Export Packaging for Safe Transportation of Dangerous Goods by Air & Sea 9th January 2026

Indian Institute of Packaging

Address by the

Director General of Maritime Administration

9th January 2026

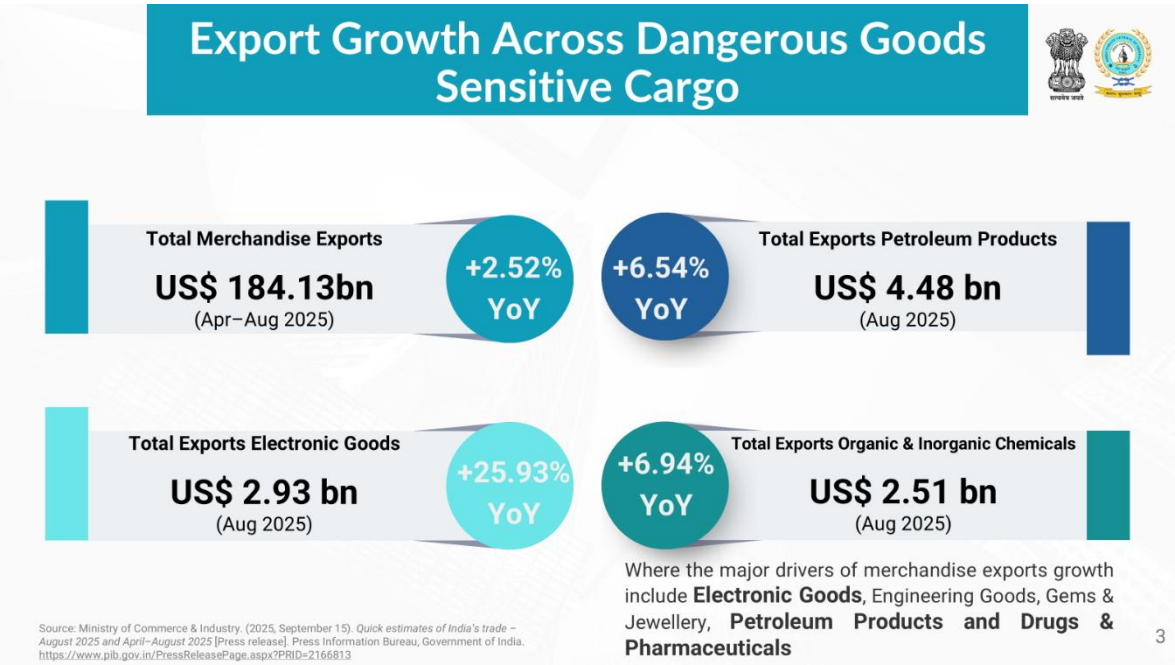
The event focuses on export packaging and the safe transportation of dangerous goods by air and sea, highlighting regulatory requirements, international standards such as the IMDG Code, UN certification processes, and emerging safety challenges. It brings together industry, regulators and technical institutions to strengthen compliance, enhance packaging practices, and support India's growing export ecosystem.

India's Maritime Trade Imperative

India's economic growth and integration with global markets are closely linked to maritime trade. Nearly **95 percent of India's international trade by volume and about 70 percent by value** is carried by sea, underscoring the critical role of the maritime sector. With a coastline of **11,098 kilometres**, supported by **12 major ports and over 200 non-major ports**, India possesses a strong physical foundation to support expanding trade flows.

The national vision of **Viksit Bharat @2047** and **Atmanirbhar Bharat** places emphasis on export-led growth, logistics efficiency and supply chain resilience. Maritime trade is central to achieving the goal of becoming a **USD 30 trillion economy by 2047**. The **Maritime India Vision 2030** provides a structured roadmap for developing ports, shipping, logistics and maritime safety, while the **Union Budget 2025** reinforced this commitment through the establishment of a **₹25,000 crore Maritime Development Fund**.

As trade volumes increase, risk exposure also rises, particularly in the transport of dangerous goods such as chemicals, petroleum products and batteries. Ensuring safety through strong regulatory frameworks, adherence to international standards and effective industry compliance is essential to protect life at sea, the marine environment and the reliability of India's export supply chains.



Export Growth Across Dangerous Goods Sensitive

India's export performance in 2025 reflects strong growth across several sectors that are inherently sensitive from a dangerous goods perspective. Total merchandise exports during April to August 2025 stood at **USD 184.13 billion**, registering a positive year-on-year growth. This overall expansion is driven by specific product categories that involve hazardous, flammable, reactive or temperature-sensitive materials.

Exports of **electronic goods**, which include batteries and battery-powered equipment, recorded a sharp increase, reaching **USD 2.93 billion in August 2025**, with nearly **26 percent year-on-year growth**. **Petroleum products**, another high-risk cargo category, rose to **USD 4.48 billion in August 2025**, while **organic and inorganic chemicals** reached **USD 2.51 billion**, reflecting sustained demand for chemical exports.

