

Policy Recommendations for the Safety Management of Dangerous Goods in Asia and Pacific

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Contents

1. Introduction
2. Major DG Incidents and Implications for Ports
3. DG Transport and Regulations
4. DG Management at ESCAP Ports
5. DG Management at Port : Case Studies
6. Measures to Improve Management of DG at Port
7. Recommendations

1. Introduction



1. Introduction

1.1 Purpose of Study

- Global DG shipping trade continues to increase, and as a result, fires and explosions continue to occur at ports.
- ESCAP is conducting research to develop safe and effective DG management, education, and training programs at ports.

1.2 Methodology of Research

- Investigate international regulations and best practices for DG management at ports, and survey the status of DG management of dangerous goods at ESCAP ports
- Suggest recommendations for ESCAP region DG management by referring to International regulations, DG incident cases, and DG management practices at major ports.

1. Introduction

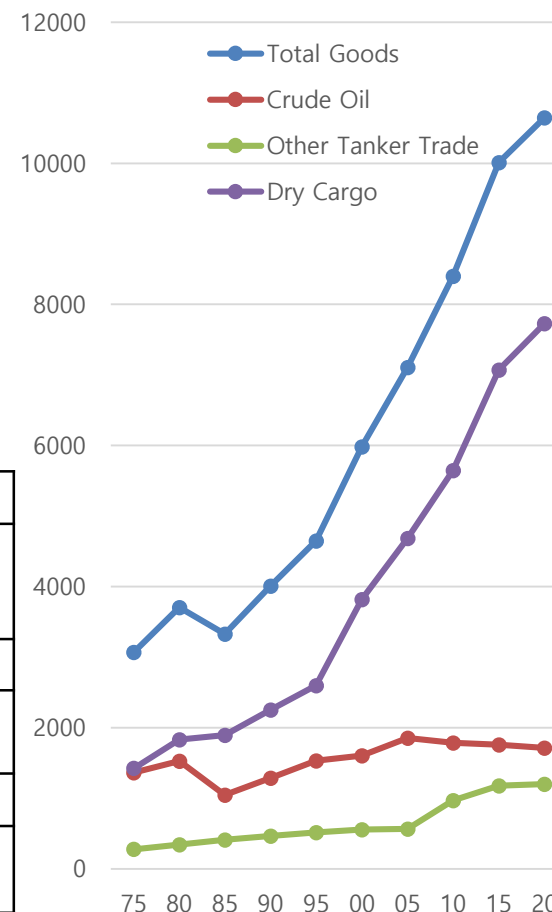
1.3 World Seaborne Trade

- The global shipments of DG gradually increasing
- Dry cargo has grown at CAGR of about 4%, Other tanker trade 3%, and Crude oil around 1% since 1975

Total Seaborne Trade by cargo type

World level	Loaded			Discharged			Balance	
	Volume (Millions of tons)		Annual growth rate(%)	Volume (Millions of tons)		Annual growth rate(%)	Volume (Millions of tons)	
	2015	2020		2015	2020		2015	2020
Total Sea-borne Trade	10013	10648	-3.8	9965	10631	-3.8	48	17
Crude Oil	1761	1761	-7.8	1910	1864	-7.9	-149	-1
Other Tanker trade	1178	1202	-7.7	1175	1222	-7.5	3	-20
Dry Cargo	7074	7730	-2.2	6879	7545	-2.2	195	185

Source: UNCTAD Handbook of Statistics 2021



Development of goods loaded worldwide by type of cargo

1. Introduction

1.4 Dangerous Goods

1.4.1 Characteristic of dangerous goods

- Dangerous goods are subject to transport, workplace, storage, consumer and environment protection regulations, to prevent accidents to persons, property or the environment, to other goods or to the means of transport employed(from UNECE)



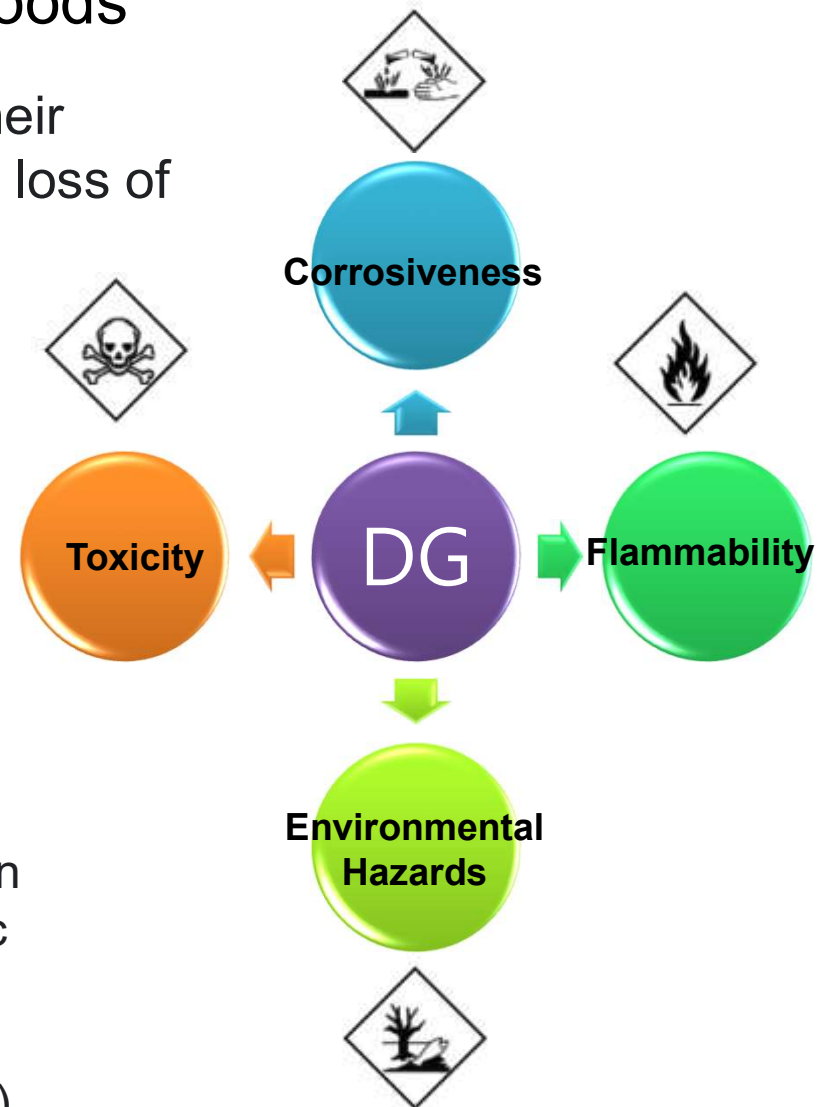
- Dangerous goods in bulk are transported in large quantities by sea, and packaged dangerous goods are mainly transported by sea along with roads, railways and air.

1. Introduction

1.4.2 Hazardous of dangerous goods

- Dangerous goods, depending on their characteristics, may not only cause loss of health or injury, but also adversely affect the marine environment.

- DG may cause death or serious injury if swallowed, inhaled or if in contact with skin (insecticides, dyes, etc.)
- There is a risk of fire or explosion due to an ignition source (paint, adhesives, etc.)
- May cause skin necrosis or corrosion of metal surfaces (sulfuric acid, nitric acid, batteries, etc.)
- May contaminate the ocean environment (marine pollutants, etc.)



1. Introduction

1.4.3 Forecast of dangerous goods market

- Dangerous goods make up around 10% of all containerized shipments worldwide
 - [Air] Every year more than 1.25 million dangerous goods shipments are transported by air. With air cargo growth predicted at 4.9% every year over the next 5 years the number of dangerous goods shipments will rise significantly(2022)
 - [In S.Korea] 44% DG in the total maritime cargo volume
- Various dangerous goods is projected to grow on a yearly
 - 3,000 types of substances or products classified by the IMDG Code
 - 6,500 types of dangerous/hazardous materials transported by sea
 - Demand for transportation of the lithium batteries is rapidly increasing every year
- Dangerous Goods Logistics Market to grow at ~ 6.8% CAGR during the forecast period (2022-2030)

1. Introduction

1.4.4 Dangerous goods incidents

- Dangerous goods have caused 30% of shipping incidents (Source: TT Club)
- According to data published by IMO, the number of transport accidents involving dangerous and hazardous materials has increased significantly
 - 29 cases (average 5.8 cases annually) between 1996 ~ 2000
 - 65 cases (average 13 cases annually) between 2006 ~ 2010

2. Major DG Incidents and Implications for Ports



2. Major DG Incidents and Implications for Ports

2.1 Beirut Explosion Accident

2.1.1 Incident overview

- Incident date: 2020. 8. 4. 18:08
- Location: Warehouse, Port of Beirut, Lebanon
- Substance: Ammonium nitrate 2,750ton
- Damage: Dead: 220 persons
Missing: 7 persons
Wounded: about 7,000 persons
Property damage: 15 billion USD



2. Major DG Incidents and Implications for Ports

2.1.2 Incident timeline

- On August 4, 2020, an explosion occurred at the Port of Beirut, the capital of Lebanon.
- The first explosion was relatively small, emitting fire and smoke, with some witnesses seeing sparks resembling fireworks.
- A second explosion much larger than the first occurred at about 6:08 p.m. The shockwave of the explosion reached downtown Beirut and raised a cloud of red dust.
- The second explosion was so intense that it could be felt even in Cyprus, 240 km away.



2. Major DG Incidents and Implications for Ports

2.1.3 Cause of Incident

- The cause of the explosion was not immediately known, but some media initially reported that there was an explosion in a fireworks warehouse or an explosion in an oil or chemicals storage facility.
- It was later reported that ammonium nitrate, which had been stored for several years in Beirut's port, caused an explosion. The cargo was seized from the *Lorokus*, a general cargo ship of Moldovan register, in 2014 and was stored at the port.
- Until now, the Lebanese government has not officially announced the cause or result of the incident investigation, but according to eyewitnesses, some testified that they saw a strange orange cloud after the explosion, and others believe that the accident was caused by weapons or explosives.
- The Lebanese government said the orange clouds were related to sodium nitrate explosions.

2. Major DG Incidents and Implications for Ports

2.1.4 Implications of Incident

- A large explosion occurred at a warehouse in the port of Beirut, Lebanon's capital, killing more than 200 people and injuring thousands.
- 2,750 tons of ammonium nitrate had been stored for a long period of six years without safety precautions in the Beirut harbor warehouse. The port office sent official letters to the relevant authorities and courts six action to address these dangerous goods, but no appropriate reply was received. A Lebanese security officer says highly explosive materials were seized from the blast site.
- Ammonium nitrate, a white crystalline solid at room temperature, is often used as a high-nitrogen fertilizer in agriculture, but it can explode violently if it comes into contact with a flame or other accelerant.
- The bulk storage of ammonium nitrate, rather than storage in packaging containers, was evaluated to represent a lack of adherence minimum safety regulations for dangerous goods.

2. Major DG Incidents and Implications for Ports

2.2 Tianjin Explosion Accident

2.2.1 Incident overview

- Date: 2015. 8. 12. 23:55
- Location: Binhai New Area, Tianjin, China
- Substance: Chemicals (Nitrocellulose)
- Damage:
 - Dead 173 persons
 - Missing 8 persons
 - Wounded 797 persons
 - Property damage 9 billion USD
 - (300 buildings, 12,000 cars, 7,500 containers)



2. Major DG Incidents and Implications for Ports

2.2.2 Incident timeline

- Around 11:30 pm on August 12, a chemical substance in a loading container exploded at Tianjin Port, causing a fire.
- The fire ignited a nearby oil storage tank and caused a two-stage explosion, leading to a large-scale explosion.
- There were two large explosions and several small explosions. The second explosion was said to be equivalent 21 tons of TNT.



2. Major DG Incidents and Implications for Ports

2.2.3 Cause of Incident

- Chemicals (nitrocellulose) stored in containers in the harbor were spontaneously ignited by high temperatures in a dried state. The fire spread, reacting with other substances such as ammonium nitrate, a raw material for explosives, leading to a large explosion.
- The reason for the spread of the explosion was that the sprinkler system activated to extinguish the initial fire doused a hoard of calcium carbide – a dangerous substance – with water, producing acetylene gas, resulting in the first explosion. The flames formed by the acetylene explosion were moved on to ammonium nitrate and potassium nitrate also stored at the facility, resulting in a large-scale secondary chain explosion, further spreading the damage.

2. Major DG Incidents and Implications for Ports

2.2.4 Implications of the Incident

- In industrial facilities handling dangerous goods, a number of risks have been identified, such as safe storage distances, mixed storage of materials with different properties, and lack of appropriate fire suppression equipment.
- This requires a detailed analysis of the environmental factors of the entire DG shipment and storage process. Such an analysis should produce a wide range of improvement measures, including reforms to incident response scenarios and measures to protect local residents. It also necessitates the conduct of detailed safety diagnoses for older port warehouse facilities.
- A chemical disaster response plan that improves the safety of related facilities by quantitative risk assessment should be prepared.



