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WORLD MARITIME UNIVERSITY
Malmö, Sweden

**PROPOSALS FOR FURTHER IMPROVEMENT
OF SEA TRANSPORTATION OF DANGEROUS
CARGOES CARRIED IN FREIGHT
CONTAINERS IN CHINA**

By

XU CUIMING
People's Republic of China

A dissertation submitted to the World Maritime University
in partial fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE

in

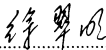
**GENERAL MARITIME ADMINISTRATION
&
ENVIRONMENT PROTECTION**

1996

DECLARATION

I certify that all the materials in this dissertation 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

With the rapid development of foreign trade there has been a high rate of growth in the maritime transportation of dangerous cargoes. The transport by sea of dangerous cargoes incorporates, by nature, a higher risk than the shipment of non-hazardous cargoes. Safety is one of the most important aspects which must be seriously considered by the appointed specialised competent authorities. Therefore, the safe transport by sea of dangerous cargoes is regarded as one of the major objectives by the Maritime Safety Administration.

This paper is a study of safe transport by sea of dangerous cargoes in freight containers. It briefly describes the present situation of sea transportation of dangerous cargoes in the People's Republic of China and emphasises the particular role of China's MSA in relation to the supervision and control of vessels carrying dangerous cargoes in freight containers. It analyses a number of weaknesses or problems that have arisen due to non-compliance with the requirements of international conventions and codes and national regulations concerning sea transportation of packaged dangerous cargoes. It also makes a comparison with the practices between developed countries and China with proposals on the further improvement of transport by sea of dangerous cargoes in freight containers in China.

This study will help Chinese Maritime Safety Administration to further improve its practices in transport chain of packaged dangerous cargoes carried by vessels.

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LIST OF ABBREVIATIONS

BC Code	The Code of Safe Practice for Solid Bulk Cargoes
CES	Centralised Examination Station
CFR	Code of Federal Regulations
CIP	Container Inspection Program
CITAT	Container Inspection Training and Assistance Team
CLC 69	The International Convention on Civil Liability for Oil Pollution Damage 1969
COSCO	China Ocean Shipping (Group) Company
CSC 72	International Convention for Safe Containers, 1972
DOT	Department of Transport
ECOSOC	Economic and Social Council
EmS No.	Emergency Schedule Number
FAA	Federal Aviation Administration
FHWA	The Federal Highway Administration
FRA	Federal Railroad Administration
HMTA	The Hazardous Materials Transportation Act
HNS	
Convention	The International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, 1996
HSA	Harbour Superintendency Administrations of the People's Republic of China
IBCs	Intermediate Bulk Containers
IMDG Code	International Maritime Dangerous Goods Code
IMO	International Maritime Organisation

IMO/ILO	
Guidelines	IMO/ILO Guidelines for Packing Cargo in Freight Containers or Vehicles
ISCA	The International Safe Convention Act
MARPOL	
73/78	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto Prevention of Pollution from Ships, 1973
MFAG	Medical First Aid Guide
MOU	Memorandum of Understanding
MSA	Maritime Safety Administration
N.O.S	Not Otherwise Specified
OHMS	Office of Hazardous Materials Safety
PRC	People's Republic of China
PWSA	Ports and Waterways Safety Act
RSPA	Research and Special Programs Administration
SOLAS	International Convention for the Safety of Life at Sea, 1974
TEU	Twenty Foot Equivalent Unit
USA	United States of America
USCG	United States Coast Guard
USCS	United States Customs Service
WMU	World Maritime University

Chapter 1

Introduction

1.1 Background to the Study

The rapid development of industry and foreign trade has brought about an increase in the volume of dangerous cargoes transported all over the world, and it is obvious that within the last decades, there has been a high rate of growth in the maritime transportation of dangerous cargoes. The transport by sea of dangerous cargoes incorporates, by nature, a higher risk than the shipment of non-hazardous cargoes. Awareness and consciousness, applied precautions, good management, good equipment and regular training of personnel can minimise the risk, but will never totally eliminate it. In this respect it is important to understand that the human factor plays the most important role, since at least 60% of industrial accidents are linked to human failure. Thus, there will never be a 100% safety level and, in spite of all efforts made, accidents may happen and seriously threaten the safety of vessels, property, human lives and the marine environment. Safety is one of the most important aspects, which must be considered by the specialised competent authorities. Therefore the safe transport by sea of dangerous cargoes is regarded as one of the major objectives by the Maritime Safety Administration (MSA) of the Ministry of Communications of the People's Republic of China.

In this context, being the regulatory governmental organisation, “the Maritime Safety Administration” is entirely responsible for the safety supervision and control of vessels carrying dangerous cargoes and protection of the marine environment. “The carriage of dangerous cargoes in freight containers” is considered to be an important subject to study.

1.2 Objective of the Study

The objective of this study is to clarify the particular role of China’s MSA in relation to the sea transport of dangerous cargoes within its general responsibilities and address the weaknesses or problems in sea transport of dangerous cargoes in freight containers in China. In order to rectify the problems it is necessary to identify them first. Therefore the author attempts to make a comparison between China and developed countries so as to draw necessary attention and enough awareness to this particular area. If the attempt is successful, the relevant organisations will better understand certain problems and consider taking the measures proposed by the author or remedy them in order to fully comply with the requirements of conventions and codes concerned. This study will help the relevant organisations further improve their work in the particular area, especially the carriage of dangerous cargoes in freight containers in order to prevent accidents and to further ensure the safety of vessels, property and human life and protect the marine environment.

1.3 Methodology and Scope of the Study

This paper is a study of the safe transport of dangerous cargoes in packaged form. The methodology is to briefly introduce the general situation of sea transport of dangerous cargoes in China, to analyse the existing problems in sea transport of dangerous cargoes in packaged form in China, to compare with the practices between China and developed countries. Some proposals are made for further improvement

of transport by sea of dangerous cargoes carried in freight containers in China according to the requirements of the applicable international conventions and regulations and developed countries' experiences in this regard.

This paper consists of six chapters. **Chapter 1** gives a short introduction to the background, the objective of this study and the methodology and scope of this study.

Chapter 2 briefly introduces the general situation of sea transport of dangerous cargoes in P.R.C., including a brief overview of the development of sea transportation of dangerous cargoes, the relevant authorities, their organisational structure and functions and especially the Maritime Safety Administration's functions regarding the supervision and control of vessels carrying dangerous cargoes in freight containers.

Chapter 3 analyses the present problems and causes affecting the safety of sea transportation of dangerous cargoes in freight containers in China. The analysis covers legislation and enforcement, packaging quality, containers packing, accidents due to inadequate cargo information, violating operation regulations, stowage and segregation, packing certificates, placarding and overboard losses of packaged dangerous cargoes.

Chapter 4 gives a general introduction to the applicable international regulations and national legislation that address the problems identified in the previous chapters, including international conventions focusing on the safety and on prevention of marine pollution and on liability and compensation regarding the carriage of packaged dangerous cargoes by sea and Chinese national legislation concerning sea transport of dangerous cargoes in packaged form.

Chapter 5 makes a comparison with the practices between China and developed countries in this regard and also makes proposals regarding the further improvement of sea transportation of dangerous cargoes in freight containers in China. The proposals cover legislation and enforcement, container inspection program, packaging quality, containers packing, stowage and segregation, documentation, placarding and marking, use of security seals, education and training, co-ordination and co-operation.

Chapter 6 concludes the study by giving recommendations for further improvement of sea transportation of dangerous cargoes in containers in China in order to be totally in line with the international conventions and regulations concerned and catch up with the advanced countries in this particular sector of sea transportation.

Chapter 2

General Situation of Sea Transportation of Dangerous Cargoes in the People's Republic of China

Sea transport of dangerous cargoes has been practised for more than one hundred years. However, it was not until the 1960's that it began to develop at a high speed. The Chinese Government has been paying much attention to this particular field since China entered the international maritime market of moving dangerous cargoes. Nevertheless, it is only a little more than ten years since China realised the importance to line up to international standards.

The transport of dangerous cargoes involves a number of governmental organisations. It goes without saying that to ensure the safety of sea transport of dangerous cargoes, it is necessary for all those governmental organisations and others to co-operate and make a united effort. This chapter will briefly introduce the situation in China today and describe the main functions of the departments pertaining to the transport of dangerous cargoes, especially regarding the transport by sea of dangerous cargoes carried in freight containers and emphasise the particular role of Chinese MSA in relation to the sea transport of dangerous cargoes within its general responsibilities.

2.1 Brief Overview of the Development of the Sea Transport of Dangerous Cargoes

The transport by sea of dangerous cargoes has been very rapidly developed and the requirements of technology and management will become greater and greater. The people who are responsible for dangerous cargoes should have an understanding of the present tendency and the regularity of its development. Today, it is estimated that more than 50% of packaged goods and bulk cargoes transported by sea can be regarded as dangerous, hazardous and/or harmful to the environment according to the International Maritime Organisation (IMO) criteria. The cargoes concerned include products which are transported in bulk, such as solid or liquid chemicals and other materials, gases and products for and of the oil refinery industry, and wastes. Some of these substances, materials and articles are dangerous or hazardous from a safety point of view, and are also harmful to the marine environment; others are only hazardous when carried in bulk and some may be considered as harmful to the marine environment. Between 10% to 15 % of the cargoes transported in packaged form including shipborne barges on barge-carrying ships, freight containers, bulk packagings, portable tanks, tank-containers, road-tankers, swap-bodies, vehicles, trailers, intermediate bulk containers (IBCs), unit loads and other cargo transport units, fall under these criteria. To ensure safety and pollution prevention, appropriate measures have to be taken, taking into account the properties of the cargoes and the form of transportation. In the last 3 decades, the two forms of the carriage of cargoes in conventional packaging form and bulk cargoes have been greatly developed. The single package form has developed into many packaging forms mentioned above.

As the world becomes increasingly industrialised and as industry itself becomes ever more complex, the transport by sea of these cargoes will continue to rise and the lists of products will grow. It is essential, if shipping is to maintain and improve its safety

record, that these cargoes should be handled, transported and stored with the greatest possible care.

The development of transportation should be applicable to the development of the economy and the technology and the actual situation in China. According to its present situation, the Chinese maritime policies are mainly focused on containerisation, not only in ship building and purchasing of ships but also in port and terminal construction and the development of ports and harbours where the trend is towards specialisation and containerisation. In recent years China has put tremendous emphasis on port development. More than \$ 8 billion were invested in ports between 1988 and 1994, with most of the investment going into container, dry and liquid bulk terminals. Container terminal capacity in China's ports is now well in excess of 3 million TEU. Some container ports, such as Shanghai, Tianjin and Dalian experience high utilisation of their capacity, while others are grossly underutilised. Altogether there are now ten coastal ports with dedicated container terminals, with another four under construction and a further three in planning. In addition several Yangtze river ports such as Nanjing and Wuhan have developed container terminals and others are being planned. Fifty two dedicated container ship's berths were completed by the end of 1995. About 5,330,000 TEU are handled per year. The total volume of transportation of dangerous cargoes has been increasing significantly, and it is estimated to account for 3.5% of all containerised cargoes shipped.

2.2 The Authorities Related to the Transport of Dangerous Cargoes in China

2.2.1 Organisations Involved in the Transport of Dangerous Cargoes

Different modes of transport are involved in different management organisations or governmental agencies. The following Ministries and agencies, under the leadership

of the State Council, are in general responsible for the management of dangerous cargoes according to the division of their work:

The State Planning and Economy Committee;
The Ministry of Chemical Industry;
The Ministry of Domestic Trade;
The Ministry of Foreign Economy and Trade Cooperation;
The Civil Aviation Administration of China;
The Ministry of Communications;
The Ministry of Railway;
The Ministry of Agriculture;
The Ministry of Public Security;
The Ministry of Hygiene;
The Nuclear Safety Bureau;
The National Environment Protection Agency;
The National Commodity Inspection Department.

2.2.2 Organisational Structure and Functions of Authorities Related to Sea Transportation of Dangerous Cargoes

2.2.2.1 Organisational Structure

The Ministry of Communications is the major responsible department of the Government for maritime transport, and its subordinate bodies—Harbour Superintendency Administrations of P.R.C. (HSA) under the Ministry of Communications are the competent authorities solely responsible for the supervision of the safety of traffic in the coastal waters of this country in accordance with Maritime Traffic Law of P.R.C. and responsible for the prevention of marine pollution according to Marine Environment Protection Law of P.R.C.. Other

departments are the Ministry of Public Security and the Ministry of Hygiene. Specialised agencies and authorities established within the above-mentioned departments are responsible for the safety of transport of dangerous cargoes and prevention of marine pollution. The organisational structure related to sea transport of dangerous cargoes is as shown in Figure 1.

