic) properties should be stored at least 50 m away from all foodstaff.
- If recommendations are followed, segregation as to (3) and (4) may only be applicable in rare cases of particular cargoes when individual schedules have to be consulted.

SEGREGATION FOR RADIOACTIVE MATERIALS ON SHORE

1 SEGREGATION FROM PERSONS

1.1 Limitation of the radiation exposure of persons should be based upon the maximum annual dose-equivalent limit of 5 mSv recommended by the International Commission on Radiological Protection (ICRP) for members of the public.

1.2 No Yellow Label package or freight container should be stored nearer to any place regularly frequented by persons than the minimum distances given in the table below, unless measurements taken by using an appropriate instrument show clearly that the radiation level at all points inside that place is less than 7.5 mSv/h. Where the package or freight container is not in a special store, the area covered by applying the table below should be barred or marked off. Entry into the special store or barred-off area should, for he purpose of essential duties only and the time spent in handling packages or freight containers, be kept to the minimum necessary. If the frequency of storage of packages or freight containers on the premises is such that persons on average over the year spend more than ten hours per week in the vicinity of the special store or barred-off area when such packages or freight containers are present, more stringent measures should be adopted (possibly including monitoring of radiation doses received). Guidance on this should be sought from national competent authorities or from the recommendations of the ICRP.

Table: Segregation of Yellow Label packages or freight containers from persons

Sum of transport indices	Segregation distances in metres*
Up to 5	4
Over 5 to 10	6
" 10 to 20	8
" 20 to 30	10
" 30 to 40	12
" 40 to 50	12
" 50 to 100) (2 or more stacks of packages	18
" 100 to 150) or freight containers, see 2.1	22
" 150 to 200) below)	26

1.3 These criteria may not be used in all countries. In such cases it may be necessary to comply with the provisions laid down by the relevant national competent authority.

2 SEGREGATION TO PREVENT CRITICALITY

2.1 Apart from segregation to reduce external radiation (in accordance with 1.2 above), certain types of packages or freight containers containing fissile material must be stacked in such a way as to eliminate any risk of criticality hazard. All such packages or freight containers (Fissile Classes II and III)

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* The segregation distance should be adhered to regardless of whether walls or ceilings intervene between the storage area and the occupied place.

carry a Yellow Label showing the Transport Index, which is specially devised to provide the necessary means of control. The following rules apply to all Yellow Label packages or freight containers.

.1 Except as provided in .2, the number of Yellow Label packages or freight containers stacked together must be limited so that the total number of Transport Indices does not exceed 50.

.2 In the case of large freight containers under full load conditions, the total number of Transport Indices may exceed 50 provided that the radiation level does not exceed 2 mSv/h at any point on and 100 mSv/h at 2 metres from the outside surface of the freight container and the allowable number of Fissile Class II or Fissile Class III packages is not exceeded in each large freight container.