2. Major DG Incidents and Implications for Ports

2.3 KMTC Hong Kong Fire Accident

2.3.1 Incident overview

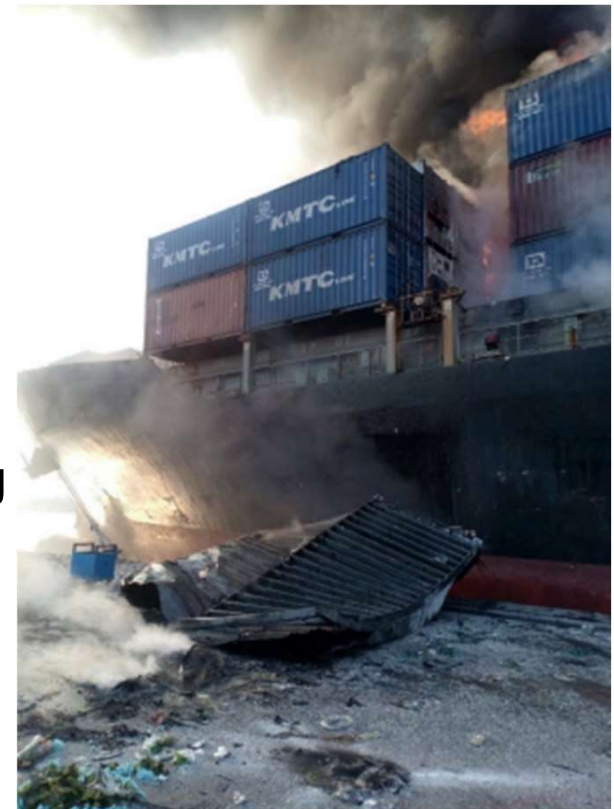
- Date: 2019. 5. 25. 06:55
- Location: Hutchison terminal, Laemchabang, Thailand
- Vessel Name: KMTC Hong Kong
 - Register/Owner: Jeju, Korea/KMTC
 - Classification: KR
 - L/B: 159.5m/27.2m
 - GT: 16,731ton
 - Cargo: Container 1,585 TEU (Loaded 676ea)
- Damage: No loss of life.
103 containers (TEU 56ea, FEU 47ea) damaged.
Hull a total loss after 2,3,4 cargo hold structures deteriorated and deformed.



2. Major DG Incidents and Implications for Ports

2.3.2 Incident timeline

- On May 10, shipper requested the shipping company to transport calcium hypochlorite between Hong Kong and Bangkok as general cargo. Cargo was to be entered onto ship manifest as “water purifier”.
- The shipping company treated this cargo as general cargo, loading 13 containers into cargo hold No. 3, where the fuel oil tank is located.
- During the voyage, for inspection and maintenance of No. 7 fuel oil tank, 63M/T of No.7 fuel oil was heated to 45~50°C and transported it to starboard No.3 fuel oil tank. Following that, the temperature in cargo hold No. 3 rose.
- On May 25, during unloading at Laem Chabang Port in Thailand, a white haze emerged from the cargo hold No. 3 and spread around 06:55. Over the next two minutes, multiple explosions blew out hold hatches and containers, and the fire spread.



2. Major DG Incidents and Implications for Ports

2.3.3 Cause of Incident

- A drum of calcium hypochlorite, a dangerous good with a critical temperature of 43.4 °C, was declared as general cargo and shipped in the No. 3 hold.
- As the fuel oil in the ship's No. 3 fuel oil tank was heated to 45~50°C, the calcium hypochlorite was exposed to a temperature above its critical point, triggering a self-accelerating reaction. The volume of gases such as oxygen generated in this process expanded rapidly, leading to explosion and fire.



2. Major DG Incidents and Implications for Ports

2.3.4 Implications of the Incident

- A shipper requesting the carriage of dangerous goods must indicate on the shipping manifest that it is a dangerous cargo, provide basic information about the risk of the cargo, and any additional information specified in the IMDG Code. However, in this case, the shipper did not notify the carrier at the time of booking, before the shipment, or even after the shipment.
- Since the prescribed method of DG transportation as stipulated in the IMDG Code was not followed, the ship could not identify this cargo as a dangerous good, so no special action was taken out.
- Shippers requesting the transportation of dangerous goods as described in the IMDG Code must faithfully declare the ingredients, content, and name of dangerous goods in accordance with the rules.
- The shipping company should establish a shipment reservation and management procedure to confirm the presence of dangerous cargo at the time of request or shipment.

2. Major DG Incidents and Implications for Ports

2.4 Stolt Groenland Fire Accident

2.4.1 Incident overview

- Date: 2019. 9. 28. 10:50
- Location: OTK terminal, Ulsan, Korea
- Vessel Name: Stolt Groenland

Register/Owner: Cayman Islands/Stolt tankers

Classification: DNV-GL

L/B: 182.72m/32.24m

GT/DWT: 25,881ton/43,478ton

Cargo: Liquid bulk chemical 27,117 ton, including
Styrene Monomer

- Damage: Injured 2 seafarers, 15 stevedores
Toxic vapors released into the atmosphere
Tank bulkhead, upper deck and hatch cover damaged;
accommodation area suffered extensive fire damage
Ship was scrapped



2. Major DG Incidents and Implications for Ports

2.4.2 Incident timeline

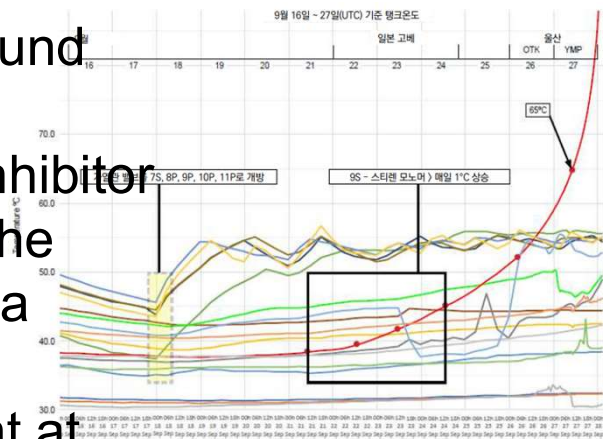
- At around 6 o'clock on September 28, the chemical tanker Bow Dalian moored alongside the Stolt Groenland for a ship to ship transfer.
- At 10:43, vapor started to release from the pressure/vacuum relief valve of the Stolt Groenland's 9S cargo tank, and about two minutes later, the tank's high-level danger alarm (95%) activated. Soon after the high-high-level danger alarm (98%) activated.
- At 10:50, two explosions occurred in the ship's cargo manifold. The second explosion ignited the released styrene monomer vapor. Flames also burned the vapors released from the 9S and 9C P/V valves.



2. Major DG Incidents and Implications for Ports

2.4.3 Cause of Incident

- The runaway polymerization resulted in a rapid volumetric expansion of the styrene monomer, which increased the pressure within 9S at a rate that exceeded the venting capacity of the tank's p/v valve. As a result, the tank ruptured through the main deck and the common bulkhead.
- As the temperature of the cargo in 9S was well below the auto-ignition point for styrene monomer when the explosion occurred, ignition of the vapor must have been caused by an external source, such as static electricity sparks or sparks from metal-to-metal contact during tank rupture.
- The heated cargo HMD loaded at 8P~11P around 9C would affect the temperature of styrene monomer increased, and the polymerization inhibitor TBC lost its effectiveness at some point, and the polymerization rate would have increased. As a result, on September 27, the polymerization runaway threshold (65°C) was reached: a point at which the reaction could no longer be arrested.



2. Major DG Incidents and Implications for Ports

2.4.4 Implications of Incident

- The basic precaution of stowing the styrene monomer away from heated HMD cargo was taken, but failed to meet the adequate segregation requirement of the IBC Code.
- The probability of heat being transferred from the HMD cargo tanks to the styrene monomer cargo was not fully considered during the planning and approval of cargo stowage.
- Instructions and guidance are clear: inhibited cargoes should not be stowed adjacent to heated cargoes. But the likelihood of heat transfer through adjacent or intermediate cargo tanks was not covered in detail.
- Despite being a requirement in SMS, the temperature of the styrene monomer was not monitored
- The seafarers considered the inhibited styrene monomer to be a non-dangerous cargo.
- Stolt tanker did not notify other ships of the incident, which could have led to a major explosion at Ulsan Port.

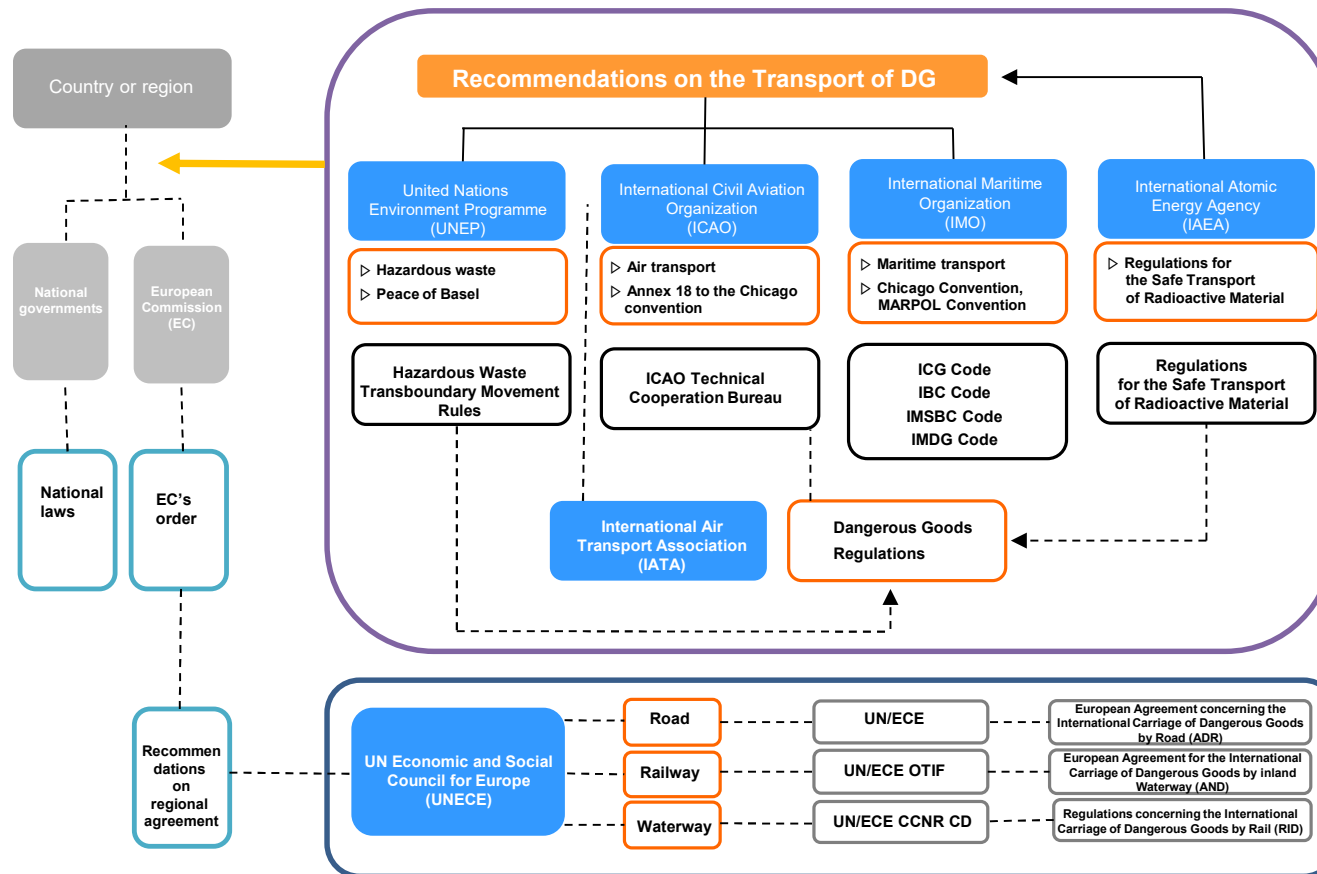
3. DG Transport and Regulations



3. DG Transport and Regulations

3.1 International Regulations for the Transport of Dangerous Goods

3.1.1 International conventions, regulations and regional laws related to the shipment of dangerous goods



3. DG Transport and Regulations

3.2 International standards for DG handling on ships and at port

UN Recommendations on the Transport of Dangerous Goods (Orange book)

IMDG Code

IMO Revised Recommendation on the Safe Transport
of DG and related Activities in Port Area

SOLAS, MARPOL, STCW

CIP

IBC Code

IGC Code

IMSBC

Code

ISM
Code

Warehousing
White Paper

ISPS Code

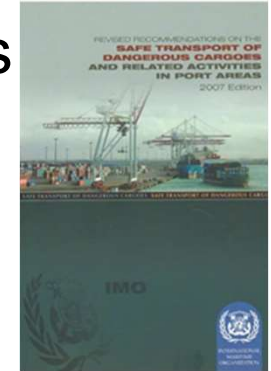
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3. DG Transport and Regulations

3.2.1 IMO Revised Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas

- Recommendations on the safe transportation of dangerous goods in ports area were first adopted by IMO in 1973 and then revised 5 times due to technological development and environmental changes.
- These recommendations are confined to dangerous goods which are in port area as part of the transport chain, but may also apply to dangerous goods used in ports or in general storage.
- These Recommendations are adopted to establish a standard framework of legal requirements to be prepared by governments to ensure the safe transport and handling of dangerous goods in port area.
- These Recommendations are structured as follows;

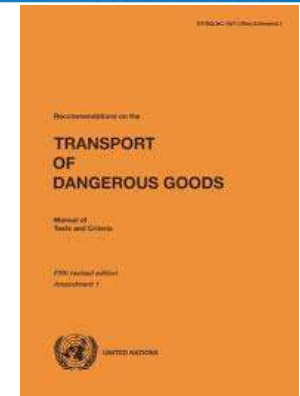
CH.1	Introduction	CH.6	Responsibilities
CH.2	Application and definitions	CH.7	General recommendations for regulatory authorities, port authorities, ships, berth operators
CH.3	Warehouses, terminal areas and infrastructure	CH.8	Dangerous cargoes in packaged form
CH.4	Training	CH.9	Liquid bulk dangerous cargoes
CH.5	Security provisions	CH.10	Solid bulk dangerous cargoes



3. DG Transport and Regulations

3.2.2 UN Recommendations: The Transport of Dangerous Goods (Orange Book)

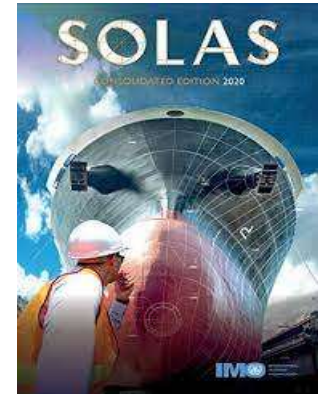
- The model regulations on the Transport of Dangerous Goods (TDG), published by the UN Economic Commission for Europe (UNECE), apply to international TDG regardless of mode of transport.
- The UN Sub-Committee of Experts on the TDG (UNSCETDG) revises the model regulations every two years. The model regulations of the Orange Book are regarded as international TDG recommendations and the basis for the enactment and revision of transport regulations for all modes of transportation, including ships, airplanes, roads, and railways.
- The IMO established the International Maritime Dangerous Goods (IMDG) Code. The regulations on dangerous goods applying to various modes of transport were proposed in accordance with UN model regulations
- All international regulations for TDG, such as ships, airplanes, roads, and railways, are established and revised in accordance with the model regulations, which are the highest international regulations for TDG.