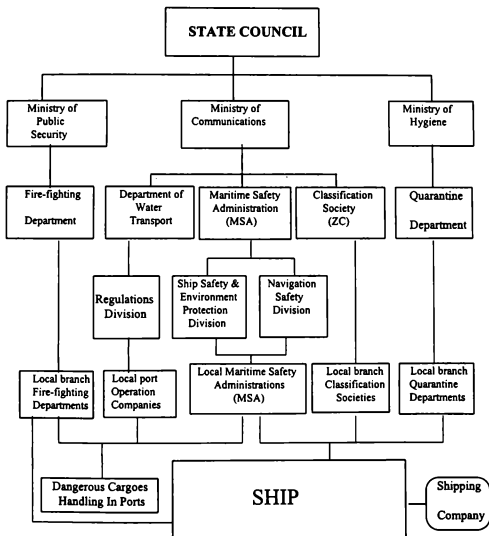


Figure 1: Organisational Structure in Relation to Transport by Sea of Dangerous Cargoes in China

2.2.2.2 Organisational Functions

The ministries and departments mentioned above, under the leadership of the State Council, are mainly responsible for macro-control, through making rules and regulations and being responsible for supervising the implementation of them. However, regarding their work involvement in dangerous cargoes, their functions are as follows:

The Ministry of Public Security is responsible for making rules and regulations concerning supervision and control of explosives and fire-fighting. Its local fire-fighting departments deal with actual fire-fighting in ports.

The Ministry of Hygiene is responsible for making rules and regulations concerning the safety and prevention of accidents from radioactive materials and toxic substances. Its local quarantine departments handle the epidemic situations and epidemic prevention .

The National Commodity Inspection Department is a department recognised by the competent authority (the Bureau of Harbour Superintendency of P.R.C.) which is listed in Section 22 of the IMDG Code, is responsible for the testing of packagings in Annex 1 to the IMDG Code and for issuing the certificates after testing. This department is not shown in Figure 1.

The Ministry of Communications is entirely responsible for the safety of vessels carrying dangerous cargoes and handling dangerous cargoes and the prevention of marine environment pollution according to international conventions and codes ratified by China. There are some specialised entities within the Ministry of Communications, such as COSCO, the Classification Societies, the Department of

Water Transport and the Maritime Safety Administrations (MSA). The functions of the specialised entities related to dangerous cargoes are as follows:

China Ocean Shipping (Group) Company (COSCO) lies at the core of the newly created COSCO Group which has three other main operating units: China Ocean Shipping Agency, China Marine Bunker Supply Company and China Road Transportation Company. Though maritime transport dominates, the group is also highly diversified with operations spread across the globe.

The COSCO Group has over 300 subsidiaries in China and abroad, including 70 overseas offices. It is mainly engaged in shipping, ship agency, marine bunker supply, and road transportation. Currently, the group has 8 shipping companies based in Guangzhou, Shanghai, Tianjin, Qingdao, Dalian, Lianyungang, Shenzhen and Xiamen, and operates 600 vessels of 15 million dwt. Its fleet is modern and multi-functional, consisting of container ships and general cargo ships. In all, the group serves 1,100 ports in over 150 countries and regions.

The COSCO Group is responsible for the safety of their vessels and prevention of pollution from ships. Nowadays almost every general cargo ship carries some dangerous cargoes. In order to ensure safety of transportation, shipping companies are responsible for choosing and arranging the vessels which should provide suitable carriage conditions such as vessel structure, electronic equipment, ventilation and fire-fighting etc. Because shipping companies are familiar with vessels' conditions and clear about which vessel that can carry dangerous cargoes, which classes of dangerous cargoes that can be carried and how many tons of dangerous cargoes that can be carried in order to properly arrange for safe stowage.

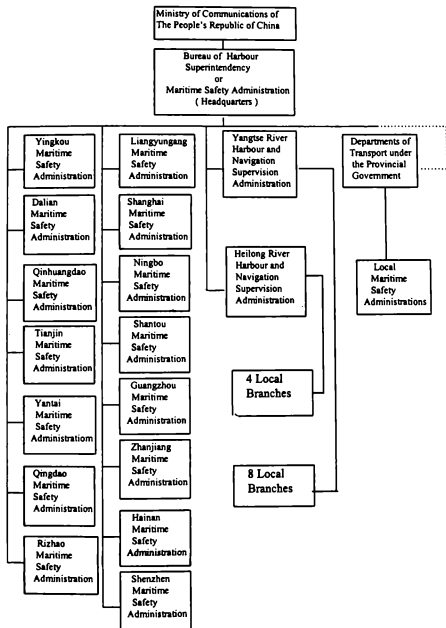
Classification Society is an organisation authorised by the Government and carries out inspection and certification of the vessels which apply for flying the flag of the

People's Republic of China. Through bilateral agreement, this organisation is responsible for surveying and issuing certificates to foreign vessels which apply for flying the flag of P.R.C. or authorised by the Government to conduct a flag state control according to the SOLAS Convention. It is also responsible for special survey and certification to the vessels which carry dangerous cargoes. The vessels, under the requirements of MSA, should apply for the surveyor's technical survey of proper carriage conditions for dangerous cargoes.

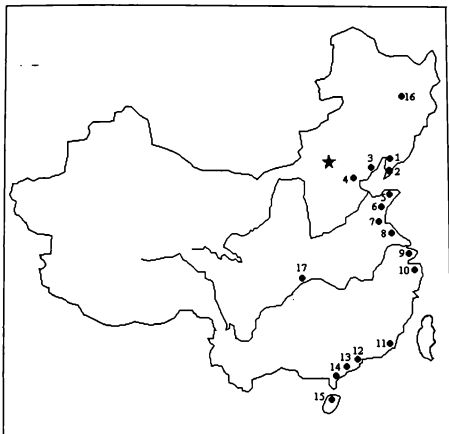
Port Operation Companies are directly responsible for actual port handling operations and storage of cargoes. They bear the responsibility for the safe operation and strictly inspect the packaging, labelling, marking and placarding. According to the requirements of stowage they should make efforts to conduct proper loading and discharging. In addition, they are responsible for the safety of stacking sites and warehouses because ports are the hub for the collection and distribution of cargoes. A lot of dangerous cargoes are transported and transited by other modes of transportation from the ports.

2.2.3 Competent Authorities Related to Sea Transport of Dangerous Cargoes and Their Functions

Harbour Superintendency Administrations (HSA), also called the Maritime Safety Administrations (MSA), under the direct leadership of the Ministry of Communications, represent the Government in exercising authority of navigation administration and supervision of maritime traffic safety and marine environment protection. They are the competent authorities solely responsible for the supervision of the safety of traffic in the coastal waters of China. This is stipulated in Article 3 of the Maritime Traffic Safety Law of P.R.C., adopted on 2 September 1983.



*Figure 2: Organisational Structure
of China's Maritime Safety Administrations*



- | | | |
|---------------|-----------------|-------------------------------|
| 1. Yingkou | 7. Rizhao | 13. Shenzhen |
| 2. Dalian | 8. Liangyungang | 14. Zhanjiang |
| 3. Qinhuagdao | 9. Shanghai | 15. Hainan |
| 4. Tianjin | 10. Ningbo | 16. Heilong River |
| 5. Yantai | 11. Shantou | 17. Changjiang(Yangtse River) |
| 6. Qingdao | 12. Guangzhou | ★ Beijing (Headquarters) |

Figure 3 MSA Branches in China's Major Coastal Ports

The coastline of the People's Republic of China contains multitudinous islands and islets. The length of the coastline is 18,000 kilometres and 14,000 kilometres in length around the islands. There are more than 300 ports and harbours in China. At present, the ports which are open to foreign trade have been increased to 122 ports. Seventeen Maritime Safety Administrations (MSA) are located at coastal lines and eight branches are located at Changjiang (Yangtze) River and four local branches at Heilong River. They all have the same functions related to maritime traffic safety and marine environment protection. MSA are directly under the leadership of the Ministry of Communications, while the others are directly under the local governments shown in Figures 2 and 3.

Such competent authorities are responsible for reviewing and approving the applications by the vessels carrying dangerous cargoes for entering or leaving ports, examining and verifying the declaration, checking stowage plans, putting forward the requirements for safe carriage and approving the sites for handling dangerous cargoes and issuing the certificates of safe stowage. In addition, they are responsible for the supervision and control in classification, packaging, labelling, marking, carriage standards, vessel condition, stowage and segregation on board the ships and loading and discharging dangerous cargoes on site and so on, according to the international conventions and codes which have been accepted and implemented by China in addition to the national regulations concerning dangerous goods.

China has implemented relevant international conventions and the IMDG Code through domestic legislation. The competent authorities carry out the supervision and control of packaged dangerous cargoes transported by sea as follows:

2.2.3.1 Declaration

Declaration is one of the important links through which the competent authorities conduct the supervision and control of vessels carrying dangerous cargoes and ensure the safety of ports, vessels, property and human life. The competent authorities, according to the declaration of the vessel, will take into account the natures of cargoes, port conditions and vessel conditions and operation environment and then decide whether or not to permit loading, discharging or transiting. If vessels carry the dangerous cargoes in packaged form, the shipper should, according to the relevant regulations, submit the relevant documents prior to shipment such as (a) “ Dangerous Goods Declaration”; (b) Container Packing Certificate; (c) Packaging Performance Test Certificate; (d) Certificate of Carriage of Dangerous Goods in Limited Quantities; (e) Certificate for the Dosage of Radioactivities, etc. (See Appendices). The above documents should be submitted to the competent authorities and to the other organisations concerned when applicable.

2.2.3.2 Arrival and Departure Approval

Vessels carrying dangerous cargoes must apply to the MSA for such carriage and they may not enter or leave the port or commence loading or discharging unless and until approval has been obtained.

2.2.3.3 Inspection of Packagings

Dangerous cargoes should be contained in the proper type of packagings which should be tested and certified by the organisations recognised by competent authorities listed in Section 22 of the IMDG Code. In China, the National Commodity Inspection Department is responsible for packaging testing. Only when the packaging performance has been tested and the qualified packaging verified, can

the packages of dangerous cargoes be offered for shipment. Consignors should select proper type of packaging for certain cargoes. If the local MSA finds the packages containing dangerous cargoes are improper, the packages will not be allowed to be loaded on board. In China, there are many problems regarding packagings. This will be discussed in chapter 3.

2.2.3.4 Packing Containers

While the use of freight containers substantially reduces the physical hazards to which cargoes are exposed, improper or careless packing or loading of cargoes into such containers, or lack of proper blocking, bracing and securing, may be the cause of personal injury when they are handled or transported; in addition, serious and costly damage may occur to the cargoes inside or to the equipment. The persons who pack the dangerous cargoes and secure them in the containers play an important role in the chain of container transport because they are the last ones to look inside the containers and know how the goods are packed and secured. Improper or careless packing may become the cause of an accident of a ship at sea. It is of great importance to train the packing persons and to let a packing inspector be present and control the packing at the packing site. The packing inspectors are chosen from the packing companies as the responsible persons for packing as referred to in Paragraph 12.3.7 of the General Introduction to the IMDG Code.

In China, when packing takes place, one packing qualified inspector who has been trained by the MSA shall be present at the packing site. He/she gives instructions to the workers and is responsible for the visible inspection of the containers both internally and externally, before the container is packed. The packing inspector supervises the complete packing procedures and takes the responsibility to make sure that the packing has been properly carried out and the following requirements, when applicable, have been met according to the IMDG Code.

- The container is clean, dry and apparently fit to receive the goods.
- If the consignments include goods of class 1, except division 1.4, the container is structurally serviceable in conformity with Section 12 of the Introduction to Class 1 of the IMDG Code.
- No incompatible goods have been packed into the container, unless approved by the competent authority concerned in accordance with 12.2.1 of the General Introduction to the IMDG Code.
- All packages have been externally inspected for damage and only sound packages have been packed.
- All packages have been properly packed in the container and secured.
- The cargo has been evenly distributed in the container.
- The container and the packages therein are properly marked, labelled and placarded.
- When solid carbon dioxide (dry ice) is used for cooling purpose, the container is externally marked or labelled in a conspicuous place at the door end with the words "DANGEROUS CO₂ GAS (DRY ICE) INSIDE VENTILATE THOROUGHLY BEFORE ENTERING".

When packing is completed and the packing inspector is satisfied that the packing has been done in accordance with the IMDG Code, he/she shall sign the Container Packing Certificate for Dangerous cargoes.

2.2.3.5 Inspection at the Terminal and on Board Ships

When a container of dangerous cargoes reaches the terminal, it will be checked again by the competent authority at the gate to make sure that:

- the container has a valid packing certificate;
- the information provided is correct;

- the container is correctly placarded according to the dangerous cargoes it contains and in compliance with the IMDG Code.

The stowage and segregation of containers on board ships is also very important as far as safety is concerned. Ship masters are required by Chinese national regulations to make their stowage plans in accordance with the IMDG Code. Since the stowage plan is mostly made on shore at the terminal, sometimes the ship's master and chief officer may overlook the segregation of the incompatible containers, which may cause danger to the ship and persons at sea. To ensure that the safety stowage and segregation of containers on board ships are in compliance with the IMDG Code, two major measures have been taken by the competent authority. One is the training program to familiarise those at terminals responsible for making stowage plan with the requirements of the IMDG Code. The other is the routine inspection conducted by the Harbour Superintendency Administrations on board ships to ensure that the containers of dangerous cargoes are correctly stowed on board and their positions are clearly marked in the stowage plan. Such routine inspections are carried out every day especially on board ships to be loaded with highly dangerous cargoes. The safety of the transportation by sea of dangerous cargoes in freight containers greatly depends on the following two factors:

- 1) the packing of the containers on shore;
- 2) the stowage of the containers on board.