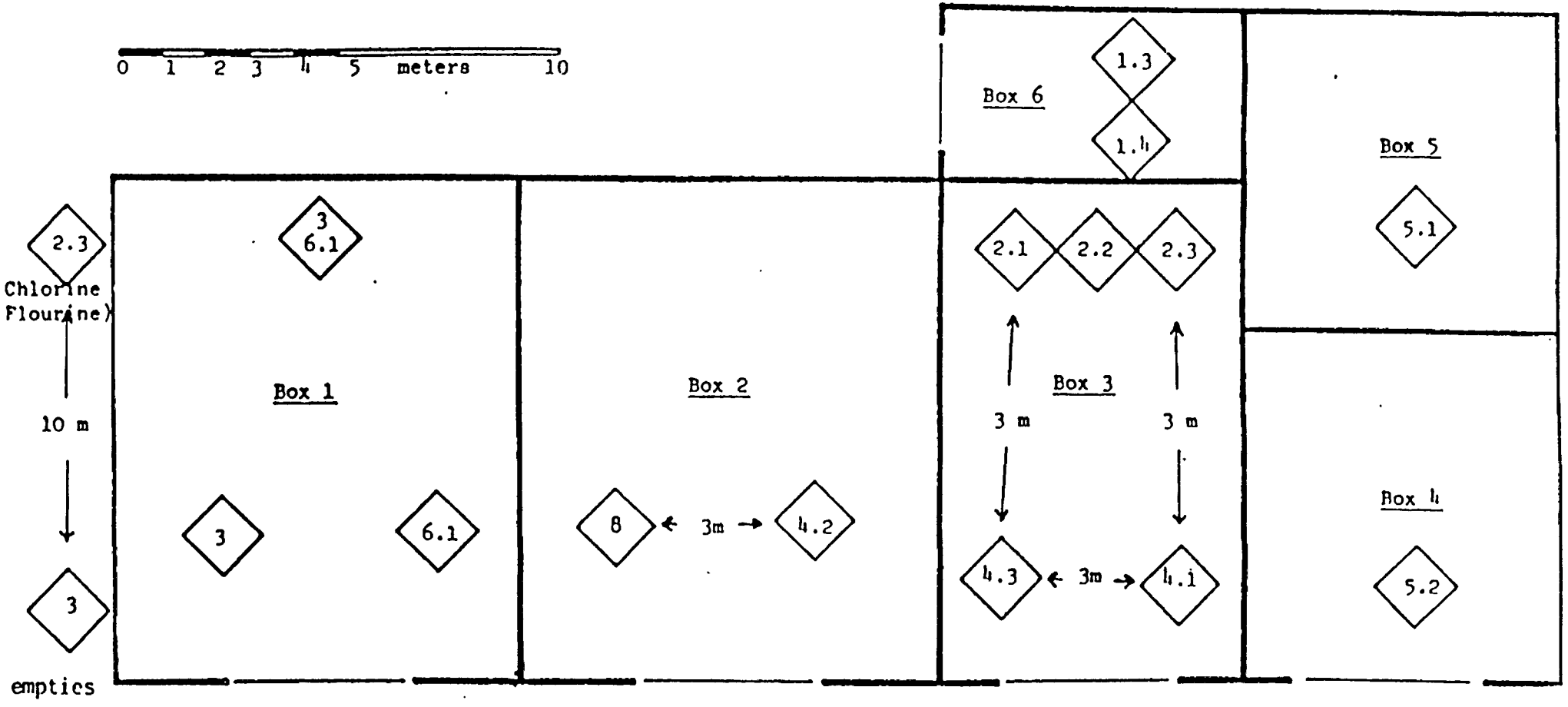
.3 A clear distance of 6 metres must be left between stacks of packages or of freight containers.

These rules must be applied regardless of whether the stacks are separated by walls or ceilings. There is no objection to the intervening space being used for the storage of other goods.

* * *

For smaller quantities and limited storage only

(from H.E.H.S. Wardelmann)



Construction: Solid floor
Fire resistant walls
Metal doors
Light roof
Closed drainage system

Safety Equipment: (In part alternatively)
Mechanical ventilation (ex-proof)
Fire detection (fixed)
Fire fighting (water spray and foam)
Portable extinguishers (chemical)
Warning signs
Floor and wall markings

Controlled from outside, separately for each box

Appendix 6.3

EMERGENCY SCHEDULE 6.1-02

TOXIC LIQUIDS, INCLUDING SUBSTANCES WHICH MAY LIQUEFY DURING TRANSPORT, NOT COVERED BY OTHER SCHEDULES

Special Emergency Equipment to be carried

Protective clothing (gloves, boots, coveralls, headgear).
Self-contained breathing apparatus..

EMERGENCY PROCEDURES

Wear protective clothing and self-contained breathing apparatus when dealing with SPILLAGE or FIRE.

EMERGENCY ACTION

Turn ship off wind.

	On deck	*Under deck*
SPILLAGE	Collect spillage, where practicable, using absorbent material for safe disposal. Wash remainder overboard with copious quantities of water.	Provide adequate ventilation. Collect spillage, where practicable, using absorbent material, for safe disposal.
FIRE	Use copious quantities of water or other media to fight fire. If possible remove receptacles likely to be involved or keep them cool with copious quantities of water.	Batten down; use ship's fixed fire-fighting installation. Otherwise adopt action as for "On deck".