3. DG Transport and Regulations

3.2.3 SOLAS Convention

- The Safety of Life at Sea (SOLAS) Convention was adopted and entered into force in 1974 to improve safety at sea by establishing internationally unified principles and rules and to proposing minimum standards for ship safety in terms of structure, equipment, and operation.
- Main contents: The main body (12 chapters) and 14 annexes include provisions for physical maritime safety standards, including: ship compartment, stability, fire extinction, life-saving appliances and arrangement, radio communications, safety of navigation, carriage of cargoes, carriage of dangerous goods, nuclear ships, high-speed craft, and special measures to enhance maritime safety.
- Maritime cargo is divided into two categories: packaged cargo and bulk cargo, which are further classified as general or dangerous cargo based on safety risk and environmental hazard as defined by SOLAS74 and MARPOL 73/78.
- Chapter VI covers regulations on general cargo, while the Chapter VII covers dangerous cargo regulations.

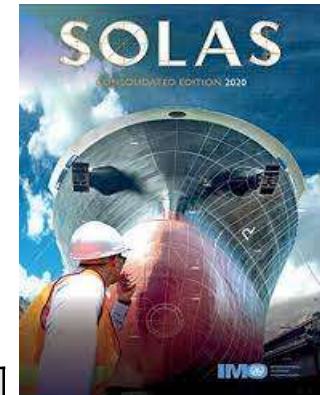


3. DG Transport and Regulations

3.2.3 SOLAS Convention

- Chapter VII defines dangerous cargo classification and transport regulations. Specific transport requirements are governed by separate transport regulations.

Part A	Dangerous goods in packaged form	IMDG Code
Part A-1	Solid form in bulk	IMSBC Code
Part B	Dangerous liquid chemicals in bulk	IBC Code
Part C	Liquefied gases in bulk	IGC Code
Part D	INF cargoes	INF Code

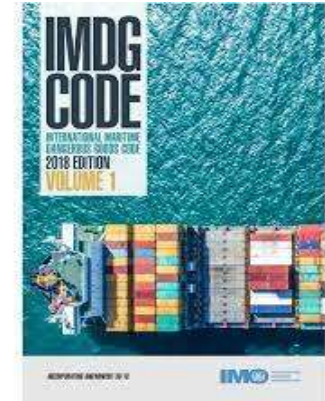


- Specific transport regulations must be developed after determining the cargo's environmental hazard. Environmental pollution prevention regulations are thus required.
- Annexes of MARPOL 73/78 identify environmentally harmful substances and include pollution control regulations by substance.

3. DG Transport and Regulations

3.2.4 IMO IMDG Code

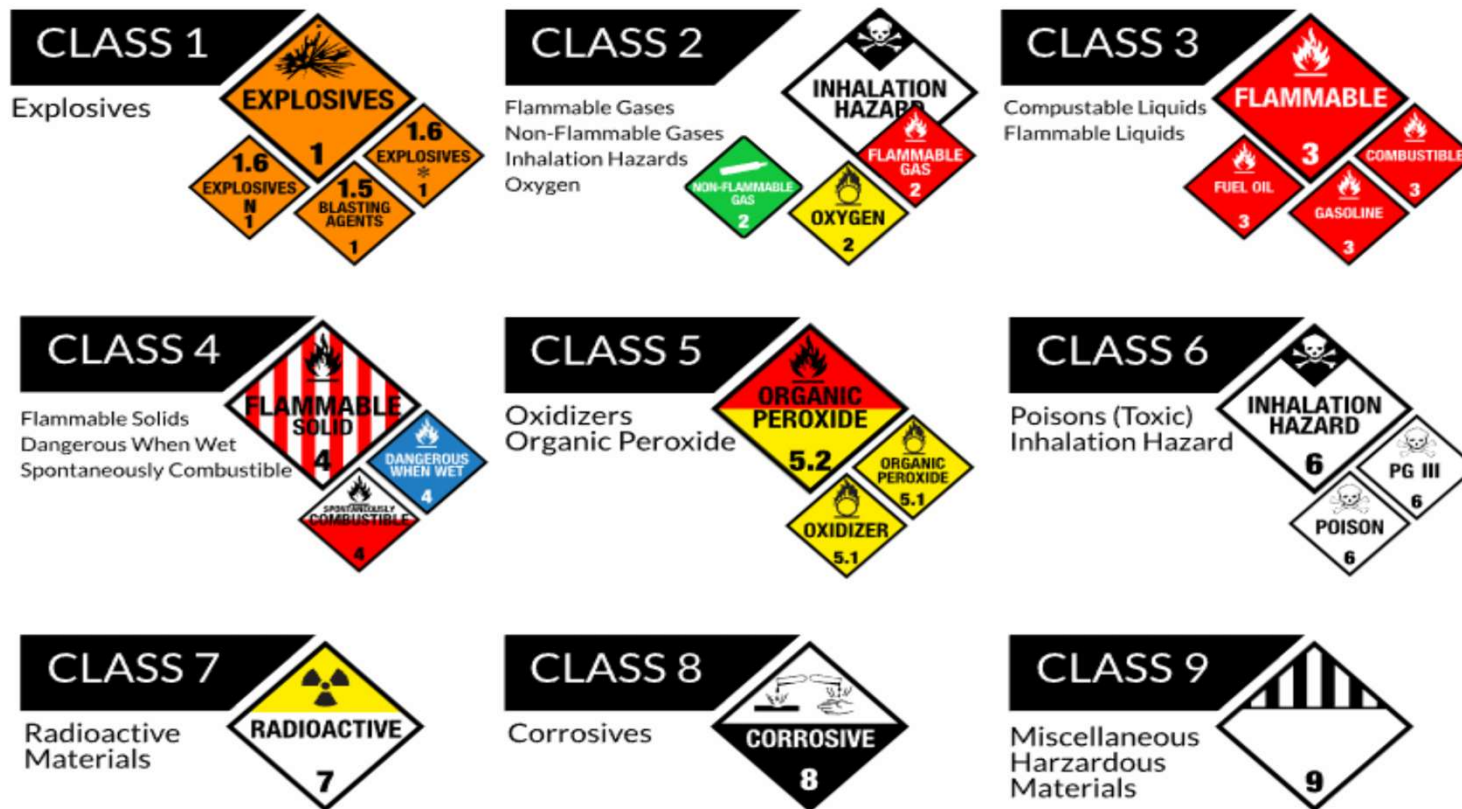
- The IMO established the IMDG code in 1965 as an international regulation for the maritime transport of packaged dangerous goods based on the Orange Book. Implemented by UNSCETDG of ECOSOC.
- Main contents: This code classifies dangerous packaged goods from Class 1 (explosives) to Class 9 (other dangerous goods), based on risk characteristics. It also establishes basic principles for the maritime carriage of packaged dangerous goods, such as criteria for classification, packaging, marking and labelling of packages, manufacturing and testing requirements for packaging containers, transport documentation, methods of stowage, and segregation of dangerous cargoes.
- The IMDG Code, based on Chapter 7 of SOLAS, was treated as a recommendation until 2003, but has since been made mandatory.



3. DG Transport and Regulations

3.2.4 IMO IMDG Code

- Dangerous goods are divided into 9 classes (and several subdivisions) based on the predominate hazard presented by the dangerous substance.



3. DG Transport and Regulations

3.2.5 STCW Convention

- The sinking of the Torrey Canyon in the Dover Strait near the Scilly Islands in 1967 prompted the need for international seafarer qualification standards. The Standards of Training, Certification, and Watchkeeping (STCW) Convention was adopted in 1978 and went into effect in 1984.
- Main contents: main body (17 articles), annexes, and Codes A and B
- The Convention establishes minimum standards relating to training, certification and watchkeeping for seafarers on an international level which countries are obliged to meet or exceed.
- Implication: The unified minimum STCW for seafarers allows for the maintenance of maritime safety in consideration of human needs. Also helps mitigate marine pollution and prevents use of unqualified seafarers. Member states are given supervisory authority over the above-mentioned issues.



3. DG Transport and Regulations

3.2.6 ISM Code

- In the aftermath of the capsizing of the Herald of Free Enterprise (1987), it was recognized that both large and small marine accidents, resulting in casualties and pollution, are typically caused by human errors, rather than ship's defects.
- The purpose of the International Safety Management (ISM) Code is to provide an international standard for maritime safety, marine accident prevention, and marine environment protection. The Code was entered into force on July 1, 1998.
- Application: engaged on international voyage ships with a gross tonnage of 500 and above
- Main content: 16 chapters (Parts A, B) include safety and environmental protection policy, company responsibilities and authority, safety management manager, master's responsibility and authority, resource operation and deployment, shipping safety management, emergency response, reports of hazardous occurrences and defects in the safety management system, review and maintenance of the ship, etc.



3. DG Transport and Regulations

3.2.7 ISPS Code

- Following the terrorist attacks on the United States on September 11, 2001, IMO amended the SOLAS Convention to enhance maritime security for ships and port facilities. The IMO replaced chapter XI with chapter XI-1 (special measures to enhance maritime safety) and added chapter XI-2 (special measures to enhance maritime security), which came into force in 2004.
- Application: international passenger ships, international voyage ships and mobile offshore structures with a gross tonnage of 500 and above, and port facilities for international voyage ships
- Main contents: 19 chapters (Parts A, B). Mandates governments, port authorities, and shipping companies to take measures to prevent terrorist acts against ships, passengers, seafarers, cargo, and port facilities
- Calls for ship and port facility security assessments, security plans, and security levels; describe roles of ship security officers, company security officers, etc.



3. DG Transport and Regulations

3.2.8 Warehousing White Paper

- The warehousing White Paper was created to remain manageable by identifying and considering factors that can influence the safe storage of dangerous goods in a storage facility or warehouse.
- Cooperation organizations: ICHCA (International Cargo Handling Coordination Association), IVODGA (International Vessel Owners Dangerous Goods Association), NCB (National Cargo Bureau), and WSC (World Shipping Council)
- Main contents: The White Paper identifies the considerations and measures that should be taken by warehouses storing and handling dangerous goods and covers topics such as: construction of the warehouse, operation, fire protection, and emergency response. It also includes a checklist for warehouse audits and inspections.
- Implication: Existing dangerous goods regulations exist to protect seafarers, ships and the marine environment. However, the White Paper identifies considerations, management methods, and emergency response plans for ports, terminals, inland warehouses or distribution centers and associated storage facilities.



3. DG Transport and Regulations

3.2.8 Warehousing White Paper

- The white paper, which was published in December 2021, has been endorsed by several significant industry stakeholders such as port operators, insurance companies and associations where shippers are directly involved.
- It includes guidelines that:
 - Identifies the considerations and measures that should be taken by warehouses storing, handling and consolidating dangerous goods and covers topics such as construction of the warehouse, operations, fire protection, security, and emergency response
 - An accompanying checklist to support these considerations and measures, which can also be used in warehouse audits and inspections



IMO INTERNATIONAL MARITIME ORGANIZATION

SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS
8th session
Agenda item 17

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Pre-session public release: ☐

ANY OTHER BUSINESS

Industry guidelines for warehouses storing, handling and consolidating dangerous goods
Submitted by BIMCO, ICHCA, ICS, IG of P&I Associations, UMI, IVODGA, and WSC

SUMMARY

Executive summary: This document contains industry-produced guidelines in the form of a white paper and accompanying checklist addressing considerations and measures that should be taken by warehouses storing, handling and consolidating dangerous goods, and covers topics such as construction of the warehouse, operations, fire protection, security, and emergency response. The document also recommends that guidelines be considered for inclusion in various instruments, codes and circulars published by IMO, as appropriate.

Strategic direction, if applicable: Not applicable

Output: Not applicable

Action to be taken: Paragraph 10

Related document: CCC B/NF-3

Introduction

1 Recent decades have shown an increase in serious incidents in the maritime containerized supply chain, involving both onboard incidents and incidents taking place on shore in warehouses where dangerous goods are stored and handled in preparation for, or after sea transport. Warehouse incidents in Tianjin in 2015 with numerous casualties and the latest serious such incident in Beirut in 2020 causing more than 200 deaths, 6,000 injured and leaving an estimated 300,000 people homeless, have caused global concern. They have revealed a need for guidance on warehousing, including consolidation, where dangerous goods are involved.

2 While reports on investigations into such warehouse incidents are seldom made public, a common cause is generally understood to be incorrect handling and storage. This includes improper segregation of the dangerous goods stored and is often combined with issues related to prolonged storage which can influence the stability of the dangerous goods.