2.2.3.6 Supervision and Control

According to the national regulations, when a container in which dangerous cargoes are loaded is offered for carriage by sea, the shipper shall submit to the competent authority the declaration and the packing container certificate. The declaration and packing certificates are checked in each department which works 24 hours-a-day and is specially responsible for the transportation of dangerous cargoes. Only those

containers with the packing certificates signed by the qualified packing inspectors are accepted for carriage by sea. If a container packed with dangerous cargoes does not have a packing certificate, or the certificate is signed by someone other than a qualified packing inspector, it will not be allowed to be loaded on board. Even if the container has arrived at the terminal it will be refused to be loaded when found unqualified. In this case the competent authority can order the container to be moved to a designated place and opened for inspection by an assigned packing inspector to make sure that the container is properly packed. If the container is correctly packed it will be allowed to continue its journey. If not, it will not be loaded on board until the deficiencies are rectified. The MSA may impose a penalty in the case of a vessel, unit and person violating the IMDG Code and the national regulations concerned.

2.2.3.7 Issuing Certificates

The MSA will carry out the supervision and control of transport by sea of dangerous cargoes in order to ensure the safety of vessels carrying dangerous cargoes and the prevention of marine pollution from ships. The MSA will issue a "Certificate of Safe Stowage of Dangerous Cargoes" (See Appendix 5) to vessels which apply for the supervision and control during handling, after checking the stowage plan and verifying that the stowage of dangerous cargoes on board the ship complies with the requirements concerned.

2.2.3.8 Statistics on Sea Transport of Dangerous and Harmful Cargoes Including Marine Pollutants in China's Major Coastal Ports

Local Maritime Safety Administrations, according to the requirements of the MSA (headquarters) of the Ministry of Communications shall submit annual statistics. The statistics of different cargoes handled in China's major coastal ports from 1992 to 1995 are shown in Tables 1 and 2.

Table 1: Statistics on Different Dangerous Cargoes Carried by Vessels in China's Major Coastal Ports from 1992 to 1995

Items		Packaged dangerous cargoes	Solid bulk dangerous cargoes	Liquid bulk chemicals	Liquified gases in bulk	Oil in bulk	Total	
Entries	No. of Vessels	Domestic	5505	569	1940	359	34072	42445
		International	15987	414	2639	2450	12514	34004
	Tons	Domestic	1251497	118370	2100711	533242	32456267	36460089
		International	6384781	665678	6446552	2637439	55313515	71447966
Depart	No. of Vessels	Domestic	11794	1802	11276	674	68546	131482
		International	21266	1699	1396	152	4435	28950
	Tons	Domestic	2694307	350766	2002090	7245475	106626450	112729280
		International	5211466	7383714	2088910	130537	59208801	74821519
Transit	Tons	1103965	367586	2593308	166044	4412332	8643228	
Supervision	Number of Vessels		1612	352	3664	1163	9627	22651
	Tons		5161536	926904	12430098	1877353	22509509	33499969
Deficiencies rectified			697	43	108	61	324	1256

Table 2: Statistics on Different Dangerous Cargoes Carried in Freight Containers in China's Major Coastal Ports from 1992 to 1995

Item Year	Entries (TEU)	Departures (TEU)	Inspection (TEU)	Transit (TEU)	Rectification (Times)
1992	17621	20199	2591	2173	58
1993	16014	25215	3473	3119	110
1994	27803	20124	5006	4097	41
1995	24748	14570	2530	2530	132
Total	86186	80108	13600	11919	341

According to the somewhat incomplete statistics within the four years from 1992 to 1995, China's major coastal ports handled 86186 TEU of dangerous cargoes for import and 80108 TEU for export, among which 11919 TEU belonged to transit cargoes. Totally 13600 TEU were inspected by the MSA. There were 341 times

when deficiencies were found and rectified. These deficiencies which involve labelling, marking, placarding, documentation, packaging, stowage and securing, segregation and damaged packages etc. will be discussed in Chapter 3.

Chapter 3

Analysis of the Present Problems in China Affecting the Safety of Sea Transportation of Dangerous Cargoes in Freight Containers

Since the advent of the first container vessel several decades ago, container shipping has become more and more popular world-wide. Today, for example, most China's ports can handle containers in which more and more dangerous cargoes are packed. As a result accidents caused by the operation of dangerous cargoes happen from time to time. Substandard packaging materials, improper packing, inappropriate stowage, indistinct marks, labels and placards, incomplete documentation and malpractice in loading and discharging are the direct causes of accidents. The indirect causes are that rules and regulations are not so perfect, supervision and control are not very strict, precautionary procedures are not very well taken and the quality of the packers, the stevedores and the seafarers is not satisfactory.

In view of the above this Chapter will analyse the present problems in China affecting the safety of sea transportation of dangerous cargoes in freight containers from the following aspects:

- Legislation and enforcement;
- Packaging quality;
- Containers packing;
- Accidents due to inadequate cargo information;
- Stowage and segregation of containers on board;

- Violating operation regulations;
- Packing certificates;
- Placarding;

- Overboard losses of packaged dangerous goods;
- Incidents attributable to human factors.

3.1 Legislation and Enforcement

At present, China's rules and regulations governing the transportation of dangerous cargoes are not adequate. The main reason is that the safety of sea transport of dangerous cargoes in freight containers is not highly valued. It is not an unusual case that the stipulation of a new instrument does not occur in the minds of the people who are responsible in this regard only when a serious accident happens. The division of the responsibilities among the organisations concerned are not very clear either. Therefore, the existing legislation, though incomplete, cannot be very well enforced, thus resulting in malpractice in the whole process from packaging to transport of the dangerous cargoes.

3.2 Packaging Quality

The packaging of dangerous goods is mainly to ensure the safety of shipment and protection of the marine environment. Most of the inflammation and explosion accidents in shipment can be attributed to improper packaging. Over the years the dangerous cargoes exported from and loaded in China have constantly experienced problems with repackaging or re-packing. Incidents of poisonous gas fuming have also been experienced. As a result vessels are refused entry into foreign ports and therefore have to return home for rearrangement.

Some years ago, for example, the Panamanian container vessel, Star Taxlas, was loaded in No. 2 hold in Qingdao port with 32 containers of epichlorohydrin (UN No. 2023, Packaging Group II, Class 6.1, Page 6143) totalling 512 tons and set sail for Rotterdam. On transit from Hong Kong to Singapore, No. 2 hold was found emitting strange odour which was suspected to be the escape of epichlorohydrin gas. When it got to Singapore roadstead it was inspected and tested by nominated experts who found that the condensation of the hazardous gas of epichlorohydrin was 200 PPM. The vessel was not permitted to enter Singapore inner harbour by the port authority. Therefore it was ordered to anchor at a special anchorage. CO₂ and N₂ were injected into its troubled hold to prevent it from exploding. Afterwards the vessel was forced to sail back to Qingdao for treatment. On further inspection and investigation on arrival in Qingdao this incident was noted to be caused by poor quality packages. The lids of the drums were not properly made fast and their sizes not identical. When they were hit the lids became deformed and damaged. What is more, one of the drums had a crack and one third of the contents had leaked from inside. To make it even worse, there were three cases of organic phosphate fertilizer stowed in the same hold. These cases were also badly damaged after some days of voyage because of their deformed inside packaging, unsecured contents and inadequate sealing.

This example reveals that:

- (a) The manufacturer of the packing for dangerous cargoes shipping did not observe the relevant national regulations or meet the relevant requirements of the IMDG Code, which specify the appropriate materials, reasonable design and techniques.
- (b) The packaging inspection department did not strictly test the packagings as required by the IMDG Code and the relevant national regulations.
- (c) The department engaged in the export of dangerous cargoes did not properly select and use the right packagings for such cargoes.

3.3 Containers Packing

Normally containers are packed in the factory of the commodity manufacturer or a specified place in the hinterland. Many packers do not understand the severe conditions and risks in sea transportation, nor do they have the necessary packing experience. Therefore the packing quality is bound to be poor such as inappropriate stowage and improper securing. Many of the containers so packed cannot withstand rolling and pitching conditions while being transported. Since container transportation is a door to door service, the competent authorities can only inspect the manifests or similar documents. It is impossible to have complete control over the whole handling procedure. Some inspectors have little knowledge of the labels, marks, placards, stowage, lashing and securing etc. So long as such containers are loaded on board ships, the contents inside are likely to be damaged or leak. When the containers get to foreign ports, many of them have to be repackaged or repacked before further transport and delivery which results in economic losses.

On January 12, 1986, M.V. Karlowicz, owned by the Chinese Polish Joint Stock Shipping Company, arrived at Rotterdam with 13 freight containers of 20' which contained 154 drums each of aluminium chloride anhydrous (UN No. 1726, Class 8, Page 8108). While discharging the containers it was noted that one unit showed traces of "fuming". After opening of the container it appeared that a number of drums were damaged as a result of which a part of the contents was spilled. This led to a reaction with the moisture inside the container resulting in fumes of hydrogen chloride. Moreover, it was noted that the unit contained two layers of drums over its full length, while a third layer on top reached as far as half way. The stowage of this top layer was in fact the cause of the damage as it was not secured. The drums were also improperly stowed with space between them, and no dunnage or other securing material had been used between the layers. Further inspection of the other 12 containers showed the same problem: improper stowage, no lashing, inadequate

securing and bracing, resulting in turned-over, damaged and leaking drums. It was also noted that many drums showed traces of corrosion. Some drums had holes and some others were not properly closed. Probably during the loading, or during the sea voyage, as a result of improper stowage, the closing rings had opened. This resulted in damage to the plastic inner bag and subsequent spillage of the contents. The lids of some other drums had been damaged in such a way that the drums could not be hermetically and properly closed.

Since the final destination of this consignment was Bulgaria, and further transport was scheduled by vessel, it was decided to detain the cargo and not to release it before proper correcting measures had been taken. Therefore, an order was given to unpack all containers and to restow them in accordance with the instructions given by the local inspectors. These instructions included cleaning and drying of all drums, the use of adequate and sufficient stowage material, repacking of all damaged drums into oversized weatherproof packaging and separating them from the non-damaged ones. Before the damaged drums were repacked, all holes and bent lids were taped off with material resistant to aluminium chloride. After this and the repacking all oversized packaging was also reloaded to the containers.

On January 31, 1986, the repacking and restowage of the containers was finalized and the detention of the cargo was lifted.

3.4 Accidents due to Inadequate Cargo Information

Inadequate information or incomplete documentation may also result in marine incidents. Container leakage caused by lack of information or documentation is usually heard or seen. For example, on October 11, 1995 a freight container aboard the 23,100 dwt container ship *Wealthy River*, operated by China Ocean Shipping (Group) Company (COSCO), began leaking dense fumes of sulfurous gas while

arriving at the port of Bayonne, New Jersey. At least four persons are known to have become ill from inhalation of the fumes and one was hospitalized. Other containers in the same hold were contaminated. The US Coast Guard (USCG) proved that the fumes were caused by violent chemical decomposition of the container's content, a product identified as thiourea dioxide, known as fomamidinesulfonic acid.

Neither the shipper nor the consignee identified the cargo as 'hazardous materials' and there was no available materials safety data sheet for thiourea dioxide. However, laboratory testing undertaken on behalf of the USCG confirmed that samples taken from one shipment met the criteria for the hazard classification self-heating solid-UN Class 4.2. An article entitled "Saying and doing" from the magazine "Cargo Systems" states that "if any port is offered this product it is suggested that it should be treated as a Oxidizing Substance, Solid, N.O.S. Class 5.1 UN No.1479 PG III unless shown to be otherwise".

The cause of the violent decomposition was not determined but the USCG believes that it may have been triggered by heat, humidity or a combination of the two. The product is listed in some sources as being moisture-sensitive, as well as dangerous both through inhalation and by contact with the skin or eyes.

The USCG has cautioned importers and carriers that recent testing supports the belief that thiourea dioxide is a 'hazardous material' transported at sea. It should be documented, prepared for shipment and carried in accordance with US Federal Regulations and applicable international codes. In particular, importers in the US are obliged under Title 49 of the code of Federal Regulations to provide foreign shippers with timely and complete information about the necessity of complying with US regulations.

3.5 Violating Operation Regulations

It is not a rare phenomenon that during loading and discharging the stevedores do not observe the relevant rules and regulations. Sometimes they start working hastily in order to finish the work earlier even without the permission or approval from the department in charge. Sometimes they simply operate in violation of the normal procedures or due to inadequate supervision. Such malpractice often results in unexpected accidents, causing damage to the cargoes.

The following is a significant example of not following the regulations.