First Aid – See IMO Medical First Aid Guide (MFAG)

UN No.	Substance or Article	Remarks
–	METHYLBROMOACETONE	Spillage may be gaseous.
1647	METHYL BROMIDE AND ETHYLENE DIBROMIDE MIXTURES, LIQUID	
1693	TEAR GAS SUBSTANCES, LIQUID, N.O.S.	
2017	AMMUNITION, TEAR PRODUCING, NON-EXPLOSIVE, with neither burster nor expelling charge, non-fuzed	

TABLE 340

CHLORINATED HYDROCARBONS

General information

These chemicals vary in their degree of toxicity. They may be irritant to the skin and lungs.

They are also absorbed into the body causing depression of the nervous system and some may cause damage to the liver.

Prolonged exposure to these chemicals may cause long-term effects. They may produce highly toxic fumes of phosgene(Table 600) if they are involved in a fire.

The following chemicals are extremely toxic and may cause death: methyl chloride, allyl chloride, chloroform, ethylene dichloride, carbon tetrachloride, pentachloroethane and tetrachloroethane.

RADIO FOR MEDICAL ADVICE.

SIGNS AND SYMPTOMS	TREATMENT
Skin contact There may be redness and irritation. Chemical burns can occur with some of these chemicals. They can be absorbed through the intact skin causing symptoms similar to those of inhalation (see below).	*Skin contact* Emergency treatment: see 8.1.
Eye contact There may be redness and severe irritation.	*Eye contact* Emergency treatment: see 8.2.
Inhalation In mild cases there may be a cough, sneezing and slight breathlessness. In more severe cases, this may be followed by drowsiness, headache, nausea, vomiting and diarrhoea. Severe shortness of breath with frothy sputum (pulmonary oedema) can occur. The patient may become drowsy, unconscious and occasionally develop convulsions. Liver failure and kidney failure may occur after 2 or 3 days.	*Inhalation* Emergency treatment: see 8.3. Pulmonary oedema: see 6.1.2. Convulsions: see 6.3.2. Liver failure: see 6.4.5. Kidney failure: see 6.5.1.
Ingestion There may be nausea, vomiting, abdominal pain and headache. Drowsiness and unconsciousness may develop, convulsions can occur. Liver and kidney failure may occur 2 or 3 days after exposure.	*Ingestion* Emergency treatment: see 8.4. Convulsions: see 6.3.2. Liver failure: see 6.4.5. Kidney failure: see 6.5.1.

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(from K. Brunings)

Categories of personnel

5.4 Target group: Top and senior managers

Main objectives: Related to legal (port regulations), financial, administrative and organizational questions.

Duration: One to two days (could be part of a seminar covering other topics as well).

Principal approach: Symposium or seminar with lectures, question periods, panel discussion.

Lecturers or instructors: High quality lecturers with good reputation and international experience.

Place and venue: National event, could also be run locally, but should take place at a convenient location (e.g. hotel).

Teaching technics: Lectures with selected audio-visual teaching aids, discussions.

Examination: None

Evaluation: Not suitable; if at all then verbal.

Incentives: None

5.5 Target group: Middle management

Main objectives: Safety risks and principles, international requirements, national/local regulations and practice and their improvement, port relationship and cooperation.

Duration: Thirty to forty hours (one week).

Principle approach: Seminar or course with lectures, working groups, question periods, site tours.

Lecturers or instructors: Well experienced lecturers with a practical background.

Place and venue: Locally organized in suitable course facilities.

Teaching technics: Lectures with selected audio-visual teaching aids; informal atmosphere; working groups could be formed to deal with locally important questions; a practical approach should be aimed at and questions should be permitted at all times.

Examination: Not recommended; if thought necessary as incentive and control, the multiple-choice tests should be used.

Evaluation: Written course/seminar evaluation on an anonymous basis.

Incentives: Certificate of attendance; coffee and tea provided, if possible lunch.