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D / WAREHOUSE CHECKLIST

SECTION: 1	GENERAL	YES	NO	N/A
1.1	Certifications			
1.1.1	Does the warehouse hold certifications demonstrating compliance with relevant industry / government standards?			
1.2	Investigation Program			
1.2.1	Has the warehouse implemented a comprehensive investigation program for accidents, losses, or near-misses?			
1.3	Business Continuity			
1.3.1	Does the warehouse have a business continuity plan in place to keep operations going in case of fire, flood, loss of power, loss of communication, etc?			
GUIDANCE NOTES: The term warehouse in this document may apply to operators or facilities including warehouses, waterfront facilities at ports or terminals, distribution centers, fulfillment houses, etc. where goods may be stored before their export, in the due course of transit, or before distribution for sale. Examples of relevant industry or government standards may include US Customs and Border Protection Customs Trade Partnership Against Terrorism (CTPAT) security program, International Organization for Standardization ISO 9001 Quality Management Standard, Transport Assets Protection Association (TAPA) Facility Security Requirements Standard (for high value client regional goods), etc. as applicable.				
SECTION: 2	WORKFORCE	YES	NO	N/A
2.1	Screening¹			
2.1.1	Are written procedures in place for screening prospective employees ² and to periodically check current employees?			
2.1.2	Do screening procedures include verification of application information such as identity, past employment, references, and criminal history?			
2.1.3	Do screening procedures extend to temporary work force and contractors?			
2.2	Formal Induction			
2.2.1	Do new warehouse employees have a formal induction when joining?			
2.3	Identification			
2.3.1	Do warehouse employees wear uniforms?			
2.3.2	Are warehouse employees required to display company ID badges?			

3. DG Transport and Regulations

3.2.9 IMSBC Code

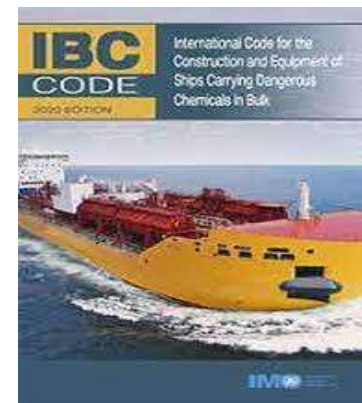
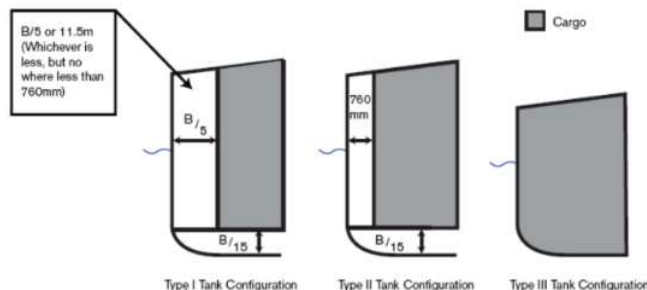
- The Bulk Cargo Code (BC Code) adopted in 1965 set forth optional guidelines for the safe stowage and shipment of solid bulk cargoes. On January 1, 2011, the International Maritime Solid Bulk Cargoes Code (IMSBC Code), which replaced the BC code, was adopted and made mandatory by Res. MSC 268(85).
- The primary purpose of the IMSBC Code is to facilitate the safe stowage and shipment of solid bulk cargoes by providing information on the dangers associated with the shipment of specific types of solid bulk cargoes and instructions on the procedures for shipping solid bulk cargoes.
- Solid bulk cargoes must be listed in the Individual Schedules of Solid Bulk Cargoes, and the shipping company must comply with requirements on stowage, loading, segregation, unloading, hold cleanliness, ventilation, and transport according to bulk cargo type and properties.
- The Code categorizes cargoes based on their properties and divides solid bulk cargoes into three groups: A, B, and C.



3. DG Transport and Regulations

3.2.10 IBC Code

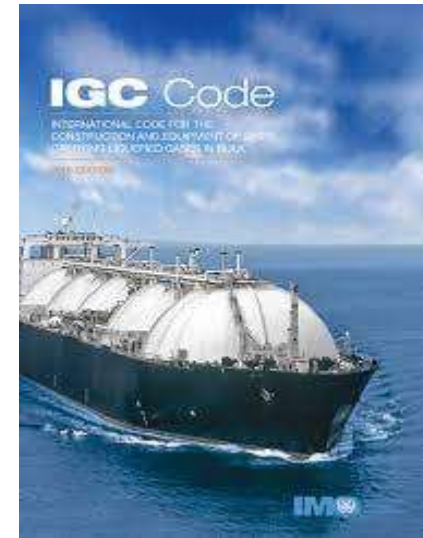
- The IBC Code provides an international standard for safe bulk carriage by sea of dangerous chemicals and noxious liquid substances listed in chapter 17 of the Code. To minimize the risks to ships, their crews and the environment, the Code prescribes design and construction standards for ships and the equipment they should carry, with due regard to the nature of the products involved.
- SOLAS and MARPOL Conventions require chemical tankers built after 1 July 1986 to comply with the International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC Code).
- The IBC Code replaced the BCH Code.
- Ships subject to the Code shall be classified as type 1, 2 and 3.



3. DG Transport and Regulations

3.2.11 IGC Code

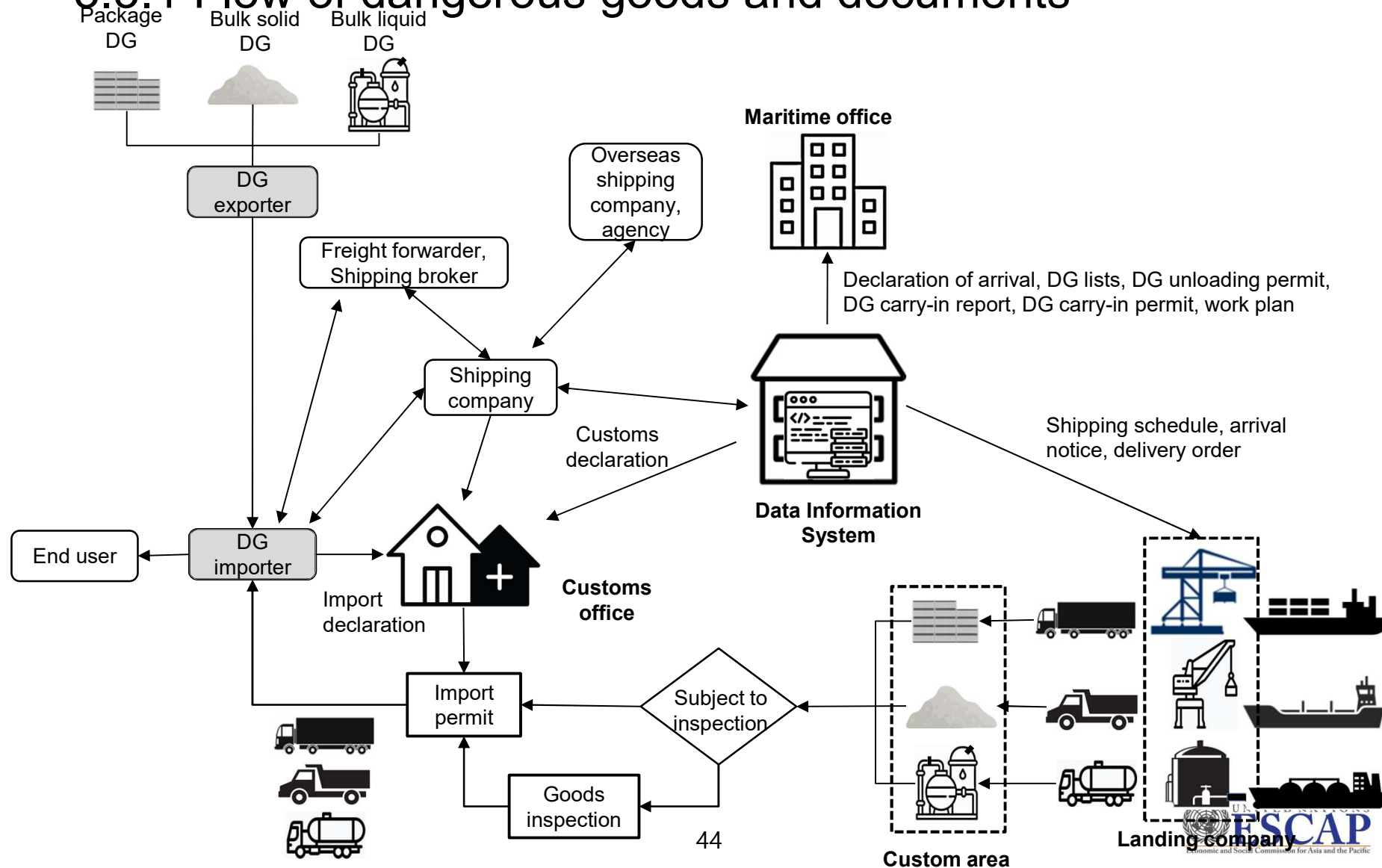
- The aim of the Code is to provide an international standard for the safe carriage by sea in bulk of liquefied gases and the substances listed in chapter 19, by prescribing the design and construction standards of ships involved in such carriage and the equipment they should carry so as to minimize the risk to the ship, to its crew and to the environment, with regard to the nature of the products involved.
 - The IGC Code adopted by resolution MSC.5(48), has been mandatory under SOLAS chapter VII since 1 July 1986.
- The IGC Code applies to ships regardless of their size, including those of less than 500 gross tonnage, engaged in carriage of liquefied gases having a vapor pressure exceeding 2.8 bar absolute at a temperature of 37.8°C, and certain other substances listed in chapter 19 of the Code.



3. DG Transport and Regulations

3.3 Transportation of dangerous goods

3.3.1 Flow of dangerous goods and documents



3. DG Transport and Regulations

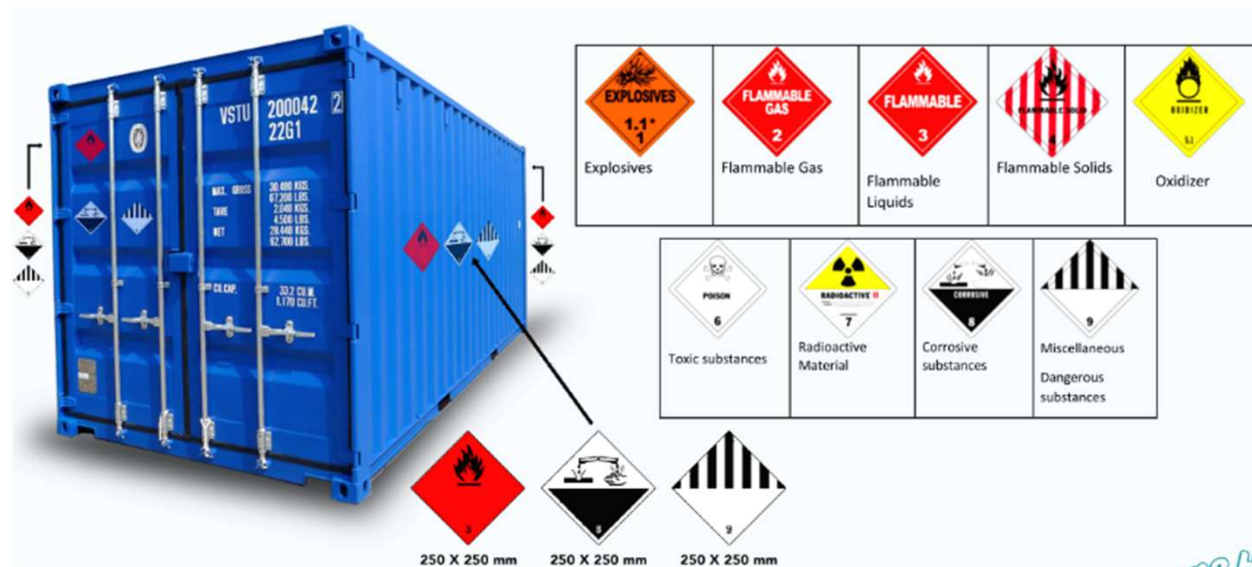
3.3.2 Onboard DG management

- Vessels entering a port area must be aware of the laws and regulations applicable within the port area.
- Vessel should be moored safely at the pier. Signals are displayed and emergency towing wires are provided.
- While berthed in the port area, the condition of any dangerous goods aboard shall be checked regularly. The vessel is to cooperate with the port authority during DG inspection.
- When reporting the entry of dangerous goods into the port, any DG aboard must be declared on the Dangerous Goods List and attached to the Cargo Stowage plan.
- A safety management system reflecting the characteristics and risks of DG should be established alongside cargo loading guidelines.

3. DG Transport and Regulations

3.3.3 Management of dangerous cargoes in packaged form

- Pay attention to avoid damage to dangerous goods, prevent unauthorized access, and take practical measures to minimize adverse effects on human life and the environment in case of damage to dangerous goods.
- Unloading dangerous goods is carried out according to the IMDG Code, and containers loaded with dangerous goods should be inspected at least once a day.



3. DG Transport and Regulations

- Precautions for loading and unloading
 - 1) Dangerous goods restricted by the UN are prohibited from being shipped.
 - 2) Dangerous goods containers must be properly labeled/placarded as required by IMDG Code.
 - 3) Carriers should refuse to ship/accept any leaking, damaged, or potentially dangerous containers
 - 4) Ensure all dangerous goods containers are loaded at planned stowage locations
 - 5) Ships transporting/loading/unloading dangerous goods should display required day and night signals
 - 6) Smoking is prohibited outside of designated areas
 - 7) No hot work in the vicinity of dangerous goods containers
 - 8) All dangerous goods containers must be accompanied by relevant manifests and declarations as required by international regulations.