On September 30, 1989, a vessel called at a warehouse dock at Guangzhou harbour to load arsenic trioxide (UN No. 1561, Class 6.1, Page 6078), which is a toxic marine pollutant. During loading, a drum of this substance, weighing 100kg, fell overboard. On inspection it was noted that the loading was not approved by the competent authority, Guangzhou Harbour Superintendency Administration. The operation team loaded the cargo arbitrarily. The warehouse did not have any safety regulation regarding dangerous cargo work. It employed unqualified stevedores to load and discharge dangerous cargoes. The stevedores had not received the necessary training and safety education. After the drum of arsenic trioxide was lost in the water, the warehouse did not instruct the stevedores to pick it up, nor did they report the accident to the local HSA. Instead they went on with the loading. During the loading it was noted that some of the drums had no lids. The arsenic trioxide was totally exposed. The stevedores did not stop but continued to load the cargo which did not meet the packaging requirement. Further inspection showed that the warehouse was filled with scattered chemicals. 1527 drums of arsenic trioxide of which 10% had no lids were still in the warehouse. To make things even worse, two out of five warehouse doors had no shutters and nobody was hired to keep watch.

The arsenic trioxide could be easily accessed. Potential dangers were exposed all around the warehouse.

The storage of dangerous cargoes directly relates to safety. Warehouses or storage yards should be suited for such storage. Watchmen and stevedores should have a good understanding of the characteristics and the operation requirements of the dangerous cargoes. It is equally important that they should have a high sense of responsibility when handling this type of substance.

3.6 Stowage and Segregation of Containers on Board

Accidents can also be caused by improper stowage and segregation. For example, on April 19, 1983, on her 39th voyage, M.V. Longxikou owned by Shanghai Ocean Shipping Company (dwt 17,990) was carrying a cargo of 6,920 tons, among which 375 tons was explosives and 110 tons dangerous chemicals. The ship had a sudden explosion in hold No.3 and caught fire immediately on the voyage between Sumatra and Sri Lanka. The fire rapidly spread to the engine room and crew accommodation. The ship was abandoned and finally sank.

On investigation, some experts concluded that the accident was initially caused by the spontaneous combustion of 44 drums of aluminum powder on the twin-deck of hold No. 3. But further analysis and experiments indicated that the fire and its rapid spreading was probably due to improper stowage and segregation.

Aluminum powder belongs to Class 4.1. It has some special characteristics. For example, in the event of a breakage of receptacles, the scattered powder is readily ignited by sparks or open flame and may give rise to an explosive atmosphere. It easily emits hydrogen, a flammable gas when in contact with water, acids or caustic

alkalis. It can also easily produce a thermite effect when reacting with iron oxide and forms explosive mixtures with oxidizing substances.

The bitter lesson of this accident again teaches people safety is very important for those who are engaged in handling dangerous goods. When it comes to transport by sea, packaging as well as stowage and segregation are essential and significant.

3.7 Packing Certificates

A container packing certificate must be completed and signed by the person responsible for the packing and loading of the cargo transport unit. According to paragraph 12.3.7 of the General Introduction to the IMDG Code the signing of a 'container packing certificate' indicates that certain provisions have been properly carried out. The person signing a 'container packing certificate' must involve himself in the packing operation and be able to attest to the relevant provisions. But two problems exist: one is that the person signing a 'container packing certificate' often has not been involved in a previous packing operation; the other one is that there often are no container packing certificates on imported containers containing dangerous cargoes. It is often difficult for the competent authorities to procure the relevant documents for transhipment cargoes in containers as required in the IMDG Code. Inspections show that most of containers come to China from aboard.

3.8 Placarding

In China, problems with the placarding of cargo transport units normally fall within the following areas:

- 1) Missing placards:
 - (a) Never affixed in the first place;

- (b) Poor surface preparation before affixing.
- 1) Wrong size labels being affixed; i.e.100x100mm package labels being used instead of the required 250 x 250mm placards.
 - 2) Subsidiary risk placards still bearing the class number.
 - 3) Failing to remove placards once the dangerous goods have been removed and the cargo transport unit cleaned.

3.9 Overboard Losses of Packaged Dangerous Cargoes

Ship navigation accidents or improper cargo operations may result in cargo being lost overboard. In China incidents still exist where cargo is lost either on the open sea or in the inland waters. When the cargo is categorized as harmful it often takes tremendous efforts to pick it up and recover the polluted area.

On June 27, 1990, a barge capsized in the lower stream of the Changjiang River with 50 tons of phenol (UN No. 2821, Toxic 6.1, Page 6225) in 250 drums weighing 200kg each. The accident was caused partly by a force majeure and partly by navigation error. At this time there were eddies in the area and the Changjiang River was at its flooding time. The current was extremely swift and the water muddy.

It is not hard to imagine the consequences by 50 tons of phenol in a river with swift currents. To pick up the phenol in order to eliminate the pollution source needed prompt and effective actions. Therefore immediately after the incident a salvage operation was carried out by the Shanghai Salvage Bureau. The diving operation was not easy because of the swift current and muddy water. Other means of operation were tried, such as lowering the divers with iron grabs, using electrical magnetic disks, etc. Finally a big electrical magnetic disk weighing 4 tons with a suction capacity of over 10 tons came to the operation.

From the above incident another problem is that China has not yet worked out a set of effective procedures regarding searching and salvaging packaged dangerous goods lost in the water, neither has a contingency plan for the response to such incidents been worked out.

Another similar incident occurred some year ago in Shanghai. A small motor cement boat, owned by a businessman in Jiangsu Province, carried 45 drums of dimethyl sulphate (UN No. 1595, Class 6.1, Page 6133) without the inspection and permission from the HSA. Because it was overloaded and was sailing beyond its navigational area, the boat capsized and sank to the bottom of the Huangpu River. All the poisonous substance was lost. This river is one of the sources of drinking water for Shanghai City. The incident startled the whole city, especially the municipality government. The organisations concerned were immediately mobilized to put every possible effort to salvage the substance. However, it cost a great deal in terms of money and labour.

3.10 Incidents Attributable to Human Factors

Many incidents relating to the shipment of dangerous goods in containers can be attributable to the human element. These elements can be traced to a number of persons in various organisations concerned. For example:

- 1) The manufacturers do not produce qualified packagings according to the requirements of the Code as regards design and manufacturing techniques. The testing departments fail to strictly perform their duties.
- 2) The shippers do not select appropriate packagings.
- 3) The packers do not properly dunnage, lash, brace, segregate or secure the cargoes as required, thus resulting in the cargoes being shipped not able to sustain the particular conditions of the sea.
- 4) Lack of correct practice in labelling, marking and placarding.

- 5) Failure to obtain a competent person's signature in Container Packing Certificate.
- 6) The cargoes to be shipped are sometimes not accompanied with adequate information, documents etc.

All these indicate that incidents often originate from the inadequacies of human beings. As is apparent, in nearly all the incidents untrained people can be easily identified from the various links of transportation.

As mentioned in Chapter 2, according to some incomplete statistics within the three years from 1992 to 1995, China's major coastal ports handled 86186 TEU of dangerous cargoes for import and 80108 TEU for export, among which 11919 TEU belonged to transhipment cargo. Totally 13600 TEU were inspected by the local MSA. There were 341 times when deficiencies were found and rectified. These deficiencies involved labeling, marking, placarding, documentation, packaging, stowage, securing, segregation and broken packages. From January to May 1996, the Tianjin Maritime Safety Administration carried out a five-month program of inspecting freight containers. Out of 7285 TEU for export they inspected 285 TEU. Among them 81 (39%) were found to be deficient. These deficiencies were caused by the following problems: Container Packing; Certificates signed by non-present inspectors; Improper dunnage and securing; Improper marking and placarding, inappropriate stacking, inadequate documentation, mistakes in filling in the forms (e.g. the properties, the classes) etc.

Regarding these deficiencies mentioned above, China's Maritime Safety Administrations have no other choice but need to take necessary measures as early as possible to solve the existing problems in the transport by sea of dangerous cargoes in order to comply with the requirements of the conventions and codes relating to ensuring the safety of ships and protection of the marine environment.

Chapter 4

Applicable International Regulations and National Legislation That Address the Problems Identified in Previous Chapters

This Chapter will introduce some applicable international regulations and Chinese legislation that address the problems identified in the previous chapters. These instruments refer to safety, pollution, liability and compensation, supervision and control of vessels carrying packaged dangerous cargoes in freight containers. They are the principles and guidelines for monitoring the safety of sea transportation of dangerous cargoes.

4.1 International Conventions Focusing on the Safety of Carriage of Packaged Dangerous Cargoes by Sea

4.1.1 UN Recommendations

In 1956 the United Nations Committee of Experts on the Transport of Dangerous Goods, established by UN's Economic and Social Council (ECOSOC), completed a report (ST/ECA/43-E/CN.2/170) which established the minimum requirements applicable for the transport of dangerous goods by all modes. It was considered by ECOSOC, at its twenty-third session (Resolution 645G (XXII)) on 26 April 1957. The UN Recommendations have been amended and updated by succeeding sessions of the Committee of Experts and published in accordance with subsequent resolutions of the ECOSOC. (This report, usually known as the United Nations

“Recommendations on the Transport of Dangerous Goods (The Orange Book)”, offered the general framework within which existing regulations could be adapted and developed, the ultimate aim being world-wide uniformity (refer to the 1995 Ninth revised edition (ST/SG/AC.10/Rev.9).

The UN Recommendations have world-wide relevance for all modes of transport. They are international recommendations on which national and other international regulations are being based. In an actual transport situation it is the appropriate modal regulation that needs to be followed, i.e. road, rail, sea, air, inland waterway, etc.

The UN Recommendations cover principles of classification and definitions of class, listing of principle dangerous goods, general packing requirements, testing procedures, marking, placarding and documentation. The aim is to give a basic scheme of provisions so as to allow national and international regulations to grow within a framework and attain an uniformity in regulations to all modes of transport of dangerous goods, ultimately leading to unhampered multimodal transport operations. The regulations are designed to eliminate or reduce to a minimum the risks of accidents to persons, property and other means of transport.

4.1.2 Chapter VII of SOLAS 74

The International Convention for the Safety of Life at Sea, 1974 (1974 SOLAS Convention), as amended, deals with various aspects of maritime safety and contains in part A of Chapter VII the mandatory provisions governing the carriage of dangerous goods in packaged form or in solid form in bulk. Regulation VII/1.3 prohibits the carriage of dangerous goods except when carried in accordance with the provisions of part A of chapter VII, which are amplified by the International Maritime Dangerous Goods Code (IMDG Code).

Revised Chapter VII, of the 1974 SOLAS Convention, as amended in 1994 applies now to all ships to which the SOLAS regulations generally apply, in addition, to cargo ships of less than 500 tons gross tonnage.

Regulation 1 of part A of Chapter VII prohibits the carriage of dangerous goods by sea except when they are carried in accordance with the provisions of the SOLAS Convention, and requires each Contracting Government to issue, or cause to be issued, detail instructions on safe packing and stowage of dangerous goods which shall include the precautions necessary in relation to other cargo .

Regulation 2 divides dangerous goods into nine classes which are described later in section 4.1.1.3. Classes 2, 3, 4, 5, and 6 are further divided into two or three subclasses.

The other six regulations of part A (including new regulation 7-1) deal with the packing, identification, marking, labeling and placarding of dangerous goods, the documents which are to be provided, stowage and segregation requirements, the carriage of explosives on board passenger ships.

Chapter VII thereby contains mandatory requirements and provides the necessary legal basis for international and national regulations for the transport of dangerous cargoes by sea.

4.1.3 IMDG Code

The carriage of dangerous cargoes is regulated by a variety of legislation in many parts of the world, but the basic requirements of the safe carriage of packaged dangerous cargoes by sea is contained in IMO's International Maritime Dangerous Goods Code (IMDG Code). The IMDG Code is recommended to Governments for

adoption or for use as the basis for national regulations in pursuance of their obligations under regulation VII/1.4 of the 1974 SOLAS Convention, as amended, and regulation 1(3) of Annex III of MARPOL 73/78. Observance of the Code harmonizes the practices and procedures followed in the carriage of dangerous goods by sea and ensures compliance with the mandatory provisions of the 1974 SOLAS Convention, as amended, and of Annex III of MARPOL 73/78.

The IMDG Code harmonizes with the recommendations prepared by ECOSOC which is responsible for determining the classification, packaging and labelling of dangerous cargoes and the documentation required according to the predominant type of risk involved in a uniform manner to facilitate safe intermodal transport. These technical conditions and requirements are incorporated in the IMDG Code.

4.1.3.1 Development of the IMDG Code

Resolution 56, adopted at the 1960 SOLAS Conference, recommended that Governments should adopt a uniform international code for the carriage of dangerous goods by sea which should supplement the SOLAS regulations and cover such matters as packing, container transport and stowage, with particular reference to the segregation of incompatible substances. It further recommended that IMO, in cooperation with the United Nations Committee of Experts on the Transport of Dangerous Goods, should pursue its studies on such an international code, especially in respect of classification, description, labeling, a list of dangerous goods and shipping documents.

To carry out this mandate, IMO's MSC established, in January 1961, a Working Group on the Carriage of Dangerous Goods (CDG). Governments with considerable experience in the carriage of dangerous goods were invited to nominate experts.