5.6 Target group: Managers with sole responsibility for dangerous cargoes, safety and emergency personnel.

Main objectives: Some theoretical and detailed practical knowledge of all related aspects; basic methodologies of knowledge transfer.

Duration: Depending on possibilities, but two weeks are the absolute minimum, better would be two months.

Principle approach: Intensive course and study tour with few participants, covering theory and practice; on-the-job training.

Lecturers or instructors: Experienced and practical lecturers and instructors with appropriate professions, including a chemist, a master mariner, a fireman, a port operations and safety expert, a port trainer.

Place and venue: Different localities; if possible, part of the training should be performed abroad; on-the-job training at home.

Teaching technics: Some lectures; working groups; role play; site visits; attachment to port safety departments in industrialized countries; participation in specialized courses (e.g. fire fighting); individual approach.

Examination: Selected multiple-choice tests after certain parts of the training.

Evaluation: End-of-training evaluation in writing.

Incentives: Certification; living allowance etc.

5.7 Target group: Dockworkers and stevedores

Main objectives: Basic operational safety awareness; first minute emergency actions.

Duration: About 25 hours

Principle approach: Practically orientated instructions, based on working environment of trainees.

Lecturers or instructors: Port instructors of the training centre or officer of safety services.

Place and venue: Locally organized; any suitable room within the port and the working places of the trainees.

Teaching technics: Simple instructional lessons and audio-visual aids; simple demonstrations; black-board drawings; discussions.

Examination: Basic multiple-choise test.

Evaluation: None

Incentives: Certificate of attendance; paid-for coffee, tea and lunch; normal pay; course to be part of skilled worker status.

RESOLUTION A.537(13)

Adopted on 17 November 1983
Agenda item 10(b)

TRAINING OF OFFICERS AND RATINGS RESPONSIBLE FOR CARGO HANDLING ON SHIPS CARRYING DANGEROUS AND HAZARDOUS SUBSTANCES IN SOLID FORM IN BULK OR IN PACKAGED FORM

THE ASSEMBLY,

RECALLING Article 16(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations concerning maritime safety,

RECALLING ALSO resolutions 11 and 13 of the International Conference on Training and Certification of Seafarers, 1978, which invite the Organization to consider provisions concerning the handling of hazardous or noxious dry chemicals in bulk and the training of officers and ratings of ships carrying dangerous and hazardous cargoes other than in bulk,

BEING OF THE OPINION that the usefulness of the International Maritime Dangerous Goods Code and the Code of Safe Practice for Solid Bulk Cargoes would be greatly enhanced through pertinent training of officers and ratings,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its forty-eighth session,

1. ADOPTS

   (a) The Recommendation on Training of Officers and Ratings Responsible for Cargo Handling on Ships Carrying Dangerous and Hazardous Substances in Solid Form in Bulk set out in Annex 1 to the present resolution; and

   (b) The Recommendation on Training of Officers and Ratings Responsible for Cargo Handling on Ships Carrying Dangerous and Hazardous Substances in Packaged Form, set out in Annex 2 to the present resolution;

2. RECOMMENDS Member Governments to take account of the guidance contained in Annexes 1 and 2 to the present resolution when considering training of officers and ratings.

ANNEX 1

RECOMMENDATION ON TRAINING OF OFFICERS AND RATINGS RESPONSIBLE FOR CARGO HANDLING ON SHIPS CARRYING DANGEROUS AND HAZARDOUS SUBSTANCES IN SOLID FORM IN BULK

1 PREAMBLE

1.1 Training should be divided into two parts, a general part on the principles involved and a part on the application of such principles to ship operation. Any of this training may be given at sea or ashore. Such training should be supplemented by practical instruction at sea and, where appropriate, in a suitable shore-based installation. All training and instruction should be given by properly qualified personnel.

2 PRINCIPLES

2.1 Elementary science

2.1.1 The important physical characteristics and chemical properties of dangerous and hazardous substances, sufficient to give a basic understanding of the intrinsic hazards and risks involved.