3. DG Transport and Regulations

3.3.4 Management of liquid bulk dangerous cargoes(including liquefied gas)

- Vessel should in co-operation with the port authority and berth operator safely handle any liquid bulk dangerous cargoes, which may react in a hazardous manner (physically or chemically) with any other cargo carried or handled.
- Vessels should take precautions to prevent flammable/toxic vapors from entering service or control stations, accommodation or machinery spaces on the vessel. All openings in cargo spaces, sighting and ullaging ports should be kept closed.
- The berth operator must take steps necessary to ensure that shore installations safely receive liquid bulk dangerous goods.
- During operation, the mixing of cargo, meetings related to loading and unloading, information exchanges between ship and shore, testing of loading and unloading equipment, agreement on load/unload rates, inspection of tanks/valves, prevention of contamination of multi-grade cargo, and the use of chemical reaction inhibitors for hazardous materials, should all be considered.

3. DG Transport and Regulations

3.3.5 Management of solid bulk dangerous cargoes

- When transporting, handling or loading solid dangerous goods in bulk, the harbor master and berth operator, within their respective areas of responsibility, must ensure that loading and unloading operations are carried out in accordance with the IMSBC Code and BLU Code, and the Manual for Loading and Unloading Solid Bulk Cargoes.
- Precautions for loading and unloading
 - 1) In the event of dust discharge, take measure to prevent or minimize discharge and protect people and the environment.
 - 2) If toxic or flammable vapors are emitted, take measures to prevent or minimize such emissions and protect people from toxic vapors.
 - 3) When loading or transporting solid bulk dangerous goods that can emit toxic or flammable vapors, measure the concentration of vapors and do not enter enclosed spaces.

3. DG Transport and Regulations

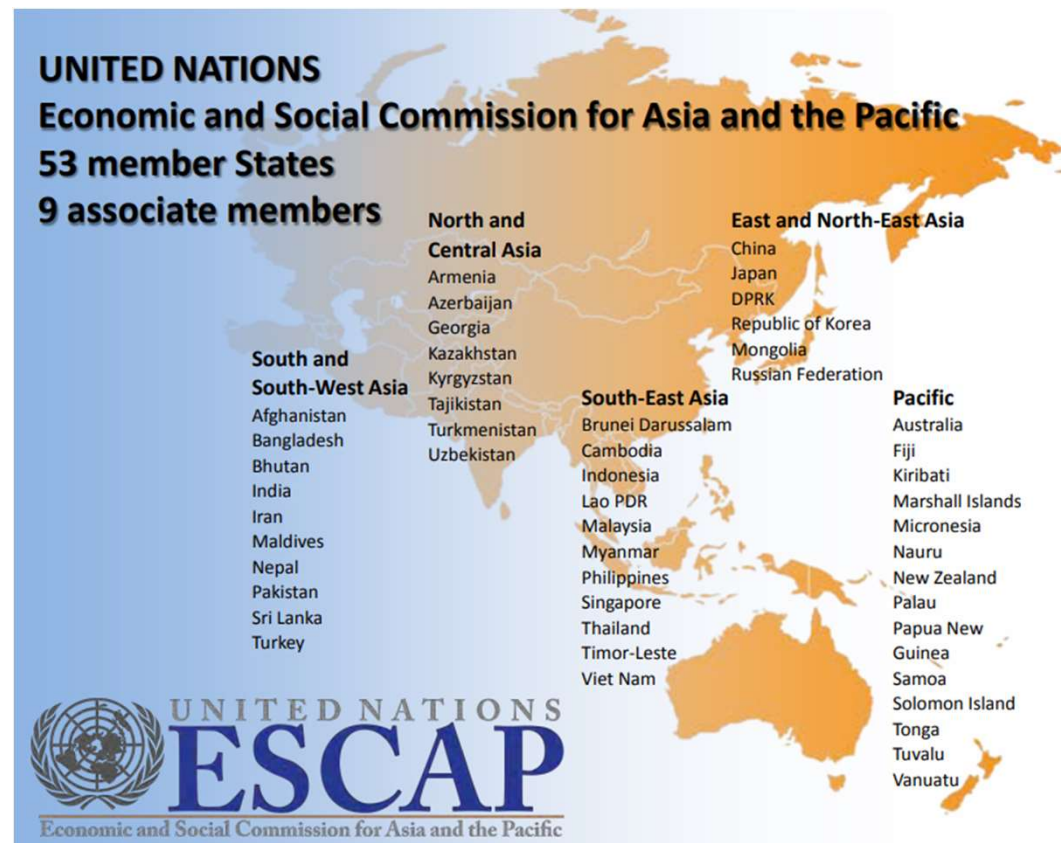
- 4) For dust and fine particles that can explode if ignited, take necessary measures to minimize the effects of the explosion.
- 5) Some dangerous goods, when in contact with water, can generate flammable or toxic vapors, which may spontaneously ignite. This goods should be kept dry.
- 6) Oxidative bulk solid goods should be kept away from heat or ignition sources to prevent contamination by combustible or carbonaceous materials.
- 7) Solid dangerous goods in bulk must be transported, handled and loaded in a manner that prevents hazardous interactions with incompatible materials.

4. DG Management at ESCAP Ports



4. DG Management at ESCAP Port

- We are circulating a questionnaire on port dangerous goods to ESCAP countries. Once the questionnaire is collected, the results will be analyzed and included in the final report.*



5. DG Management: Case Studies



5. DG Management: Case Studies

5.1 Port Management Information System (Port-MIS)

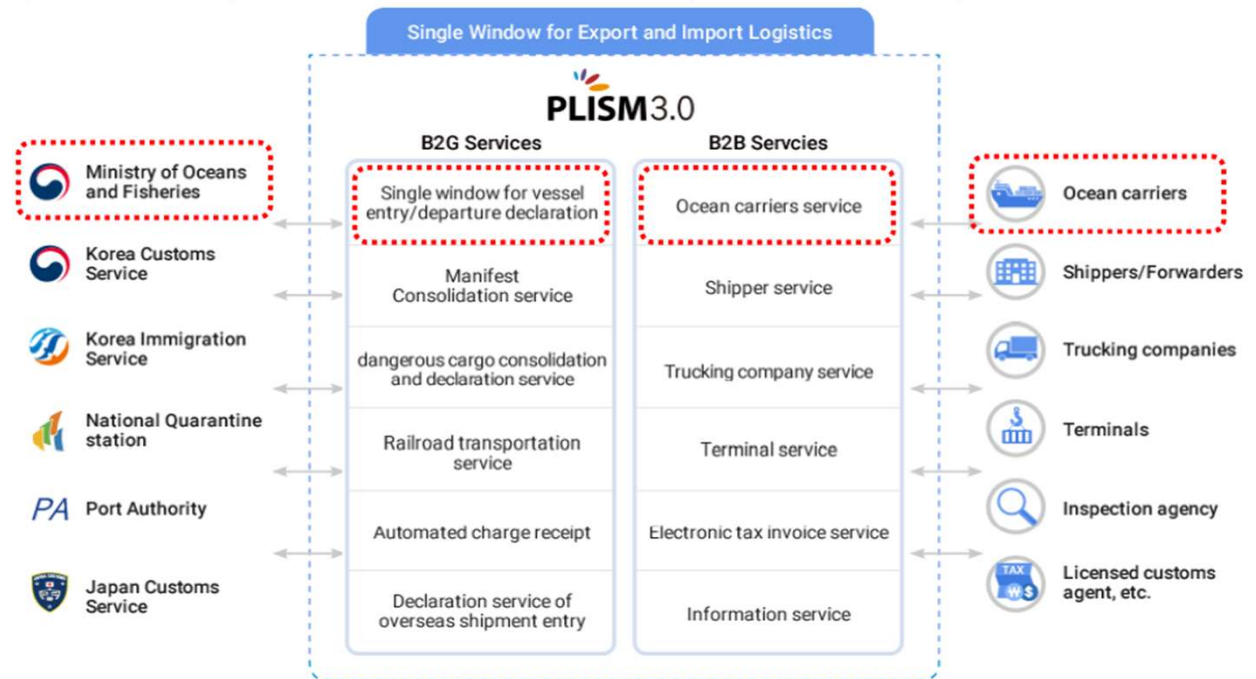
5.1.1 Establishment

- History
 - 1974 Government and logistics companies established Port Logistics Information & Communications Co., Ltd.
 - 2004 Developed Port Logistics Integrated Information System
 - 2006 Changed company name to KLNET
 - 2011 Port-MIS mobile application distribution begins
- Promotes efficient port management and offers increased convenience to port users
 - Handles all port operation and civil affairs documentation. Includes: Entrance report, Usage of Port Facilities, Vessel Control, Cargo Import and Export, Revenue and all other Maritime and Port Logistics Services for 31 trade ports
- Composed of 3 regions and 4 port authorities (147 employees)

5. DG Management: Case Studies

5.1.2 Services Provided

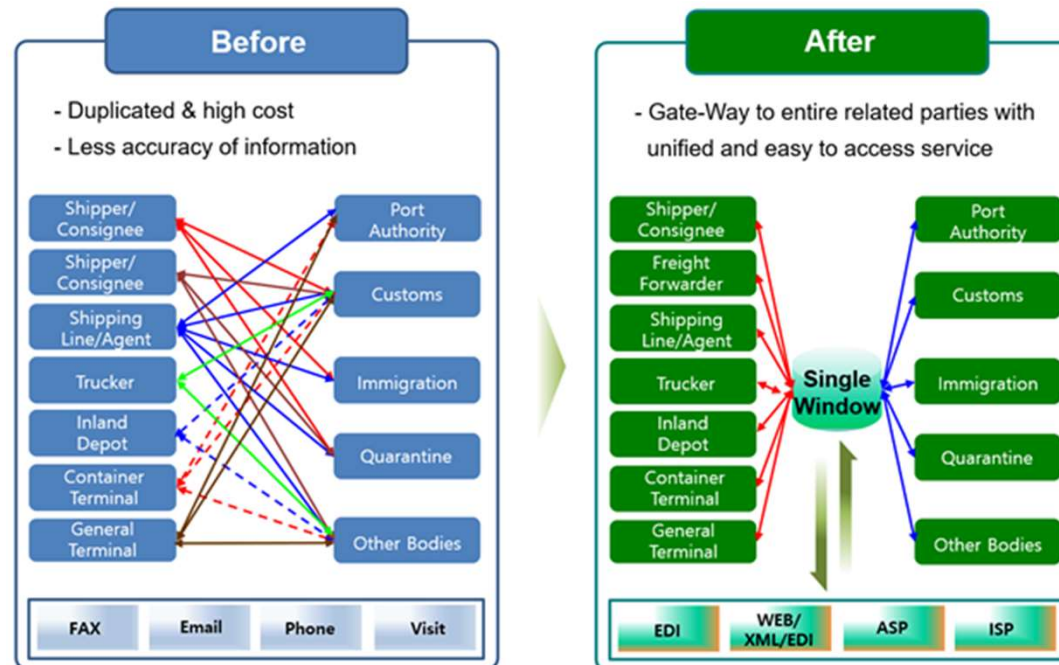
- **B2G:** Information exchange/utilization through EDI method with Maritime Affairs and Fisheries Administration, Port Authority, Korea Customs Service, Immigration Office, Dangerous Goods Inspector, and Railway Corporation through the Shipping and Port Integrated Information System
- **B2B:** Information exchange/booking, waybill, transport results, shipping documents, and inspection between import and export logistics suppliers and consumers such as shippers, forwarders, transport companies, and terminals through EDI.