The Group met for the first time from May 29 to 31, 1961 and set about preparing the “unified international maritime code” as envisaged by the 1960 SOLAS Conference.

By November 1965, good progress had been made in preparing such a code and the resulting document became known as the IMDG Code. It was adopted by the fourth IMO Assembly in 1965. Up to 1996, 51 countries, whose combined merchant fleets total more than 80% of the world’s gross tonnage, have informed IMO that they are applying the IMDG Code.

4.1.3.2 Application

Although designed primarily for mariners, the provisions of the IMDG Code provide guidance to chemical manufacturers, exporters, shippers and a number of industries as well as storage, handling and transport services from manufacturers to consumers.

Chemical and packaging manufacturers, packers, shippers, forwarders, carriers and terminal operators are guided by its provisions on classification, terminology, identification, packing and packaging, marking, labeling and placarding, documentation and marine pollution aspects. Feeder services, such as road, rail, harbor and inland water craft are governed by its provisions. Port authorities, terminal and warehousing companies also consult the IMDG Code to segregate dangerous substances in loading, discharge and storage areas. The Code only applies to ships covered by the SOLAS Convention carrying dangerous goods in packaged form. IMO considers it highly desirable that its provisions should be observed by all ships.

4.1.3.3 Main Contents

The IMDG Code sets out comprehensive recommendations for the classification, packaging, general and individual stowage, segregation and documentation of dangerous cargoes in packaged form that are transported by sea.

The first part of the IMDG Code (Volume I) consists of the General Introduction. Part A of Chapter VII of the 1974 SOLAS Convention, Annex III of MARPOL 73/78, both as amended, and resolution 56 of the 1960 SOLAS Conference are reproduced in Sections 2 and 3, followed by Section 4 on the application of the Code and Section 5 on the classification of dangerous goods.

The General Introduction goes on to describe, inter alia, the marking, identification and consignment procedures, labeling and placarding, documentation and packing of dangerous goods shipments.

The General Introduction includes sections providing special provisions for freight containers, portable tanks and road tank vehicles, stowage and segregation, fire prevention and fire fighting. The final few sections deal with the carriage of dangerous goods on roll-on roll-off ships, in limited quantities, in shipborne barges on barge-carrying ships, the chemical stability of dangerous substances and provisions for transport under controlled temperatures, competent authority approvals and a list of national competent authorities, marine pollution aspects of dangerous and harmful substances in packaged forms, transport in bulk in the cargo spaces of the ship or in bulk packaging, and intermediate bulk containers (IBCs). A new section on the transport of wastes has been included with Amendment 26-91.

Volume I also contains the Alphabetical General Index of dangerous substances, materials and articles, and harmful substances (marine pollutants). This index is

followed by the Numerical Index (the table of UN numbers with corresponding IMDG Code-page numbers, Emergency Schedule (EmS) numbers and Medical First Aid Guide (MFAG) table numbers) and a list of a definitions, including a list of common abbreviations.

Annex I to the IMDG Code contains recommendations on the packing of dangerous goods, and on the construction and testing and standards of packaging performances. The Annex was adopted by the Maritime Safety Committee in 1984 and is included in Volume I of the IMDG Code. From 1 January 1991, only tested and marked packaging/packages should be used for the transport of dangerous goods.

The recommendations take into account the mandatory requirements on packing set forth in Regulation 3 of Chapter VII of the 1974 SOLAS Convention, as amended, and Regulation 2 of Annex III of MARPOL 73/78. These regulations require packages containing dangerous or harmful goods to be capable of withstanding the ordinary risks of handling and carriage by sea and lay down other specifications.

The principle of dividing dangerous goods, other than those covered by classes 1, 2, 6.2 and 7, into three packaging groups according to the degree of danger they present, i.e.

Packaging group I: goods presenting great danger

Packaging group II: goods presenting medium danger

Packaging group III: goods presenting minor danger

is reflected in the recommendations of Annex I and has an impact on the detailed provisions for the construction and performance testing of types of standard receptacles, packagings and packages ready for shipment.

General Index of the IMDG Code, all substances, materials and articles which appear in the IMDG Code are listed in the alphabetical order of their proper shipping

name (correct technical name) in the General Index of the IMDG Code which also gives the product's UN No., its EmS No., MFAG Table No., the IMDG Code-page number of the individual schedule, class, packaging group and subsidiary risk label(s).

Some dangerous goods are not listed by names in the Code and, therefore, will have to be shipped under a generic name/entry or a "Not Otherwise Specified (N.O.S) " entry. These entries have also been included in the General Index. For some goods, abbreviated and secondary names and synonyms are also listed.

Volumes II, III and IV mainly specify the classification of dangerous goods. They contain nine main classes and nineteen subclasses of dangerous goods which are those cargoes posing a defined hazard to life, environment or property. For transport purposes, the United Nations has classified dangerous goods into nine main classes. Threshold limits have been established. Substances which are offered for transport have to be tested according to testing specifications and internationally accepted criteria. If they fall under any one or more of the UN classes, their transport has to be carried out under the established regulations. IMO, responsible for safety at sea and the protection of the marine environment from ship pollution, has specified this classification for sea transport. The provisions on classification of the IMDG Code follow the method used by the UN for all modes of transport, although these provisions are more stringent. The IMDG Code then details the nine classes of dangerous goods, divided as follows:

Class 1 Explosives

Class 2 Gases

Class 2.1 - Flammable gases

Class 2.2 - Non-flammable gases

Class 2.3 - Poisonous gases

- Class 3 Flammable liquids
 - Class 3.1 - Low flash-point group
 - Class 3.2 - Intermediate flash-point group
 - Class 3.3 - High flash-point group
- Class 4 Flammable solid or substances
 - 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 Oxidizing substances (agents) and organic peroxides
 - Class 5.1 - Oxidizing substances (agents)
 - Class 5.2 - Organic peroxides
- Class 6 Toxic and infectious substances
 - Class 6.1 - Toxic substances
 - Class 6.2 - Infectious substances
- Class 7 Radioactive materials
- Class 8 Corrosives
- Class 9 Miscellaneous dangerous substances and articles, substances and articles which are not covered by other classes, marine pollutants.

It is very important to note that this classification is by type of risk and has been drawn up to meet technical transport conditions. The numerical order of the classes does not indicate a degree of danger.

The supplement to the IMDG Code contains EmS, MFAG, the Code of Safe Practice for Solid Bulk Cargoes (BC Code), the Reporting Procedures under SOLAS and MARPOL, the IMO/ILO Guidelines for Packing Cargo Transport unit, the Recommendations on the Safe Use of Pesticides in Ships and other relevant recommendations issued by IMO.

4.1.3.4 Legal Aspects

The legal system of each country determines in detail whether the IMDG Code becomes mandatory or is applied as a recommendation. Application of the Code as a recommendation does not detract in any way from the obligations imposed by the SOLAS Convention, as amended, but merely provides a great flexibility in the method of observance.

The IMDG Code is a recommendation under the SOLAS Convention; Annex III is a part of MARPOL 73/78 Convention. This means a state being party to SOLAS may use the IMDG Code to follow its obligation under Chapter VII of SOLAS, but it could use any other way as well so long as that meets the requirements set out in chapter VII. In contrast to that, Annex III is binding in itself on every state which is a party to MARPOL and has specially ratified this Annex.

The IMDG Code gives effect to Part A of Chapter VII of SOLAS Convention which regulates the transport of packaged dangerous cargoes and Annex III of MARPOL 73/78 which regulates the transport of marine pollutants. Some marine pollutants have no other significant hazard which can be related to any hazards of dangerous cargoes in classes 1 to 8. Such marine pollutants are listed in Class 9 and are to be carried in full compliance with all the applicable provisions of the Code.

4.1.3.5 Changes in the IMDG Code

Since its introduction in 1965, the IMDG Code has undergone many changes, both in appearance and content to keep pace with the ever-changing needs of industry. Amendments which do not affect the principles upon which the Code is based may be adopted by the Maritime Safety Committee alone. Thus IMO can respond to transport developments in reasonable time.

Amendments to the IMDG Code originate from two sources; proposals submitted directly to IMO by Member Governments and amendments required to take account of changes to the United Nations Recommendations on the Transport of Dangerous Goods which sets the basic requirements for all the transport modes.

Amendment 25-89 to the IMDG Code is one of the most important improvements. The main features include: Provisions for marine pollutants; Intermediate Bulk Containers (IBCs); Revision of all classes; Entry into force of Annex I which refers to mandatory testing of packages.

It has been expanded to cover marine pollution aspects necessary for the implementation of Annex III of the MARPOL73/78 Convention through the IMDG Code. Substances, materials and articles with marine pollution hazards are identified in individual schedules and in the General Index of the Code. Packages containing marine pollutants should be marked with the marine pollutant mark. The special requirements for goods are to be found in Section 23 of the General Introduction to the Code.

The most visible change from the existing regime in Amendment 28-96 is the completely revised text for Class 1 explosive packagings; an exercise based on recent similar work undertaken by the UN Experts in their Recommendations on the Transport of Dangerous Goods, i.e. the Orange Book. In addition, the maritime mode will be fully aligned with the overland transport requirements for aerosols, Sub-committee on Dangerous Goods, Solid Cargoes and Container (DSC 1) having agreed to stop classifying small quantities of such consignments under Class 9 and to dispatch all aerosols as Class 2 goods. The packaging specifications for Class 5.2 substances have been extended while the provisions for Class 2 gases in general have been subject to a major editorial tidying up exercise. Numerous protests led to the deletion of the entry for internal combustion engines. Such articles have only been

recognized as dangerous for transport since their introduction into the IMDG Code in Amendment 27.

4.1.3.6 Role of Competent Authorities

There are always some problems in practice for the shipments of goods. Such problems are referred to competent authorities for clarification and decision. The competent authority is the regulatory authority for safe transportation of dangerous goods by sea. It provides guidance and clarification where references are made for competent authority approval. It has been agreed in Section 22 of the IMDG Code that :

- An approval permit or certificates issued by a competent authority or a body authorized by a competent authority should be recognized by other countries;
- Such approvals and permits to comply with provisions of SOLAS 74 Convention, as amended, MARPOL 73/78 Convention, as amended, and standards of the IMDG Code;
- Addresses in individual countries to be provided to which inquiries regarding competent authority approval can be referred and shall have to be kept up to date.

4.1.4 International Convention for Safe Containers, 1972

In view of the rapid increase in the use of freight containers for the consignment of goods by sea and the development of specialized container ships, IMO in 1967 undertook a study of containerization in maritime transport. The container itself emerged as the most important aspect to be considered.

In 1972 the Convention for Safe Containers, prepared by IMO in cooperation with the Economic Commission for Europe was issued. The conference was jointly convened by the United Nations and IMO.

The Convention has two goals. One is to maintain a high level of safety of human life in the transport and handling of containers by providing generally acceptable test procedures and related strength requirements which have proven adequate over the years. The other is to facilitate the international transport of containers by providing uniform international safety regulations, equally applicable to all modes of surface transport. In this way, proliferation of divergent national safety regulations can be avoided.

The requirements of the Convention apply to the great majority of the freight containers used internationally, except those designed specially for carriage by air. As it was not intended that all containers, vans or reusable packing boxes should be affected, the scope of the Convention is limited to containers of a prescribed minimum size having corner fitting-devices which permit handling, securing or stacking.

The Convention sets out procedures whereby containers used in international transport will be safety-approved by an administration of a Contracting State or by an organization acting on its behalf.

The technical Annex to the Convention specially requires that the containers be subjected to various tests which represent a combination of safety requirements of both inland and maritime modes of transport.

4.1.5 IMO/ILO Guidelines

The use of freight containers, vehicles and other cargo transport units substantially reduces the physical hazards to which goods are exposed. Improper or careless packing of goods into containers or vehicles may be the cause of injury to personnel when such units are handled or transported. Serious and costly damage may occur to

the goods inside the container or to the carrying equipment itself. The person who packs and secures goods in a unit may be the last person to look inside the container until it is opened at its final destination. Consequently, a great many persons will rely on his skill: such as shippers, forwarders, road vehicles drivers and other highway users when the unit is carried by road, railway personnel and others when the unit is carried on a railway wagon, dock workers when the unit is lifted on or off a ship, crew members of the ship which may be taking the unit through very difficult conditions, and the consignees at the final destination. All may be at risk from a poorly packed unit and in particular one which is packed with dangerous goods.

The IMO/ILO Guidelines provide advice as to the essentials of the safe packing of freight containers and vehicles by those responsible for the securing of cargo. They are not intended to cover the filling or emptying of tank-containers or the transport of solid cargo in bulk packagings, nor are they meant to replace or supersede any existing regulations which may relate to the carriage of dangerous goods. The users of the guidelines are advised to consult their Governments for more detailed advice at the national level concerning shipment. The user is recommended to consult also the transport operator/carrier concerning the packing and securing of particularly bulky or heavy goods and the use of special purpose containers or transport units.