2.2 Classification of materials possessing chemical hazards

2.2.1 IMO classes 4-9 and materials hazardous only in bulk (MHB). The hazards associated with each class.

2.3 Health hazards

2.3.1 Dangers from skin contact, inhalation, ingestion and radiation.

2.4 Conventions, regulations and recommendations

2.4.1 General familiarization with the relevant requirements of chapters II-2 and VII of the 1974 SOLAS Convention.

2.4.2 General use of and familiarization with the Code of Safe Practice for Solid Bulk Cargoes (BC Code) with particular reference to:

.1 safety of personnel including safety equipment, measuring instruments, their use and practical application, and interpretation of results;

.2 hazards from cargoes which may liquefy; and

.3 materials possessing chemical hazards.

2.4.3 General familiarization with the IMO Recommendations on the Safe Transport, Handling and Storage of Dangerous Substances in Port Areas.

3 SHIPBOARD APPLICATION

3.1 Handling, stowage and segregation

3.1.1 Class 4.1 — Flammable solids

Class 4.2 — Flammable solids or substances liable to spontaneous combustion

Class 4.3 — Flammable solids or substances which in contact with water emit flammable gases

Measures used to prevent heating, ignition or the emission of toxic or flammable gases.

3.1.2 Class 5.1 — Oxidizing substances

Reaction with acids.

Sensitivity to heat.

Explosive decomposition.

Separation from combustible materials.

3.1.3 Class 6.1—Poisonous (toxic) substances

Contamination of foodstuffs.

Working areas and living accommodation.

Ventilation.

3.1.4 Class 7 — Radioactive materials

Types of ores and concentrates.

Full load shipments.

Segregation.

Decontamination.

3.1.5 Class 8 — Corrosives

Dangers from wetted substances.

3.1.6 Class 9 — Miscellaneous dangerous substances

Examples and associated hazards.

3.1.7 Materials hazardous only in bulk (MHB)

Emission of flammable or poisonous gases when wet.

Spontaneous heating.

Oxygen depletion.

Anaerobic degradation with methane emission.

3.2 Safety precautions and emergency procedures

3.2.1 Electrical safety in cargo spaces.

3.2.2 Precautions to be taken for entry into enclosed spaces that may contain oxygen-depleted, poisonous or flammable atmospheres.

3.2.3 The possible effects of fire in shipments of substances of each class.

3.2.4 Emergency Procedures for Ships Carrying Dangerous Goods.

Emergency plans and procedures to be followed in case of incidents involving dangerous and hazardous substances. The use of individual entries in the Code of Safe Practice for Solid Bulk Cargoes in this respect.

3.3 Medical first aid

3.3.1 The IMO Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG).

Use and application in association with other guides.

Medical advice by radio.

ANNEX 2

RECOMMENDATION ON TRAINING OF OFFICERS AND RATINGS RESPONSIBLE FOR CARGO HANDLING ON SHIPS CARRYING DANGEROUS AND HAZARDOUS SUBSTANCES IN PACKAGED FORM

1 PREAMBLE

1.1 Training should be divided into two parts, a general part on the principles involved and a part on the application of such principles to ship operation. Any of this training may be given at sea or ashore. Such training should be supplemented by practical instruction at sea and, where appropriate, in a suitable shore-based installation. All training and instruction should be given by properly qualified personnel.

2 PRINCIPLES

2.1 Elementary science

2.1.1 The important physical characteristics and chemical properties of dangerous and hazardous substances, sufficient to give a basic understanding of the intrinsic hazards and risks involved.

2.2 Classification of dangerous and hazardous substances and materials possessing chemical hazards

2.2.1 IMO classes 1-9 and the hazards associated with each class. Materials hazardous only in bulk (MHB)

2.3 Health hazards

Dangers from skin contact, inhalation, ingestion and radiation.

2.4 Conventions, regulations and recommendations

2.4.1 General familiarization with the relevant requirements of Chapters II-2 and VII of the 1974 SOLAS Convention and of Annex III of the 1973/78 MARPOL instrument.

2.4.2 General familiarization with the IMO Recommendations on the Safe Transport, Handling and Storage of Dangerous Substances in Port Areas.