5. DG Management: Case Studies

5.1.3 Benefits of Port-MIS

- Improves competitiveness of logistics industry by establishing an information system suitable for the business environment. 2.5 million digital documents processed yearly



- Prevents accidents with better and more accurate DG information
- Allows for prompt response in case of fire or explosion caused by dangerous goods

5. DG Management: Case Studies

5.1.4 Quantitative benefits

- Reduced logistics costs by USD 102 million per year through single-window service

2.5 million fewer paper documents
processed annually

Reduced vessel standby time
and container handling time

USD 102 million in annual cost savings

(Unit : million US dollars)

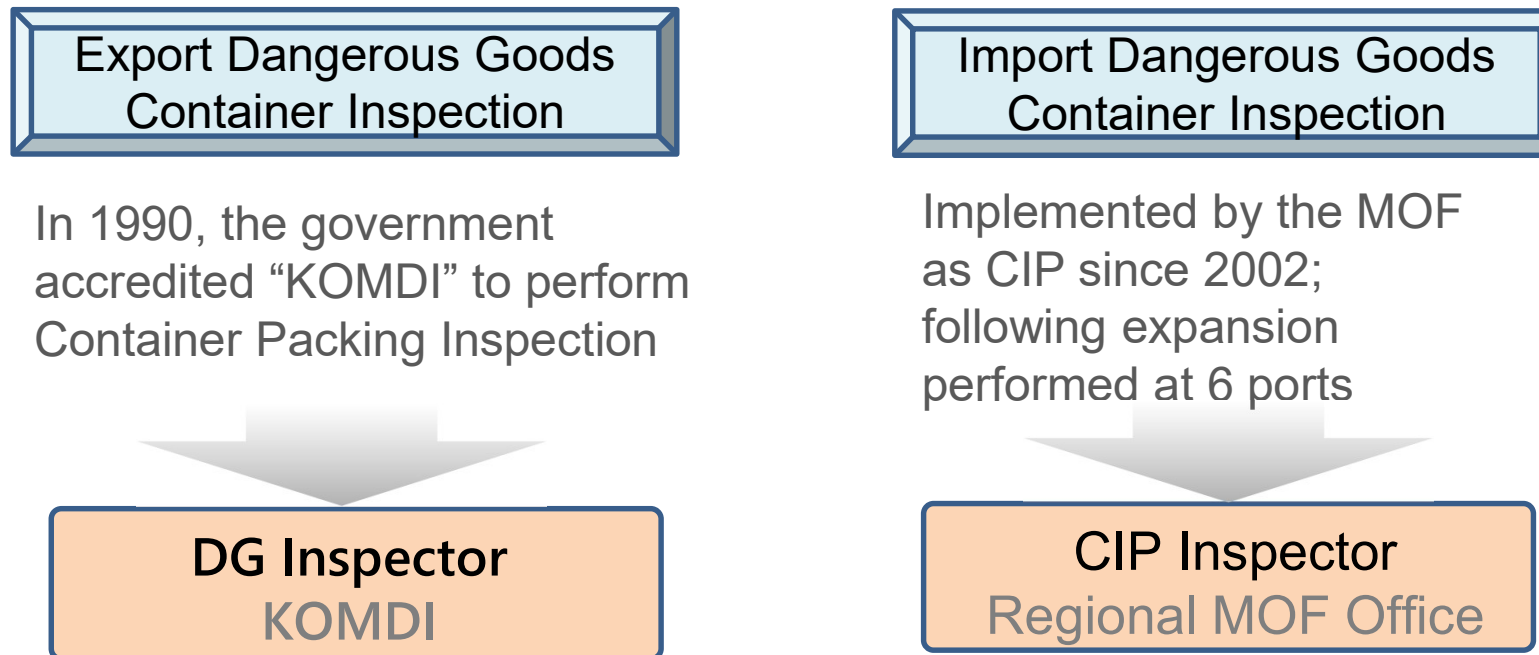
Paperless processing cost savings	22
Civil applications administrative cost savings	11
Labor cost savings	27
Effect of automatic transfer system for port use fee	12
Effect of integrated port & shipping DB system	8
Cost savings attained by pooling multi-agency PORT-MIS information (port authority, customs, immigration office, quarantine station, coast guard, etc.)	15

- Import-export document reduction:
 - 75 docs → 16 docs → Web based single-form entry
- Cost-efficient import/export(vessel arrival/departure) process
 - Electronic processing of 5 million requests per month, annual saving of 100 million USD

5. DG Management: Case Studies

5.2 Dangerous goods container inspection and training system

5.2.1 Dangerous goods container inspection system in Korea



- CIP workshop is held every year to strengthen the capacity of CIP inspectors
 - Participation of government inspectors, KOMDI inspectors, and shipping managers
- Korea MOF and IMO ITCP to strengthen international cooperation on safety management of dangerous goods

5. DG Management: Case Studies

5.2.2 Establishment of KOMDI

- History
 - 1989. 12. 15 Established as a foundation
 - 1990. 02.16 Dangerous goods inspection on behalf of the government
 - 1990. 12. 09 Designated as an educational institution specializing in safe transportation of dangerous goods
- Promotes safe shipping and storage of dangerous goods through DG inspection service and education
- Contributes to accident prevention and technology promotion due to ship transportation and storage of dangerous goods
- Organization consists of three departments, one bureau, seven branches and two branch offices (126 employees)



5. DG Management: Case Studies

5.2.3 Inspection Types

- In addition to the usual port state control or flag state control inspections, port authorities conduct additional inspections to ensure that DG meet IMDG Code
- KOMDI performs DG inspection according to technical requirements and responsibilities under the IMDG Code on behalf of the Korea government.



Inspection	Process
Onboard DG stowage	<ul style="list-style-type: none">• Confirm stowage requirements document complied with SOLAS.• Confirm segregation requirements.• Confirm use of suitable packaging, conformity of marking, labelling and placarding.
Container DG packing	<ul style="list-style-type: none">• Verify that use of containers complies with CSC requirements.• Confirm cargo fastened as contained specified in CTU code.• Confirm safety of packaging, and verify conformity of marking, labelling and placarding.
DG Packages	<ul style="list-style-type: none">• Classification requirements, conformity of marking and labelling.• Use of suitable packaging

5. DG Management: Case Studies

5.2.4 Training and education

- KOMDI conducts training for workers involved in manufacture, transport, loading, and handling of dangerous goods transported by ships



Course		Time	Target Audience
DG safe transport training	Initial course	24h	<ul style="list-style-type: none"> Shippers and their agents DG container manufacturing/packing workers DG handlers at int'l logistics forwarders DG handlers at shipping companies
	Refresher (biannual)	8h	<ul style="list-style-type: none"> Those who have finished initial course
DG transport driver training	Initial course	4h	<ul style="list-style-type: none"> DG vehicle drivers
	Refresher (biannual)	4h	<ul style="list-style-type: none"> Those who have finished initial course
DG safety officer training	Initial course	40h	<ul style="list-style-type: none"> Those seeking DG safety manager certification (>5 years exp. in liquid bulk DG handling)
	Refresher (triannual)	16h	<ul style="list-style-type: none"> DG safety managers; based on internal safety management plan

5. DG Management: Case Studies

5.2.5 KOMDI core activities

- KOMDI handles more than 18,000 tons of packaged DG annually at each domestic port
 - Over the past six years, dangerous goods accounted for 32.8% of total cargo, and packaged dangerous goods accounted for 3.5% of total dangerous goods
- KOMDI inspected export DG cargo accident-free for 32 years (since establishment)
- Developed an application that is used to inspect packaging requirements for 2,800 types of dangerous packaging items listed in the IMDG Code using IT technology

PLACARD(컨테이너) 상황별 적용

Container 종류	<input checked="" type="radio"/> CLOSED	<input type="radio"/> TANK
혼적 여부	<input type="radio"/> 1종류(단일)	<input checked="" type="radio"/> 2종류(혼적)
위험물 중량	<input type="radio"/> 4,000kg 초과	<input type="radio"/> 4,000Kg 이하
위험물 TYPE	<input checked="" type="checkbox"/> MP (해양오염물질)	<input type="checkbox"/> LQ (소량 위험물)

PLACARD(컨테이너), LABEL(용기) 규격 및 적용

<input type="radio"/> Placard	<input type="radio"/> Label	<input type="radio"/> MP, LQ	<input type="radio"/> Overpack
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SAMPLE (예시)



Placard (A) / Placard (B), MP Mark

6. Measures to Improve Management of Dangerous Goods at Port



6. Measures to Improve Management of DG at Port

6.1 DG management Regulatory Reform

6.1.1 Status

- Existence of various international standards for dangerous goods
 - UN Recommendations, SOLAS Convention, IMDG Code, STCW Convention, White Paper, etc.
- These international standards are enforced by national administrative organizations/agencies
 - In Korea, various laws & regulations apply. Including: Rules for Transportation and Storage of Dangerous Goods by ships, the Dangerous Goods Safety Management Act, the Chemical Substances Control Act, etc.
- Notable absence of standards for safety equipment and fire extinguishing equipment safety measures in the event of an accident involving packaged form DG, except DG in bulk.

6. Measures to Improve Management of DG at Port

6.1.2 DG management regulatory reform

- It is necessary to establish an efficient management system for dangerous goods at port through classification according to the IMDG Code wherever DG are loaded and stored.
- Promote step-by-step progress. The opinions of related organizations should be coordinated; moreover, amendments to relevant laws are necessary
- Laws on the transportation, storage, and handling of DG, itemized by substance need to be revised in order to unify DG classifications at port. In addition, the accident response system for each type of DG at port should be reestablished

6. Measures to Improve Management of DG at Port

6.2 Mutual Cooperation among DG Management Authorities

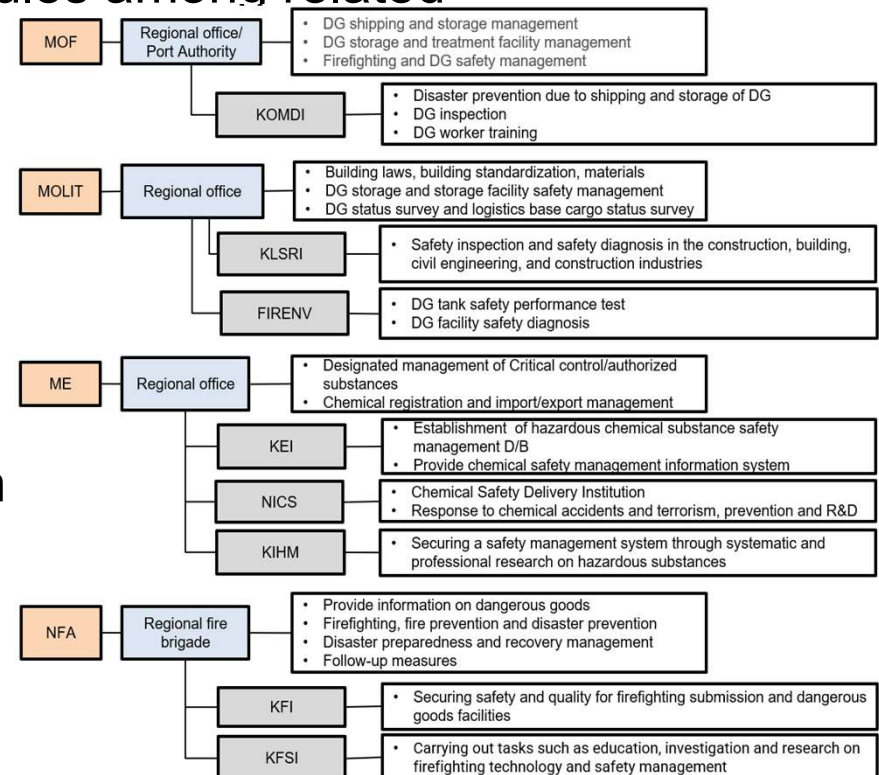
6.2.1 Role of each management entity

Regulatory authority	Disaster authority
<ul style="list-style-type: none">• Prepare and promulgate legal requirements for DG handling• Appropriate enforcement action by relevant organizations• Issue recommendations to parties obliged to fulfill legal requirements• Establish education & training criteria for DG handlers	<ul style="list-style-type: none">• Firefighting, disaster prevention, disaster preparedness and recovery management in event of DG incidents• Provide information on DG• Establish & implement accident prevention safety management plan• Develop & disseminate accident response plans
Port authority	Berth/Cargo personnel
<ul style="list-style-type: none">• Control of the movement of dangerous goods• Develop & execute contingency plans• Control vessels carrying dangerous goods• Secure safe access from ship to shore	<ul style="list-style-type: none">• Ensure DG handled in a manner that protects the health and safety of employees• Comply with DG transit/handling requirements• Conduct appropriate training and supervision of staff

6. Measures to Improve Management of DG at Port

6.2.2 Establishment of a cooperative system among dangerous goods management entities

- DG port management involves multiple institutions, resulting in differing management standards and facility guidance
- Possibility of confusion in facility management and accident response in the event of a DG incident due to differences in responsibilities and enforcement rules among related organizations
- Recommendation: Establish a Harbor Dangerous Goods Management Consultative Group comprising related organizations and seek ways to cooperate
- It is also necessary to establish an itemized manual for DG entry/unloading/storage and update it periodically.



6. Measures to Improve Management of DG at Port

6.3 Reinforcing the Importance of Training for DG Handling at Port

6.3.1 Necessity of dangerous goods workforce management

- The safe handling and storage of dangerous goods depends on competent, trained and reliable personnel.
- Relevant training provides the tools for workers to prevent accidents
- Administrative authorities need to establish minimum requirements for training and qualifications for each person involved in the transport or handling of dangerous goods and ensure that they have received appropriate training.
- Dangerous goods handling workers at port are responsible for completing the relevant training required by law.

6. Measures to Improve Management of DG at Port

6.3.2 Types of dangerous goods education

- According to UN recommendations or IMO regulations, dangerous goods handlers on ships and at ports need to complete training.
- A certificate of completion describing the content of training is issued to those who have completed the training.
- Education and training records are kept for a period as prescribed by law

Familiarization course

Training on classification of dangerous goods, labeling, marking, placarding and packaging, segregation and compatibility requirements, the purpose and content of dangerous goods transport documents, and available emergency response documents.

Practical course

Training on the specific dangerous goods transport requirements that apply and the functions they perform.

Safety course

Training on the safety measures to be followed by each person in proportion to exposure risk in the event of leakage, and functions to be performed.

Security course

Training on the nature of security risks, awareness of security risk, how to address and mitigate these risks, and actions to be taken in the event of a security breach.