4.2 International Conventions Focusing on the Prevention of Marine Pollution Regarding the Carriage of Packaged Dangerous Cargoes by Sea

MARPOL 73/78 deals with various aspects of prevention of marine pollution. Annex III deals with the prevention of pollution by harmful substances carried by sea in packaged form. Regulation 1 (2) prohibits the carriage of harmful substances in ships except when carried in accordance with the provisions of Annex III, which are also amplified by the IMDG Code. Taking into account the recommendation of the Marine Environment Protection Committee at its twenty-seventh session (13 to 17

March 1989) that the marine pollution provisions should be implemented with Amendment 25-89 to the IMDG Code, even if Annex III of MARPOL 73/78 had not entered into force by that date, the Maritime Safety Committee unanimously agreed to Amendment 25-89 to the IMDG Code.

Annex III of MARPOL 73/78 is optional, meaning that Governments which ratify the MARPOL Convention as a whole can at the same time exercise their option not to accept one or all of these Annexes. In practice, several of them have done so and as a result, although the MARPOL 73/78 as a whole entered into force in 1983, Annex III, as amended, entered into force (received the acceptances required for its entry into force) on 28 February 1994 (status July 1995: 73 contracting parties with 65% gross tonnage of world combined fleet).

This Annex applies to all ships carrying harmful substances in packaged forms, or in freight containers, portable tanks or road and rail tank wagons. It requires the issuing of detailed standards on packaging, marking, labeling, documentation, stowage, quantity limitations, exceptions and notifications, for preventing or minimizing pollution by harmful substances. To help implement this requirement, the IMDG Code was amended to cover pollution aspects. This amendment became effective on 1 January 1991.

The Annex consists of seven regulations and an appendix and the revised text has been included in the General Introduction to the IMDG Code. Regulation 1 deals with application and states that they are those substances which are identified as marine pollutants in the IMDG Code. This means, if the substance is not listed by name in the IMDG Code, it is not a marine pollutant as far as Annex III is concerned.

Regulation 2 is concerned about packing and simply states that packages shall be adequate to minimize the hazards to the marine environment having regard to their specific contents.

Regulation 3 deals with marking and labeling and requires that packages are marked with correct technical names and labeled to indicate that the substance is a marine pollutant.

Regulations 4, 5, 6 deal with documentation including a stowage plan of pollutants, proper stowage and quantity limitations respectively.

Regulation 7 provides for exceptions where it is necessary for the safety of the vessel or its crew to allow the jettisoning of harmful substances or for washing spillages over board.

The usual reason to search for and recover packages lost at sea is to protect the marine environment from pollution. The IMDG Code has identified substances regarded as marine pollutants and this is noted on the individual schedules. In the General Index of the Code, these pollutants are identified by the letter **P** against the name of the substance. Some substances have such extreme pollution potential that even diluted solutions or mixtures of these substances are marine pollutants. These substances have been designated Severe Marine Pollutants and are identified by the letters **PP** against the name of the substance. As far as marking the packages for transport is concerned, both severe and standard marine pollutants bear the same marine pollutant mark.

4.3 International Conventions Focusing on Liability and Compensation Regarding the Carriage of Packaged Dangerous Cargoes by Sea

Liability and compensation issues in respect of oil pollution damage were discussed in the International Convention on Civil Liability for Oil Pollution Damage 1969 (CLC 69) and the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971 (FUND 71). Unfortunately, none of these conventions discusses liability and compensation for damage caused by dangerous cargoes other than oil/nuclear materials, and this is a serious flaw which requires rectification. Some member states have advocated that new regimes covering liability for damage caused by substances other than oil/nuclear materials are needed. Discussions in this respect have taken place in the international forum. IMO convened a Diplomatic Conference in 1984 to discuss a draft International Convention Relating to Liability for the Carriage of Hazardous and Noxious Substances at sea (HNS Convention, 1984). In 1996, the Legal Committee of IMO prepared again a draft HNS Convention and adopted the HNS Convention on 3 May 1996 at a conference held at IMO.

The HNS Convention defines its scope of application by reference to existing lists of substances, such as the IMDG Code and Annex II of the MARPOL 73/78 Convention. The Convention introduces strict liability for the shipowner, higher limits of liability than the present general limitation regimes and a system of compulsory insurance and insurance certificates.

4.4 Implementation of International Conventions and Codes in Relation to Package Dangerous Cargoes in China

Implementation of the international conventions and codes in relation to packaged dangerous cargoes in China is embodied to some extent in its national legislation.

The status of its implementation of the relevant instruments is shown in the following Table:

Table 3: Implementation of the International Conventions and Code Concerning Packaged Dangerous Cargoes in China

Instruments	Date of entry into force internationally	Date of entry into force in China
SOLAS 1974	May 25, 1980	May 25, 1980
MARPOL 73/78	October 2, 1983	October 2, 1983
Annex III, MARPOL	February 28, 1994	Not yet in force
CSC 1972	September 6, 1977	September 23, 1981
IMDG Code		October 1, 1982 (Implementation)

4.5 Chinese National Legislation Concerning Carriage of Packaged Dangerous Cargoes by Sea

4.5.1. Maritime Traffic Safety Law of P.R.C.

Maritime Traffic Safety Law of P.R.C., which was adopted at the 2nd Session of the Standing Committee of the 6th National People's Congress of the P.R.C. in September 1983, stipulates that Harbor Superintendency Administrations (HSA) of the P.R.C. are the competent authorities solely responsible for the supervision of the safety of traffic in coastal waters. It also specifies that HSA are the competent authorities responsible for the safety of water traffic. Regarding the transport of dangerous cargoes. It stipulates that "Vessels or installations storing, loading,

discharging or carrying dangerous goods must be provided with equipment and facilities to ensure safety and security and must observe rules and regulations governing the control and carriage of dangerous goods. Vessels bound to carry dangerous goods must apply to the HSA for such carriage. No vessels are allowed to enter or leave the port or commence cargo handling until proper approval from the HSA has been obtained.”

The Maritime Traffic Safety Law applies to waters under Chinese jurisdiction only. For inland waters the State Council has promulgated another law which is called the Inland Waters Traffic Safety Regulations. Unfortunately this law has no relevant regulations or requirements regarding the transport of dangerous goods.

4.5.2 Regulations Governing Supervision and Control of Vessels Carrying Dangerous Cargoes

The Regulations issued by the Ministry of Communications of P.R.C. apply to the loading and discharging and transport of dangerous goods carried by vessels and handled by relevant organizations and personnel in Chinese ports and waters. It also has some provisions regarding stowage, packing, marks and labels, loading and discharging, declaration, endorsement and penalties, etc. It further stipulates that vessels carrying dangerous goods must fill in the Declaration Form of Dangerous Goods Carried by Vessels and report directly or through their agents three days before they arrive in port to the HSA. The report should state the names of the goods, UN numbers, types and characteristics, quantity, packaging and stowage locations. If the voyage is less than three days the vessel must do the reporting before departure. With the approval from the HSA, the vessel can then enter the harbour.

In order to implement the IMDG Code the Ministry of Communications promulgated a circular which requires that the Provisions Concerning Supervision and Control of Containers Carrying Dangerous Goods stipulated by the HSA should be well complied with. In this document there are specific requirements.

It stipulates that containers used to carry dangerous goods must meet the requirements of the IMO's Convention, the CSC 1972, and be proved to be qualified by the relevant inspection authorities. Incompatible goods must of course not be loaded in the same container. The goods in the containers must comply with the requirements set forth in Section 12 of the IMDG Code. The goods itself and the containers must be marked and labeled as required by Sections 7 and 8 of the Code. Irrelevant marks and labels must be removed from the containers.

After the containers are packed and inspected, the organizations responsible for the packing must endorse the Container Packing Certificates as required by Section 12 of the IMDG Code. The packing inspectors are required to sign this Certificate.

Containers for dangerous goods must not be packed and dismantled at the harbor area without prior approval from the HSA. The stowage and segregation on board must comply with Provisions 12.5. and 12.6. of the IMDG Code.

Whenever the HSA thinks it necessary, containers should be opened for inspection. If discrepancies are found regarding the container itself or the cargo stowage inside, the HSA shall instruct the responsible parties, which may be packing departments or shippers, to take the necessary safety measures to correct them. Any consequences arising therefrom must be borne by the parties concerned. In addition there are some rules and regulations regarding rectification. Under the following circumstances, the HSA are authorized to stop the vessel from working and instruct the Master,

responsible people and parties concerned to take the necessary measures to properly rectify them.

1. Vessels arbitrarily enter the harbor and work starts on dangerous goods without approval.
2. Vessels arbitrarily load or discharge dangerous goods at the places or berths which are not appointed by the HSA.
3. Cargo handling machinery and equipment onboard are not in conformity with the requirements.
4. Stowage of the goods do not comply with the regulations.
5. Vessels conceal or make a false report about the dangerous goods.

Accidents occur while working or potential risks of accidents are identified.

To deal with the organizations or vessels that have broken the rules and regulations, the HSA will, at its discretion, give warnings and/or impose a forfeit or some other administrative penalties on them.

In summary, as presented above it goes without saying that the international instruments in this respect are very well worked out and comprehensive although the Chinese national legislation is not so perfect at this stage. The main problem is the implementation of all those regulations. To solve it, all personnel involved in the manufacturing and transportation chain of dangerous cargoes should first of all have a good understanding of them and consciously act accordingly.

Chapter 5

The Practices of Transporting Dangerous Cargoes in Containers in Developed Countries and Proposals for Overcoming Existing Weaknesses or Problems in China

As mentioned earlier, dangerous cargoes have been transported in freight containers by sea for many decades. Many countries, especially the developed countries, have accumulated a lot of good experience. In the author's opinion, the USA, Germany and the Netherlands are among the most experienced. This Chapter will, therefore, study the practices used by them in the safe transportation by sea of dangerous cargoes in freight containers and, in the light of their practices, make some proposals which would overcome the existing weaknesses or problems in China.

5.1 Legislation and Enforcement

Rules and regulations are the indispensable principles and guidance for any administration in its management as well as the norms for restricting the behaviors of the legal person and the natural person. In order to implement the requirements of relevant international conventions and codes, the USCG has established a perfect legal system on the transportation of hazardous materials on water, such as the Ports and Waterways Safety Act (PWSA), the Hazardous Materials Transportation Act (HMTA) and the International Safe Containers Act (ISCA), etc. The relevant responsibilities and jurisdiction in the regulations concerned are very clearly spelled

out. Those instruments are very comprehensive and detailed. What is more, they have been very strictly enforced since their existence. On the contrary, at present China's rules and regulations dealing with the transportation of dangerous cargoes are not perfect and the division of the administrative responsibilities among some organizations are not clear. The existing rules and regulations are lacking in enforcement mechanisms. To improve such a situation in China, it is important that China should first of all establish a relevant legal system with reference to the transportation of dangerous cargoes. The division of responsibilities and jurisdiction similar to the United States are necessary. They are important in that they form the administrative basis of the HSA which is the solely responsible organization for the safety of sea transportation and the protection of the marine environment. Apart from the existing instruments, some specific and unique legal documentation should be supplemented or perfected, such as Safety Regulations Governing Water Transport of Dangerous Cargoes, Rules Concerning Dock for Dangerous Cargoes, Regulations for Accident Report on Dangerous Cargoes, Contingency Plan for Dangerous Cargoes Accidents, etc. With the legal framework in place, enforcement mechanisms should be provided. Otherwise legislation would become lip talk.

5.2 Container Inspection Program

In 1994 the USCG established a new national standardized Container Inspection Program (CIP) for hazardous materials in response to the increased port safety risk posed by containerized dangerous goods in US ports. The CIP's purpose is to prevent incidents related to hazardous material transportation at American seaports, and on the rail and highway systems that serve them and to promote increased compliance with applicable federal laws, regulations, and international conventions (i.e. documentation, packaging, stowing, securing, hazard placarding, marking and labeling, etc.) by commercial or governmental entities engaged in the transport of non-bulk hazardous materials. CIP operations will benefit hazardous material

transportation safety for not only the maritime mode, but also the national rail and highway transportation system. This program will better enable the Coast Guard to ensure compliance of intermodal freight containers with the provisions of the Hazardous Materials Transportation Act and the International Safe Container Act. In practice, specific Coast Guard efforts in education, enforcement, and inter-agency cooperation have resulted in improved safety of water, rail and highway transportation networks converging at port interface as well as intermediary facilities used for staging containers for inter-modal transfers, decreased risk to persons, property, and the environment from hazardous materials incidents and other casualties caused by noncompliance with applicable hazardous material requirements, improved packaging, stowage, and securing of hazardous material cargo in inter-modal containers for transportation aboard commercial vessels using the United States ports.

Although the Maritime Safety Administration of the Ministry of Communications of P.R.C. has also established a container inspection system and has trained several hundreds of inspectors on the spot who are responsible for inspecting the freight containers carrying dangerous cargoes, the container inspection system and container inspector training course are not perfect. The USCG has established not only the inspection program itself but also an Evaluation Plan and a Training and Qualification Guide. The USCG's practices should also be applicable in China. Therefore China should learn from the USA and improve the existing container inspection system.