2.5 General use of and familiarization with the International Maritime Dangerous Goods (IMDG) Code

2.5.1 Declaration, documentation, packing, labelling and placarding. Freight container and vehicle packing. Portable tanks, tank containers and road tank vehicles, and other transport units for dangerous substances.

2.5.2 General requirements for stowage, securing, separation and segregation in different ship types.

General cargo ships.

Ro-ro ships.

Container ships.

Shipborne barges on barge-carrying ships.

Combination carriers.

2.5.3 Safety of personnel including safety equipment, measuring instruments, their use and practical application and interpretation of results.

3 SHIPBOARD APPLICATION

3.1 Handling, stowage and segregation

3.1.1 Class 1 — Explosives

Hazard divisions, compatibility groups and stowage categories.

Suitability of cargo spaces.

Magazines.

Security.

Segregation within class 1.

3.1.2 Class 2 — Gases (compressed, liquefied or dissolved under pressure) flammable, non-flammable and toxic

Types of pressure vessels and portable tanks.

Relief and closing devices.

3.1.3 Class 3 — Flammable liquids

Classes.

Receptacles, tank containers and portable tanks.

Road tank vehicles.

Empty receptacles.

Ventilation and drainage of compartments.

3.1.4 Class 4.1 — Flammable solids

Class 4.2 — Flammable solids or substances liable to spontaneous combustion

Class 4.3 — Flammable solids or substances which in contact with water emit flammable gases

Measures used to prevent heating, ignition, or the emission of toxic or flammable gases.

3.1.5 Class 5 — Oxidizing substances (agents) and organic peroxides

Reaction with acids.

Sensitivity to heat.

Explosive decomposition.

Prevention of spillage.

Separation from combustible materials.

3.1.6 Class 6 — Poisonous (toxic) and infectious substances

Prevention of leakage.

Contamination of foodstuffs.

Working areas and living accommodation.

Ventilation.

3.1.7 Class 7 — Radioactive substances

Types of packages.

Full load shipments.

Segregation.

Decontamination.

Transport index.

Stowage limitations.

3.1.8 Class 8 — Corrosives

Dangers from leakage and spillage.

Dangers from wetted substances.

3.1.9 Class 9 — Miscellaneous dangerous substances

Examples and associated hazards.

3.1.10 Materials hazardous only in bulk (MHB)

Examples and associated hazards.

3.2 Safety precautions and emergency procedures

3.2.1 Electrical safety in cargo spaces.

3.2.2 Precautions to be taken for entry into enclosed spaces that may contain oxygen-depleted, poisonous or flammable atmospheres.

3.2.3 The possible effects of spillage or fire in shipments of substances of each class.

3.2.4 Consideration of events on deck or below deck.

3.2.5 IMO Emergency Procedures for Ships Carrying Dangerous Goods.

Emergency plans and procedures to be followed in case of incidents involving dangerous substances.

3.3 Medical first aid

3.3.1 The IMO Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG).

Use and application in association with other guides.

Medical advice by radio.

ANNEX 9

INTERNATIONAL MARITIME ORGANIZATION

4 ALBERT EMBANKMENT.
LONDON SE1 7SR

Telephone: 071-735 7611
Telegrams: INTERMAR-LONDON SE1
Telex: 23588
Telefax: 071-587 3210

IMO

MSC/Circ.559
20 June 1991

Ref. T3/1.06

CARRIAGE OF DANGEROUS GOODS

Guidelines to ensure the reporting to the Organization of incidents involving dangerous goods and marine pollutants in packaged form on board ships and in port areas

1 The Maritime Safety Committee, at its fifty-ninth session (13 to 24 May 1991), approved the "Form for reporting incidents involving dangerous goods and marine pollutants in packaged form on board ships and in port areas", developed by the Sub-Committee on the Carriage of Dangerous Goods (CDG 42/22, annex 6) with a few modifications (MSC 59/33, paragraph 8.15).

2 The Maritime Safety Committee recalled that, in accordance with SOLAS regulation I/21 (Casualties):

"(a) Each Administration undertakes to conduct an investigation of any casualty occurring to any of its ships subject to the provisions of the present Convention when it judges that such an investigation may assist in determining what changes in the present regulations might be desirable*.