6. Measures to Improve Management of DG at Port

6.3.3 Dangerous goods education institute

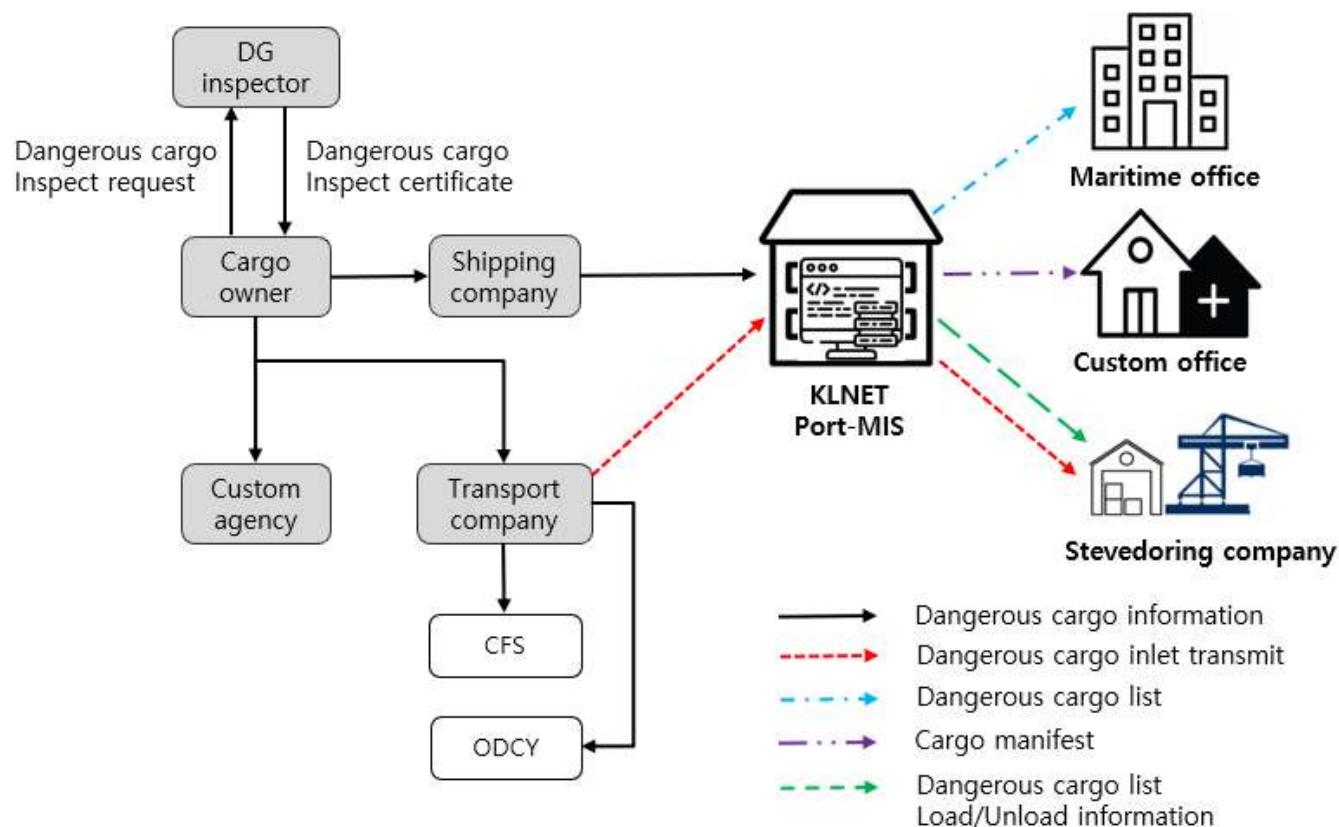
- It is difficult to hold training courses for all dangerous goods handlers at any one port or one educational institution.
- Thus, the curriculum is jointly developed and provided by related organizations, and each related educational institution subdivides and teaches the curriculum for each subject.
- It is the institution's responsibility to employ qualified and competent instructors capable of conducting the necessary training.

6. Measures to Improve Management of DG at Port

6.4 Rational information flow for of dangerous goods movement

6.4.1 Information flow for DG imports/exports

- In order for dangerous goods to be imported into the country, they must go through import customs clearance. Only then DG are allowed to carrying out in following customs clearance.



6. Measures to Improve Management of DG at Port

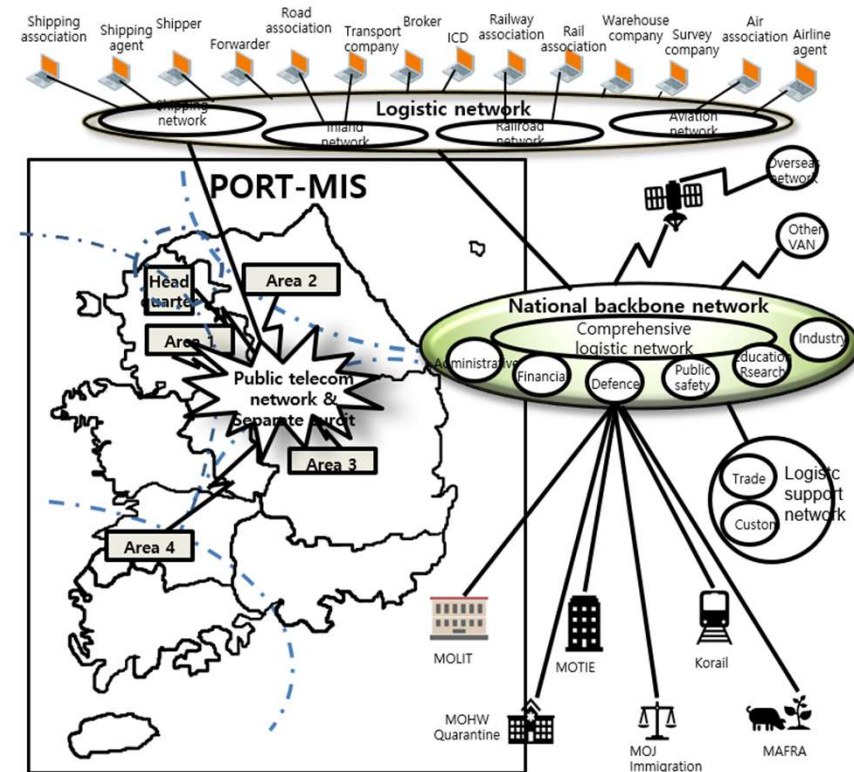
6.4.2 Computerization of dangerous goods information **at** port

- The current problems of national logistics information systems are as follows:

- Absence of logistics computer network database
- Absence of joint industry database
- Every institution owns and operates independent systems and databases
- Insufficient database standards
- Duplicate information retention and code inconsistency across institutions

- Cargo tracking difficult
- Creation of One-Stop-Service difficult

- If the computerization of logistics information is delayed, issues such as non-entry, incorrect entry, redundant processing, disconnection, redundancy, and inefficiency of information frequently emerge in DG reporting
- Using the EDI method, it is possible to automate work, reduce costs, and respond quickly in case of an accident



6. Measures to Improve Management of DG at Port

6.4.3 Preparation and verification of DG documents

- Administrative authorities need to check whether DG transport vessels are suited to shipping the cargo
- It is necessary to confirm the availability of all required documentation for the relevant DG (packaged DG, liquid bulk DG, solid bulk DG)
- Administrative authorities need to conduct inspections to ensure that dangerous goods are loaded according to the certificate of fitness
- Administrative authorities should establish a system that notifies the port authority in advance that a vessel carrying dangerous goods is scheduled to leave or enter port.
 - At least 24 hours prior to arrival and at least 3 hours prior to departure

6. Measures to Improve Management of DG at Port

6.4.4 Rationalization of DG handling document control

- A vessel submits a certificate of fitness for transporting dangerous goods to the management (port) authority, and if the administration (port) authority determines that the certificate is inappropriate, the vessel is inspected.
- When reporting dangerous goods, it is necessary to indicate the name of the substance specified in the international standard.
- Need to computerize the import cargo reporting system to reduce time and simplify procedures
- Administration (Port) authorities need expertise in imported dangerous goods
- The shipping company or agent must supply authorities with relevant D G information in advance, at time set by the administration (port) authority.
 - Transmission to authorities should also note any storage defects that may affect the safety of the vessel

6. Measures to Improve Management of DG at Port

6.5 DG storage and facility management

6.5.1 Receipt and storage of dangerous goods

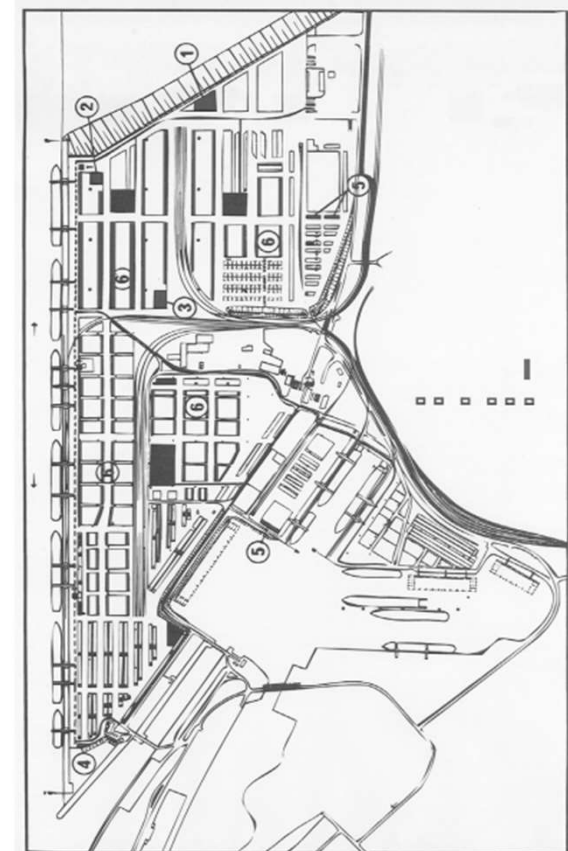
- When receiving and storing dangerous goods regulated according to one or more of the 9 UN dangerous goods classes, receipt may be granted after risks confirmed
- Need to have a documented process in place to ensure that the dangerous goods storage complies with any storage restrictions or permitting requirements.
- Inventory statements and management plans for all dangerous goods stored in warehouses must be established, updated and managed.
- Dangerous goods must be properly marked, labeled and placarded in accordance with regulations. Inspection and documentation procedures for responding to dangerous goods incidents must be prepared.

6. Measures to Improve Management of DG at Port

6.5.2 Set up of warehouse and terminal areas

- DG storage requires a separate area to ensure segregation and facilities capable of dealing with the risks unique to DG
- Dangerous goods storage requires separate containers to secure loading, rail sidings, and truck parking areas, and install emergency facilities.
- A separate fumigation area is necessary
- Maintenance and cleaning facilities must be located away from dangerous goods transportation/handling areas.
- Treatment facilities for drainage, waste, ballast water and/or slop contaminated by DG are required
- Permanent facilities for the storage of liquid dangerous goods must be designed, built and maintained in accordance with legal requirements.

Figure 2 – Plan showing dangerous goods areas



6. Measures to Improve Management of DG at Port

6.6 Establishment of Dangerous Goods Accident Response System

6.6.1 Dangerous goods accident emergency response

- The port authority, with the participation of the relevant parties, must evaluate the risk of a dangerous goods accident, and develop an emergency response plan to deal with an emergent situation. This plan should be continuously reviewed.
- Port authorities are to establish appropriate emergency procedures and provide awareness and training regarding:
 - Alarm operation, emergency notification procedures, emergency equipment, emergency response team composition, ship unberthing, securing access/exit, etc.
- Port Authorities are to maintain all DG records for use in emergencies and ensure that emergency response information is accessible at all times.

6. Measures to Improve Management of DG at Port

6.6.2 Fire and explosion prevention measures

- In order to prevent fires and explosions, which are the biggest DG risks at port, multi-layered risk management that integrates ships, infrastructure, and dangerous goods is required.
- Based on a risk assessment, the following fire response measures are required:
 - 1) Installation of an automatic detection and manual alert system
 - 2) Design compartments/safe zones separated by fireproof walls and doors; education for users
 - 3) Automatic sprinklers, fire pumps, control valves, etc. are to be maintained and managed to ensure that they function properly. Regular inspections and testing also required
 - 4) Systems located in an earthquake zone must be fitted with seismic restraints and bracing.
 - 5) Having appropriate fire extinguishing equipment is essential. This equipment must also be regularly maintained and inspected.
 - 6) All systems are to be regularly reviewed and updated when important field changes occur.

6. Measures to Improve Management of DG at Port

6.6.3 Prompt reporting of dangerous goods incidents and work stoppages

- Accident reports must provide useful information for minimizing damage and preventing recurrence, but there is a phenomenon in which proper reporting is not done to avoid being held accountable
- It is necessary to establish a system in which berth operators, DG goods handlers, and captains promptly report to the port authorities in the event of an accident that may threaten the safety and security of people, ships, property, or the environment.
- When a dangerous cargo incident occurs at port that may threaten the safety and security of people, or potentially cause damages to the ship or other ships in the port, the port itself, residents near the port, other property, or the environment, the captain must have the person in charge of handling cargo immediately stop work and until appropriate safety measures are implemented

6. Measures to Improve Management of DG at Port

6.6.4 Establishment of a disaster prevention system

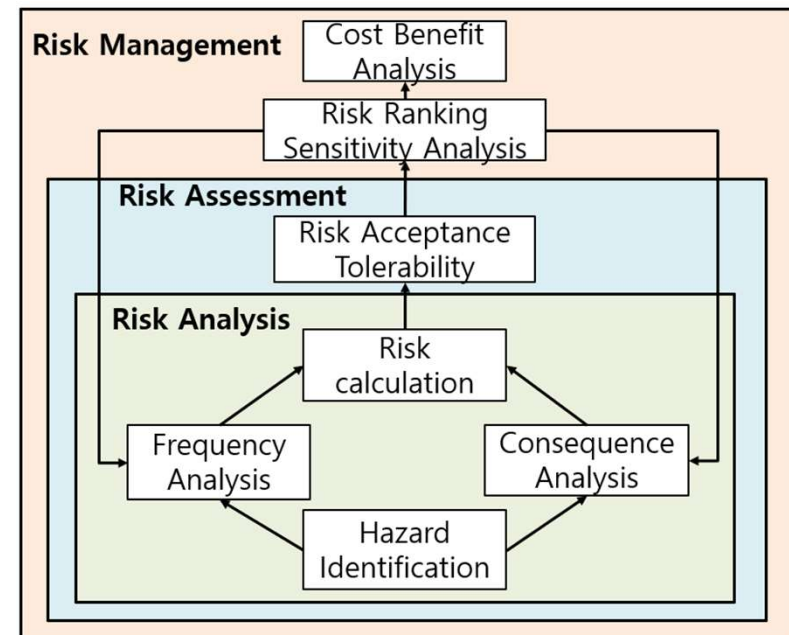
- An early warning system that can assess the risk of DG incidents at port using IoT and IT and handle them professionally and promptly should be established.
- Dangerous goods classification codes are maintained and managed in an integrated manner according to IMDG Code, and dangerous goods handling information is shared and easily used by those involved in DG handling at port.
- National chemical disaster prevention centers are often located in or around chemical industrial complexes on land. But it is also necessary to establish and operate disaster prevention centers near port areas, where large volumes dangerous goods are handled, to prevent the spread of danger at an early stage.