5.3 Use of Security Seals

In the United States any container used in international transportation, placarded or unplacarded, may be inspected for structural serviceability if the inspector has reason to believe that the container does not comply with the requirements of the

International Safety Container Act when necessary. Each the USCG marine safety unit will maintain a supply of security seals for use during inspections. When not in use, all Coast Guard security seals shall be stored in a locked cabinet, safe or drawer. Each Coast Guard seal will be marked with an alphanumeric identifier. All information pertaining to seals removed from containers and Coast Guard replacement seals shall be recorded in a permanent unit log. Unit seal logs must contain, at a minimum, the following information:

- Date and time existing seal was broken;
- Serial number or identifier of existing seal;
- ID number of the container or transportation unit being inspected;
- Serial number or identifier of replacement seal;
- Name/rate/rank of Coast Guard inspectors; and
- Name/title of witnesses.

If security seals are removed, the removal and replacement of seals shall be conducted in accordance with the Coast Guard/Customs Memorandum of Understanding. Seals shall be applied and logs maintained in numerical order. If, during the course of transportation, a container is breached, the seal log and other records may help to pinpoint where in the chain of custody the container was compromised, who was responsible, and other information necessary to prevent future occurrences.

In China, at present, if the inspector from the MSA has reason to believe that the sealed container does not comply with requirements, he can not open the container to inspect the interior structural components unless a Customs officer is present.

With the successful experience of the USCG, China's MSA should be authorized to work in the same manner as the USCG does and sign a memorandum of understanding with the Customs. By doing so, deficiencies can be timely corrected

on the spot and the safe transportation of dangerous cargoes in freight containers can be ensured.

5.4 Packaging Quality

The packaging of dangerous cargoes for shipping will protect them from the accidents of inflammation, explosion, corrosion, poisoning, radiation and so on. Therefore, suitable packaging is one of the most important procedures to ensure safe transport.

In the United States, strict regulations and control procedures are exercised over the whole process of packaging. The U.S. Department of Transportation's Research and Special Programs Administration (RSPA) is responsible for enforcing the requirements for testing, monitoring, and controlling packaging quality. RSPA's Office of Hazardous Materials Enforcement is initiating nationwide efforts to check certified and marked UN standard non-bulk packagings for compliance with performance test standard in 49 CFR part 178. By October 1, 1996, all dangerous goods packagings, including non-specification containers under the pre-HM-181 regulations have had to meet UN performance standards. Whether a package is tested at an in-house operation or an outside facility, testing laboratories play a critical role in determining whether or not the UN mark may be placed on the packaging.

Although the function of packaging is clearly known to all and there are special requirements set forth by the relevant international conventions and rules dealing with dangerous cargoes transported by sea, such as the requirements regarding the packaging materials, packaging techniques and performance test, etc., accidents still happen from time to time resulting from improper packaging. There is no exception in China's sea transport of dangerous cargoes. Accidents have also been experienced

at home and abroad. In order to ensure safe transport by sea of dangerous cargoes and prevent pollution, packaging quality should first be improved.

This requires that the manufacturers produce qualified packaging materials. Quality testing organizations should strictly control the products, consignors should select suitable packaging compatible with goods to be packaged and tested and marked as required according to packaging groups I, II or III. Packers should carefully dunnage and lash the cargoes in the containers. In short, as long as all the related links are well coordinated and people concerned do their best to ensure packaging quality in such procedures as material selection and monitoring, the existing problems are sure to be minimized.

5.5 Containers Packing

International regulations and most developed countries' legislation impose various duties on different classes of persons regarding the safe transport of dangerous goods. These persons are categorized as: the packer, the shipper, the freight forwarder or agent and the carrier. These four categories of persons or organizations in the transport chain have their respective responsibilities for ensuring safety. However the packer is in many ways the most important as his actions or omissions will affect all the others in the transport chain. In other words, the packer is the real key to the safe transport of packaged goods, whether or not they are dangerous. He is the only person who knows what he packs and how he packs it. Similarly only the packer is in control of the placarding, etc. of the package and the generation of the correct documentation to give the necessary information to those further along the transport chain. Errors and omissions by the packer can lead to serious accidents to others throughout the transport chain, right through to the final consignee.

To ensure safety and soundness of this link, measures should be taken. For example, packers should be trained before they are assigned the task. They also need a high sense of responsibility and should be highly aware of their duties. Duties should be clearly defined and incorporated into the training course since they are vitally important. They should become the guiding principle for the actions of the packers.

In 1993, Leith International Conferences organized a seminar on the carriage of dangerous goods in containers by sea. During the seminar Mr J. L. Alexander presented an article titled "Packing -- a key to safe transport", in which he defined the duties of packers under the following five headings, which, in the author's mind, also should become the duties for Chinese packers.

The packages themselves. These should be in good condition, UN tested, and conform to the requirements of Annex I of the General Introduction to the IMDG Code. They should also protect the interior of the cargo transport unit from their contents, be capable of withstanding the stress of handling and carriage and be labeled and marked in accordance with the Code.

The freight container. This should be checked before loading to ensure that it is suitable for the cargo and is clean, dry and in suitable structural condition. Any doors should close securely. Any irrelevant placards or marks should be removed. In the case of freight containers they should also carry a valid safety approval plate and the maximum gross load markings should be consistent with those on the safety approval plate.

Loading. This should be undertaken in an appropriate sequence. Matters to be considered include the compatibility of packaged dangerous goods, the segregation of non compatible goods, the load distribution and securing, including the need for

adequate bracing and dunnage. Attention is drawn to further guidance, including the IMO/ILO Guidelines for packing cargo in freight containers .

Placarding and marking. The appropriate number of correct hazard warning placards and any necessary marine pollutant marks should be fixed to the freight containers.

Documentation. A container packing certificate should be issued and signed. Where the container packing certificate is included in the dangerous goods declaration separate signatures are required for the certificate and declaration.

Apart from the above duties, the packing and securing of the dangerous goods inside the container should be done under the supervision of a knowledgeable and personally responsible person, since operation requirements have to be observed. It should be noted that all dangerous goods packed into a container require packagings, marking and labeling as though transported as breakbulk.

5.6 Stowage and Segregation

The stowage and segregation of packaged dangerous cargoes in ships is a complicated process. Different types and properties of goods have different requirements in respect of packaging, stowage, segregation and safeguard against pollution. It is of utmost importance to a cargo officer, a stevedore, a warehouse or a terminal operator to have good knowledge of the cargoes they handle.

In this regard, the USA, the Netherlands and Germany, as far as the author knows, strictly follow the IMO Code of Practice for Cargo Stowage and Securing and the IMDG Code. These instruments succinctly cover what should be known and done regarding stowage and segregation. The Stowage & Segregation Guide to the IMDG

Code by publisher K. O. Storck Hamburg, provides a realistic and easy-for-use guide to the practice.

In order to rectify the current deficiencies in China and to be in line with the international practice, China should also apply the following basic principles:

- Personnel commissioned to cargo stowage should be properly qualified and experienced;
- Safe stowage and securing depends on proper planning, execution and supervision;
- Cargo carried in containers should be packed and secured so as to prevent damages or hazard to the ship, to the crew and to the marine environment.
- On completion of stowage the Master of a ship should prepare a dangerous goods stowage plan which includes the exact location of the dangerous cargoes in containers and offers details as to the hazards of the cargo.
- Emergency procedures should also be indicated on the stowage plan and a dangerous cargo manifest should be prepared.
- The stowage and segregation of dangerous cargoes carried in containers should comply with the requirements in the IMDG Code.

In other words, to ensure the safe transportation of dangerous cargoes, compliance with the stowage and segregation requirements will prevent serious incidents from happening. It is recommended that each ship undertaking such transportation should have a copy of the Stowage & Segregation Guide to the IMDG Code on board.

5.7 Documentation

Documentation provides people with a clear picture of the whole consignment. Complete, adequate and correct documentation is indispensable for the safe transport of dangerous cargoes. The importance of documentation can never be over-

emphasized. Documentation or declaration faults will cause weaker emergency procedural planning, thus resulting in additional and unrecoverable losses. For example, in the USA, documents are strictly checked at all levels and stages in the transport chain. Whenever faults or inadequacies are found, remedy work is timely done. Cargoes without adequate documentation are always rejected.

In China, problems with documentation normally fall within one of the following areas: unsigned documents, illegible handwriting or reproduction, incomplete/incorrect information, and missing documents. In order to solve these problems, it is very important that dangerous goods declarations and container packing certificates should be completed by those with the authority to do so, the following requirements must be complied with:

- Ships built on or after 1 September 1984 and carrying dangerous goods are required to carry on board a document of compliance in accordance with SOLAS 1974, regulation II-2/54.3 as evidence that the ship complies with the special requirements for ships carrying dangerous goods stipulated in SOLAS regulation II-2/54.
- The document of compliance furthermore provides information on the classes of dangerous cargoes that may be carried on deck and in each compartment. Also, on board a ship carrying dangerous cargoes a list, a manifest and a detailed stowage plan detailing the dangerous cargoes and their location on board are required.
- All dangerous cargoes transported by sea have to be accompanied by special information and a declaration on behalf of the shipper by a responsible person.
- The information is also required for dangerous cargoes packed in containers, in which case an additional document is demanded, namely the container packing certificate. This certificate has to be issued by the person responsible for the packing and securing of the dangerous cargoes in the box and has to accompany the dangerous cargoes container from packing to unpacking.

- The uniformity of all forms, tables and other documents is important. The competent authorities should designate special personnel with a high sense of responsibility to take charge of the production of these papers.

5.8 Developing a Contingency Plan for Dangerous Cargoes

In the course of transport of dangerous cargoes, there will never be a 100% safety level and, in spite of all efforts made, accidents may happen. The conclusion must be that this fact has to be realised and that, therefore, precautions have to be taken to respond to possible accidents as quickly and efficiently as possible so that the accidents can be limited in their extent in order to prevent a spreading of the harm already caused. It is vital that all thinking and planning on what to do must be taken before the accident happens so that in case of an emergency immediate action can be taken without delay.

Accidents caused by containerized dangerous cargoes are always unexpected. Ships and ports are not purpose-built, people are not always trained and aware of the dangers, the construction and layout is complex and equipment is not specialized everywhere. Because of these facts ships' crews as well as port workers are often caught unprepared when accidents do happen.

To be well prepared for unexpected accidents, contact persons, available equipment etc. must be defined and presented in writing in a contingency plan. Nowadays such preparedness should be part of the quality assurance program of shipping companies and ports. In this regard, Germany and the USA have accumulated good experience. They have contingency plans for ships as well as for ports. The emergency response procedures on ships and those in ports are different and should be respectively defined.

Unfortunately up to now China has not a single comprehensive onboard or onshore contingency plan for dangerous cargoes. Therefore developing such a contingency plan is extremely urgent. Relevant international conventions and codes should be used as guiding principles when the emergency or contingency planning is being carried out. What is more important, however, is that such a plan must be made realistic and workable. Additional investments should be assured because necessary response equipment, the training of personnel etc. are indispensable costs that need to be covered. To conclude, it is vital for both the ship and the port to be prepared for the accident. "Prevention first, treatment integrated." Once an accident happens, a contingency plan will enable people to respond rapidly and deal with it timely, thus controlling its further spreading and reducing the damage and losses already caused by the accident to the minimum. Necessary investments may, in the long run, incur savings which could make a port or a ship profitable and more reputable.

5.9 Education and Training

The change and development of transport modes are accompanied by the development of various transport means, which in turn require the improvement of techniques and management levels. Advanced techniques and management systems need qualified expertise. In order to meet the new challenge, the quality of people should be quickly improved through education and training. In the maritime industry this has already become a popular topic on the lips of people.

The USCG established not only the CIP but also a Container Inspection Training and Assistance Team (CITAT) at the DOT's Transportation Safety Institute in Oklahoma City. The CITAT consists of three officers and six enlisted personnel. Its responsibilities include:

- Providing container inspection assistance to field units implementing the national container inspection program.

- Promoting standardization of CG inspection procedures nationwide.
- Provide deployable on-site packaged hazardous materials and container inspection training to CG units involved in container inspection.
- Assisting Marine Safety Office's/Captain of the Port's during CG participation in multi-agency "Strike Force" operations (MASFO).
- Coordinating joint inspection with other federal and state enforcement agencies.
- Providing exportable hazardous material familiarization training to U.S. Customs inspectors as per existing interagency agreements.

The USCG has also compiled a complete container inspection, training and assistance team course syllabus in which the subjects listed are more detailed and more complete. This course is applicable to China. Therefore China's MSA should set up a training and assistance team responsible for training the people who are in charge of the inspection of containers carrying dangerous cargoes in order to improve the safety of water transportation; to decrease risk to persons, property, and the environment and to improve packaging, stowage, and securing of dangerous cargoes in containers for transportation aboard vessels using the Chinese ports and waters.