(b) Each Contracting Government undertakes to supply the Organization with pertinent information concerning the findings of such investigations. No reports or recommendations of the Organization based upon such information shall disclose the identity or nationality of the ships concerned or in any manner fix or imply responsibility upon any ship or person.

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* Reference is made to the recommendations on "Exchange of information for investigations into marine casualties" and on "Personnel and material resource needs of Administrations for the investigation of casualties and contraventions of conventions" adopted by the Organization by resolutions A.440(XI) and A.442(XI)."

3 The Maritime Safety Committee agreed that the purpose of such investigations was the assessment of the effectiveness of existing regulations and the identification of areas for improvements.

4 Governments are invited to exchange information on incidents involving dangerous goods and marine pollutants in packaged form on board ships and in port areas.

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ANNEX

FORM FOR REPORTING INCIDENTS INVOLVING DANGEROUS GOODS AND MARINE POLLUTANTS IN PACKAGED FORM ON BOARD SHIPS AND IN PORT AREAS

1 This report is a supplement to the report made by the master in accordance with the guidelines and general principles adopted by the Organization*/ in case of an incident involving dangerous goods and marine pollutants in packaged form on board ships and in port areas.

2 The form should be completed in case of:

.1 an accident with loss of life, injury or damage to ship or property; or

.2 an incident, where an unsafe situation, an emergency or loss has occurred involving dangerous goods in packaged form and marine pollutants.

3 The form should be completed by the Administration carrying out the investigation, if necessary in consultation with other parties involved (e.g. authorities of ports of loading, transit or discharge, etc.) and forwarded to the International Maritime Organization (IMO)**/ together with recommendations, if considered necessary, for rectifying any detected deficiencies.

4 The summary and recommendations of any subsequent investigations should also be reported to the Organization.

5 If necessary, additional information should be given on separate sheets.

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* Reference is made to the "General principles for ship reporting systems and ship reporting requirements, including guidelines for reporting incidents involving dangerous goods, harmful substances and/or marine pollutants" adopted by the Organization by resolution A.648(16).

** The completed form and any further report or reports should be sent to: The International Maritime Organization, 4 Albert Embankment, London SE1 7SR, United Kingdom.

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INCIDENT REPORT FOR DANGEROUS GOODS AND MARINE POLLUTANTS IN PACKAGED FORM

Incident occurred on board ship					
1 Name of ship	2 Distinctive No. or letters	3 Type of ship	4 Year of construction	5 Flag	6 Gross tonnage

Incident occurred in port area		
7 Name of port	8 Country	9 Type of terminal/operating area

10 Date of incident day-month-year	11 Time of incident (local time)	12 Type of incident	13 Name and flag of other ships involved

14 Position of ship at time of incident	15 Sea and weather conditions at time of incident	16 Last port of call and date of sailing	17 Port of next destination

18 Description of dangerous goods and marine pollutants involved

Proper shipping name		Type of packages, portable tank, tank vehicle, freight container, other cargo transport unit, or barge	
UN number		Marking according to IMDG Code Marking according to CSC	
IMO hazard class (subsidiary risk and whether marine pollutant if applicable)		Stowage or storage of the goods	
		Quantity and condition of the goods	
Name of manufacturer(s) of goods and country of origin		Port of loading of the goods	
Date of manufacture, if available			

19
Brief account of the sequence (including cause) of events of the incident:

20
Brief account of the extent of damage:

21
Emergency response measures taken:

22 Number of fatalities	23 Number of persons injured	24 Extent of pollution	25 Loss of dangerous goods or marine pollutants

26
Comments on compliance with applicable convention/recommendation requirements:

27
Comments on effectiveness of applicable convention/recommendation requirements:

28
Measures/recommendations to prevent recurrence:

29	
Is a further investigation to be carried out: Yes/No	If yes, further report should be forwarded in due course.

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30

Time and location of inspection:

31

Person completing this form:

Name

Title

Address

Telephone
Telefax
Telex

Signature

Date

+ + + +