6. Measures to Improve Management of DG at Port

6.7 Establishment of a Port Risk Assessment and Security Management System

6.7.1 Significance and necessity of port risk assessment

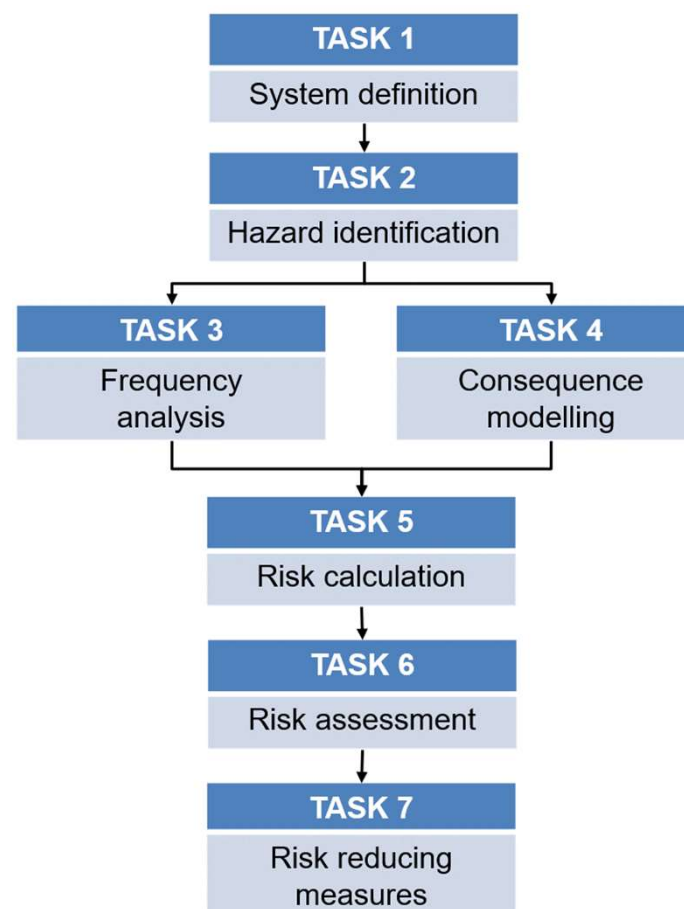
- 'Risk assessment' is a part of risk management in the safety management system. It identifies hazards and risk factors in the workplace and estimates and determines the likelihood (frequency) and severity (intensity) of injuries or diseases caused by the hazards. After calculating the risk tolerance, risk mitigation measures are established and implemented
- Port risk assessment evaluates the risk of fire and explosion caused by DG at port and analyzes the possible scale and scope of hazardous consequences that may occur as a result of a fire or explosion scenario with a high probability of occurrence.



6. Measures to Improve Management of DG at Port

6.7.2 Port risk assessment method

- A risk assessment is conducted when dangerous goods first enter port, then at least every 5 years or after a serious incident at the site.
- The quantitative risk assessment procedure is shown in the figure to the right.
- Experts in related fields (hazardous materials, dangerous goods handling, dangerous goods safety, etc.) must participate in risk assessment process.
 - Need to collect opinions of employees before preparing evaluation plan

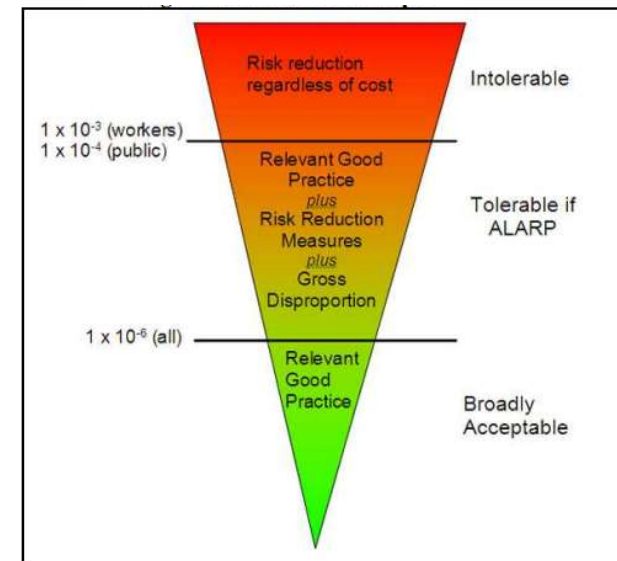


6. Measures to Improve Management of DG at Port

6.7.3 Risk calculation and control measures

- Risk assessment can be evaluated using a 5×5 risk matrix, which is divided into 5 categories of probability (X-axis) and impact (Y-axis), each on a scale from low to high.
 - Identifies the probability and impact of worker injury and exposure to hazards in relation to hazards at dangerous goods handling sites
- Determine what risk control measures, systems or procedures are required to minimize risk to an acceptable level.
 - When selecting control measures, the goal is to identify an acceptable level of risk, i.e. “as low as reasonably practicable (ALARP)”.

		Impact How severe would the outcomes be if the risk occurred?				
		Insignificant 1	Minor 2	Significant 3	Major 4	Severe 5
Probability What is the probability the risk will happen?	5 Almost Certain	Medium 5	High 10	Very high 15	Extreme 20	Extreme 25
	4 Likely	Medium 4	Medium 8	High 12	Very high 16	Extreme 20
	3 Moderate	Low 3	Medium 6	Medium 9	High 12	Very high 15
	2 Unlikely	Very low 2	Low 4	Medium 6	Medium 8	High 10
	1 Rare	Very low 1	Very low 2	Low 3	Medium 4	Medium 5

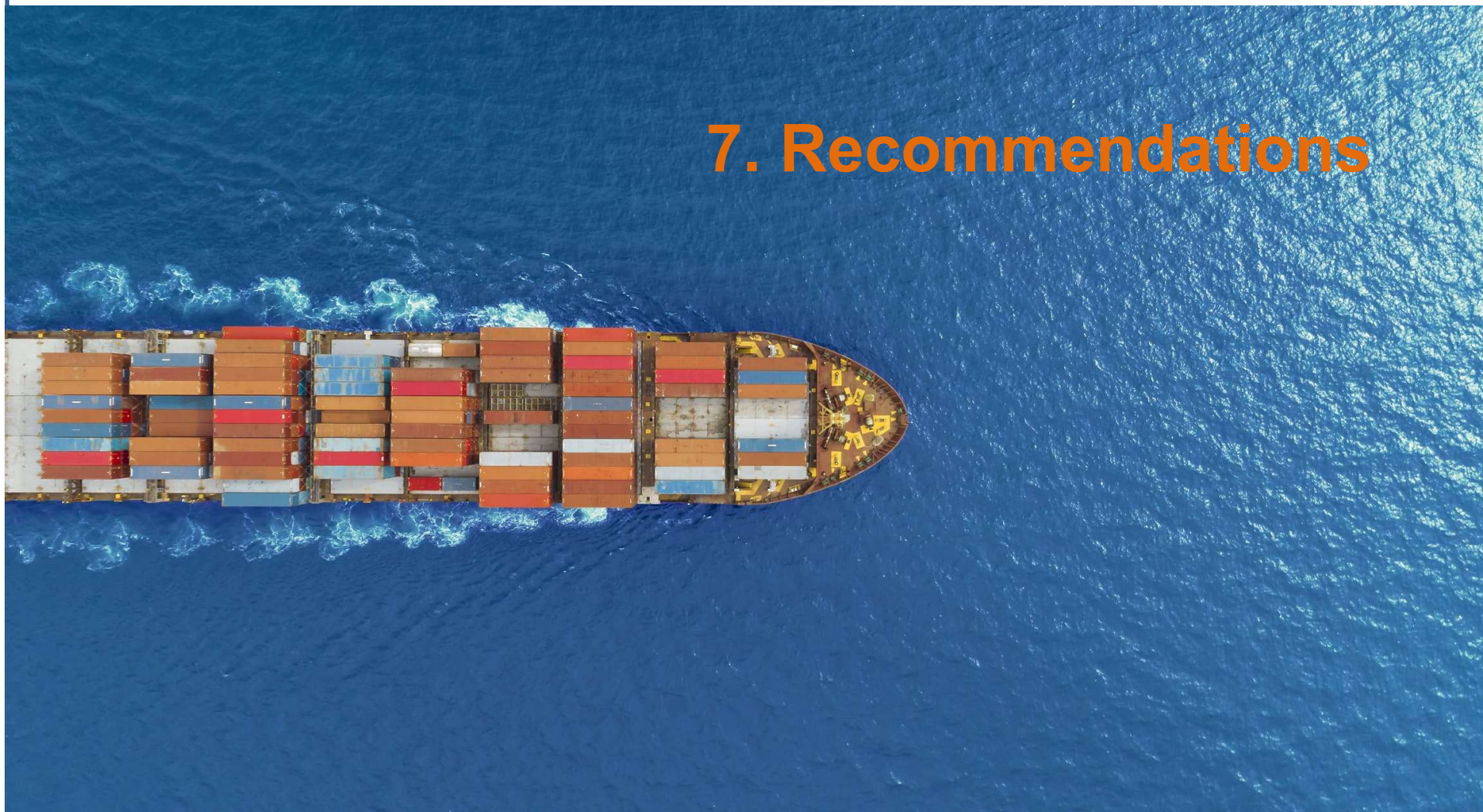


6. Measures to Improve Management of DG at Port

6.7.4 Port security management

- DG at port are prime targets for terrorists, disgruntled employees, and other bad actors, and can be used to damage warehouses, high-profile targets, or critical infrastructure.
- People entering and exiting secure areas should be identified, and the process for hiring, dismissing, and re-hiring employees thoroughly documented.
- Conduct risk assessments to identify potential security vulnerabilities associated with warehouses.
- Cybersecurity measures should be taken to ensure the integrity of access systems, computer systems and related monitoring and data processing.
- Respond quickly to security incidents and protect and control sensitive information. In addition, all personnel must be aware of security requirements and measures and maintain appropriate records.

7. Recommendations



7. Recommendations

7.1 Strengthen on-site DG inspections at port

- In addition to the usual port State control or flag State control inspections, port authorities should conduct additional inspections to ensure that DG meet IMDG Code.
- Inspections should be carried out at berth site at the terminal
- Remote inspection technology should be used to conduct DG inspections at port
 - Singapore Port Authority used remote inspections during COVID-19 pandemic
- Train and utilize port DG experts
 - In Korea: “Port Safety Inspector” system introduced in 2022, in accordance with Port Safety Special Act and Serious Accidents Punishment Act

7. Recommendations

7.2 Port Risk Assessment Support

- The catastrophic consequences of an accident can be reduced if a well-planned emergency response is carried out by assessing the degree of risk that may arise from dangerous goods at port.
- Risk assessment involves identifying and evaluating risks by qualified experts, and then proposing risk control measures.
- Despite the need for risk assessment at ports that handle DG, there exist difficulties in implementation due to financial limitations and a lack of expertise.
- ESCAP provides some funding and groups of experts to evaluate ports that handle high DG volumes

7. Recommendations

7.3 Development and dissemination of dangerous goods curriculum

- The attitude of DG handlers negatively impacts the damage caused by hazardous substances rather than the probability of accidents at ports
- Many countries conduct training for workers handling dangerous goods on land or at sea but focus on basic training and neglect functional training.
- It is necessary to develop educational content and secure high-quality instructors for educating hazardous materials workers at ports
- It is additionally necessary to promote curriculum development and instructor training in cooperation with countries with financial resources at the ESCAP level and secure expertise in dangerous goods education

7. Recommendations

7.4 A study on the production of port Dangerous Goods management manuals

- International standards for managing dangerous goods at ports are being presented, but there are difficulties in domestic application due to different administrative organization systems and legal structures in each country.
- It is necessary to manualize the procedures necessary for entry, unloading, and storage (according to the country's situation) by DG type.
 - Packaged DG, solid bulk DG, liquid bulk DG
- It is recommended that a standard manual should be prepared at the ESCAP level and modified for use in each country.

7. Recommendations

7.5 Establishment of a port DG information system

- DG information management at port is necessary to reduce logistics costs and improve customer service. Prompt response is critical in event of DG-related accident
- Each country's port logistics system independently owns and operates databases for each relevant institution and company, resulting in work redundancies, non-standard documentation and inconsistency in Codes.
 - Excessive information disconnect, redundancies, and inefficiencies
- With the development of ICT, there is no difficulty in establishing a hardware-based logistics network, so it is necessary to establish a reasonable logistics information system suitable for each country's administrative system.

7. Recommendations

7.6 Cooperation with related organizations to prevent and respond to dangerous goods accidents

- When a dangerous goods accident occurs at port, local governments, the Coast Guard, the Ministry of Environment, and National Fire Agency must coordinate a joint response.
- For this reason, it is necessary to establish a system in which each institution shares information on relevant dangerous goods.
- To improve the effectiveness of dangerous goods safety management among these institutions, it is necessary to form a 'Port Consultative Body' for each individual port, regularize meetings, and conduct regular response training in which these institutions jointly participate in preparation for accidents.

Thank You !

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