The rapid development of science and technology and the constant amendments of international conventions and codes require the personnel in the maritime industry to gain more knowledge apart from the past experiences and common practices. The maritime transport and management of dangerous cargoes is a specially high professional and technical task. To meet the new requirements of the management, the professional knowledge of the personnel in this particular field should be upgraded. Firstly, container consolidation personnel of dangerous cargoes, container packers and container inspectors on the spot should be trained to have a good understanding of the requirements in the international conventions and codes. Secondly, seafarers engaged in dangerous cargoes transport should be educated and trained to have a thorough understanding of their vessels' conditions, stowage and

segregation, and to be well in command of the relevant techniques. In a word, through appropriate training in their respective responsibilities, the quality of the personnel concerned can be raised overall and the accidents caused by the human factor which contributes to 80% of them can be certainly minimized. In order to train people more effectively, it is strongly recommended that foreign experts be invited to conduct seminars in China or key personnel be sent to advanced countries to learn from others.

5.10 Coordination and Cooperation with the Organizations Concerned

Coordination and cooperation among the organizations are the basic elements for government organizations to carry out day-to-day activities. To ensure the safety of transportation of hazardous materials and to protect the marine environment, the Department of Transportation's hazardous materials programs in the United States are coordinated by the Research and Special Program Administration's (RSPA) Office of Hazardous Materials Safety (OHMS). Each modal administration (the Federal Highway Administration (FHWA), Federal Aviation Administration (FAA), Federal Railroad Administration (FRA), and Coast Guard) is responsible for enforcing applicable regulations within its area of jurisdiction. In the United States, the Department of Transportation is responsible for water, highway, aviation and railroad administration. In this way it is easier to coordinate and cooperate among the organizations where issues of mutual interest are interrelated.

In China, however, there are relatively many organizations with numerous administrative links dealing with the transport of dangerous cargoes. The division of administrative responsibilities among some organizations is quite implicit. This adversely influences the safe supervision of dangerous cargoes. As mentioned in Chapter 2, three Ministries (the Ministry of railway, the Civil Aviation Administration of China and the Ministry of Communications) are respectively

responsible for railway, air, and water and highway transportation. It is not easy to coordinate and cooperate among the organizations concerned if issues of mutual interest arise.

The US formation of these interrelated organizations is more reasonable and facilitates coordination and cooperation. In this regard China should follow suite. The three Ministries should be combined into one department. Appropriate coordination and cooperation among the organizations concerned should be enhanced and all links should be well connected in order to further improve safety work.

Regarding the coordination and cooperation between the USCG and the USCS, the USA also has very good experience. In 1988, the Coast Guard and the United States Customs Service (USCS) signed a Memorandum of Understanding (MOU) governing the waterfront areas. The Customs has expressed concern that Coast Guard inspectors opening freight containers on waterfront facilities could inadvertently compromise Customs surveillance of a container suspected of containing contraband. The purpose of the MOU is to avoid misunderstandings between the two agencies regarding their respective goals and authorities. In addition, the MOU clearly spells out their respective jurisdiction and ensures that the interagency inspection activities are well coordinated.

The USCG and the USCS are working in close cooperation and support each other with respect to the suppression of violations of the Customs and transportation safety laws in inter-modal freight containers. The Customs assists the Coast Guard in arranging for the examination of cargo, although they will not normally place a "Customs Hold" on cargo for another agency. The Coast Guard is responsible for making examination arrangements with the carrier. If the Coast Guard discovers evidence of possible contraband and/or other Customs enforced violations, the Coast Guard will immediately contact the Customs. Similarly, the Customs will

immediately contact the Coast Guard upon discovering evidence of any possible hazardous materials violations. When seals are broken the Coast Guard will contact carriers or their representatives. The Coast Guard will ensure that all seals removed from containers are noted, that the containers are re-sealed with Coast Guard seals after examination, and that this seal information is made available to the Customs, upon request. When the Customs and the Coast Guard both have an interest in a containers, the Customs will coordinate a Centralized Examination Station (CES) for an examination. However, shipments that pose dangers or risks to transportation will be examined at a site determined by the Coast Guard.

The USCG has paid attention to not only inter-organizational coordination within the Department of Transportation but also external coordination with the Customs. In this regard China should introduce the practice of the US and enhance the coordination between MSA and the Customs. Therefore a good cooperation and coordination relationship between MSA and the Customs should be established.

5.11 Establishing a Liability and Compensation System for the Damage Caused by Dangerous Cargoes

Transportation of dangerous and hazardous materials is also confronted with compensation to the parties who sustain damage to the goods or environment. In China's coastal ports, the Changjiang River and Shanghai Huangpu River, accidents of poisons falling overboard have happened several times requiring salvage operations and pollution elimination (mentioned in Chapter 3). Therefore, it is necessary to establish a system of liability and compensation for the damage and pollution caused by dangerous, hazardous and harmful substances. In doing so the responsible organizations can not only ensure to mobilize the social force to take the necessary steps to eliminate and control pollution, but also be in line with the system after the HNS Convention comes into force in the future.

5.12 Strengthening the Exchange and Cooperation Between Countries

China is one of the maritime powers in the world today. It should take an active part in the various activities of the International Maritime Organization. It should also understand the situation of international shipping and the requirements of the relevant conventions and codes. This will help the international conventions and their standards to be implemented in China.

As for technology exchange, the method of two-way exchange by inviting experts to China or sending delegates abroad should be encouraged. The invitees may include some technology and management experts from the developed countries such as the USA, Germany, the Netherlands etc., while the delegates sent may be personnel in technology and management from home. In doing so mutual understanding and cooperation between China and other countries can be effectively strengthened.

Chapter 6

Conclusions and Recommendations

6.1 Conclusions

From this study, the following points can be concluded:

- With the increase in international trade, the world will be moving towards universal regulations to streamline shipping requirements. There will be more and more dangerous cargoes moved by sea. To ensure safety, sea transportation presents an ever increasing challenge.
- The Maritime Safety Administrations in China have played a lead role in the sea transportation of dangerous cargoes. But compared with the practices between some developed countries and China, the latter has many areas that needs improvement.
- To meet the requirements of transportation of dangerous cargoes applicable to all modes of transport, harmonization between the rules of various modes needs to be looked into.
- The good quality of packagings containing dangerous cargoes will ensure that safety is maintained in the transport chain.
- The importance of the selection of competent packers who are familiar with the requirements relating to the transport of dangerous cargoes by sea has not been realized . The packer of a cargo transport unit holds one of the most important keys to the safety.

- The safety of transport by sea of dangerous cargoes in freight containers depends greatly on two factors: the packing of the containers on shore and the stowage of the containers on board. Safe stowage and proper securing and lashing depend on proper planning, execution and supervision.
- Documentation and declaration faults will cause weaker emergency procedural planning and delay.
- China's Maritime Safety Administrations have no other choice but to take the necessary measures as early as possible in order to comply with the requirements of the conventions and codes concerned and catch up with developed countries. It is essential that safety in the transport chain relating to the transport by sea of dangerous goods in freight containers be assured .

6.2 Recommendations

In order to enhance the safety of transport by sea of dangerous cargoes and to protect the marine environment, this paper, based on the analysis of the existing problems in the transportation of packaged dangerous cargoes in China and advanced management experiences gained from developed countries, intends to put forward the following recommendations:

- China's national legal system regarding the safe transport by sea of dangerous cargoes should be established and updated.
- The existing container inspection system should be further perfected.
- The quality of packaging should be further improved.
- On the spot the container packing inspection should be enhanced.
- China's Maritime Safety Administrations should be authorized to open any containers suspected of deficiency for inspection without the presence of the Customs as the USCG.

- The dangerous cargoes packing/shipping procedures should be strictly followed.
- Cargoes carried in cargo transport units should be packed and secured so as to prevent damage or hazards to the ship, the persons on board and the marine environment.
- Complete, adequate and correct documentation should be provided for the safe transport of dangerous cargoes.
- Vessel Traffic System should pay special attention to ships carrying dangerous cargoes on board when reporting flow of traffic.
- Personnel should be continuously upgraded in the transport chain.
- A contingency plan for dangerous cargoes, and harmful substances should be developed.
- A liability and compensation system for the damage caused by dangerous, hazardous and harmful substances should be established.
- The coordination and cooperation between the organizations concerned should be enhanced.
- The exchange of information and cooperation with foreign countries should be further strengthened.

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Appendix 1

DANGEROUS GOODS DECLARATION

Shipper		Reference number(s)	
Consignee		Carrier	
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 or 17.7.7.		Name/status, company/organization of signatory	
		Place and date	
		Signature on behalf of packer	
Ship's name and voyage no.		Port of loading	
Port of discharge		Instructions or other matter	
Marks & nos. If applicable, identification or registration number(s) of the unit	Number and kind of packages, proper shipping name*, IMO hazard class/division, UN number, packaging group (where assigned), flashpoint (in °C c.c.)**, control and emergency temperatures**, identification of the goods as MARINE POLLUTANT**, EmS No. and MFAG Table No.***	Gross mass (kg) net quantity/ mass**	Goods delivered as <input type="checkbox"/> Breakbulk cargo <input type="checkbox"/> Unitized cargo <input type="checkbox"/> Bulk packages Type of unit (container, trailer, tank vehicle, etc.) <input type="checkbox"/> Open <input type="checkbox"/> Closed Insert "X" in appropriate box
*Proprietary/trade name 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 QUANLITY" should be added. **When required in 9.3 of the General Introduction of the IMDG Code. ***When required.			
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.		Name/status, company/organization of signatory	
		Place and date	
		Signature on behalf of shipper	

Appendix 2

CONTAINER PACKING CERTIFICATE

Ship Name		Voyage		Destination		
Container Serial No.						
Dangerous cargoes packed therein						
Proper Shipping Name	UN No.	IMDG Code Class	Packaging Group	Package Quantity	Total of Container	Total Weight

It is certified that:

1. The container was clean, dry and apparently fit to receive the goods.
2. No incompatible goods have been stowed therein.
3. All packages have been externally inspected for damage, and only sound packages have been packed therein.
4. All packages have been properly packed and secured.
5. The container and packages are clearly marked, labelled and placarded.
6. The dangerous goods declaration required in Subsection 9.4 of the General Instruction to the IMDG Code has been received for each dangerous goods consignment packed in the container.

All stated above are correct.

Signature of packing inspector

Place of inspection

No. of packing inspector's certificate

Packing organization (stamp)

Date of packing

Date of issue

Note: Two copies of the certificate should be completed by the packing inspector. The original should be submitted to Harbour Superintendency Administration three days prior to shipment and the copy should be given to the carrier on the delivery of the containers.

Appendix 3

CERTIFICATE OF COMPLIANCE FOR DANGEROUS CARGOES IN LIMITED QUANTITIES

It is certified that the consignment described complies with Section 18 of the General Introduction of IMDG Code and is offered for shipment as dangerous cargoes in limited quantities.

Proper Shipping Name	UN No.	Property	Packaging Group	Package Type	Receptacle (net)	Package (gross)	Consignment (total weight)	Remarks

Signed by applicant:

Date:

Approved by competent authority:

Date:

Note: This certificate should be completed and attached to the Dangerous Goods Declaration when cargoes are offered for shipment as dangerous cargoes in limited quantities.

Appendix 4

CERTIFICATE FOR THE DOSAGE OF RADIOACTIVES

Proper Shipping Name		Physical State		Lump (Sealed/unsealed), Powder, Crystal, liquid, Gas							
Quantity		Rays		α		β		γ		fast neutron	
Package No.	Radioactive Level (Ci)	Dose Equivalent Rate(mrem/h)		Packaging	Transport		Whether contaminated on the surface of the outer packaging				
		On the surface of package	One meter from the package	Group	Index						
Safe distance not less than _____ meter if outer package damaged		Half Decay Time		Days/Year							
Remarks											

Checking authority (stamp)

Checker (signature)

Verifying authority (stamp)

Verifier (Signature)

Appendix 5

_____ HARBOUR SUPERINTENDENCY ADMINISTRATION,
THE PEOPLE'S REPUBLIC OF CHINA

CERTIFICATE OF SAFE STOWAGE OF DANGEROUS CARGOES

No.: _____

This is to certify that the vessel _____, _____ flag, loaded under supervision of this Harbour Superintendency Administration _____ tons of dangerous cargoes (as per the list attached) in this port on _____, to _____ and the stowage thereof complies with the regulations of our country in respect of stowage and carriage of dangerous cargoes.

Date: _____

LIST OF DANGEROUS CARGOES LOADED

Proper Shipping Name	UN No.	Property	Package quantity	Weight	Location of stowage	Remarks

Appendix 6

Inspection Certificate of Dangerous Cargoes Packaging

No.	Inspection Date	Day	Month	Year
Package	Type:	Packaging Group	Net Weight	Gross Weight
	Lot No.	Production Date	Time limit for use	
Records	Item	Technical Specification		Results
Remarks (the validity of this certificate to be identified)				
Signed by (Technically competent personnel):				
Packaging Adaptability Evaluation				
(To be completed by user) Day Month Year				
Cargo	Chinese Name		Class	Relative Density
	English Name		UN No.	Status
Package Method			Package Evaluation	
			Signed by (Technically competent personnel)	
Port comments after verification				
Signature of Inspector:				

Day Month Year