These trends indicate that a growing share of India's export basket involves cargo with elevated safety and handling requirements. Even where dangerous goods are embedded within general cargo categories, the associated risks during storage, packaging, handling and transport increase proportionately with volume.

As export volumes continue to rise, the importance of robust regulatory compliance, accurate declaration and appropriate packaging becomes critical. Safe transport of these cargoes is essential not only for protecting crew, vessels and the marine environment, but also for maintaining the reliability and credibility of India's export supply chains.

Regulatory Compliance and Packaging Standards for Dangerous Goods

The growth in India's exports of electronics, chemicals, pharmaceuticals and energy products has resulted in a parallel increase in the movement of dangerous goods, including dangerous goods embedded within general cargo. This trend places greater responsibility on all stakeholders to ensure that such cargo is identified, packaged and transported safely across the supply chain.

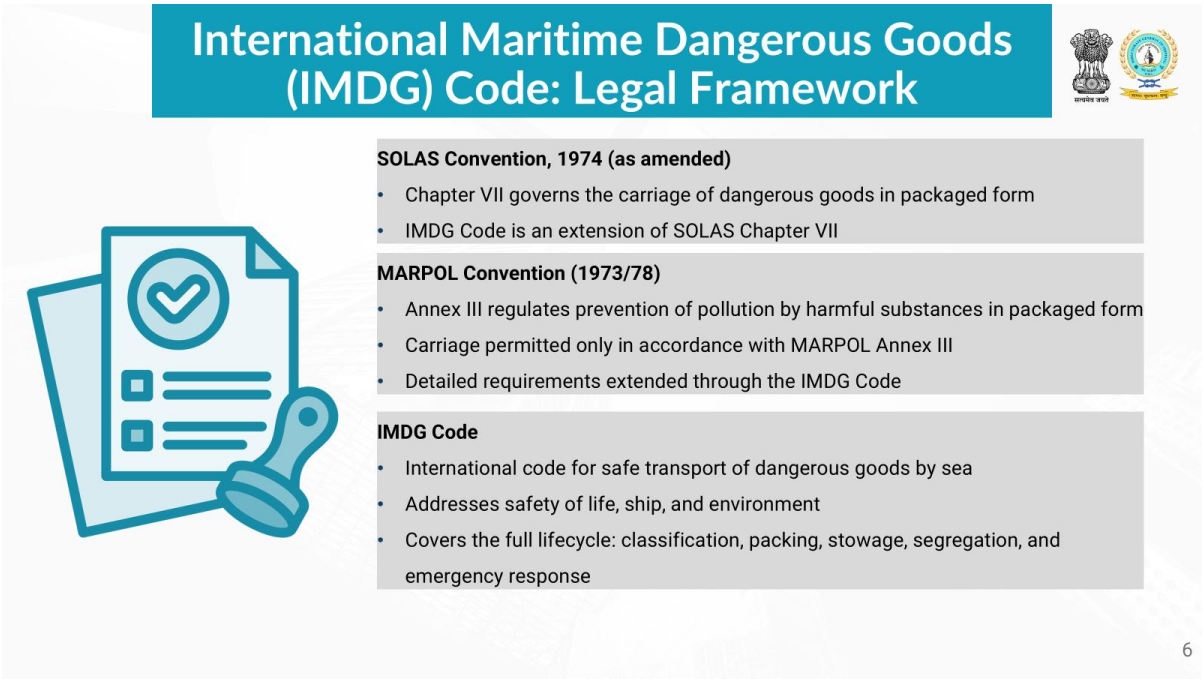
Effective management of these risks depends on strong regulatory alignment with internationally accepted frameworks. For maritime transport, the **IMDG Code** provides the primary global standard for classification, packaging, marking, documentation, stowage and emergency response for dangerous goods. For air transport, the **Aircraft (Carriage of Dangerous Goods) Rules, 2025** and the **IATA Dangerous Goods Regulations (2025)** establish corresponding requirements, particularly for emerging risks such as lithium and other advanced battery technologies.

National standards play an important supporting role in ensuring consistency and compliance. **BIS IS 18149:2023** lays down uniform requirements for dangerous goods classification, packaging, marking, handling and emergency preparedness within the domestic supply chain. Together, these international and national frameworks reinforce the importance of certified and compliant packaging as the first line of defence against fire, leakage and other incidents.

Adherence to these standards is essential not only for protecting life, vessels and the marine environment, but also for ensuring efficient intermodal logistics and maintaining confidence in India's export ecosystem.

Overview of Recent Marine Incidents

Between July 2024 and June 2025, several serious marine incidents occurred along the Indian coastline, particularly off Kerala and Karnataka. These included major shipboard fires involving hazardous cargo, a container fire caused by lithium-ion batteries, and the capsizing of a vessel carrying dangerous chemicals. While some incidents were effectively managed through swift multi-agency response, others posed significant risks of environmental pollution and highlighted ongoing safety and hazardous cargo management challenges in maritime operations.



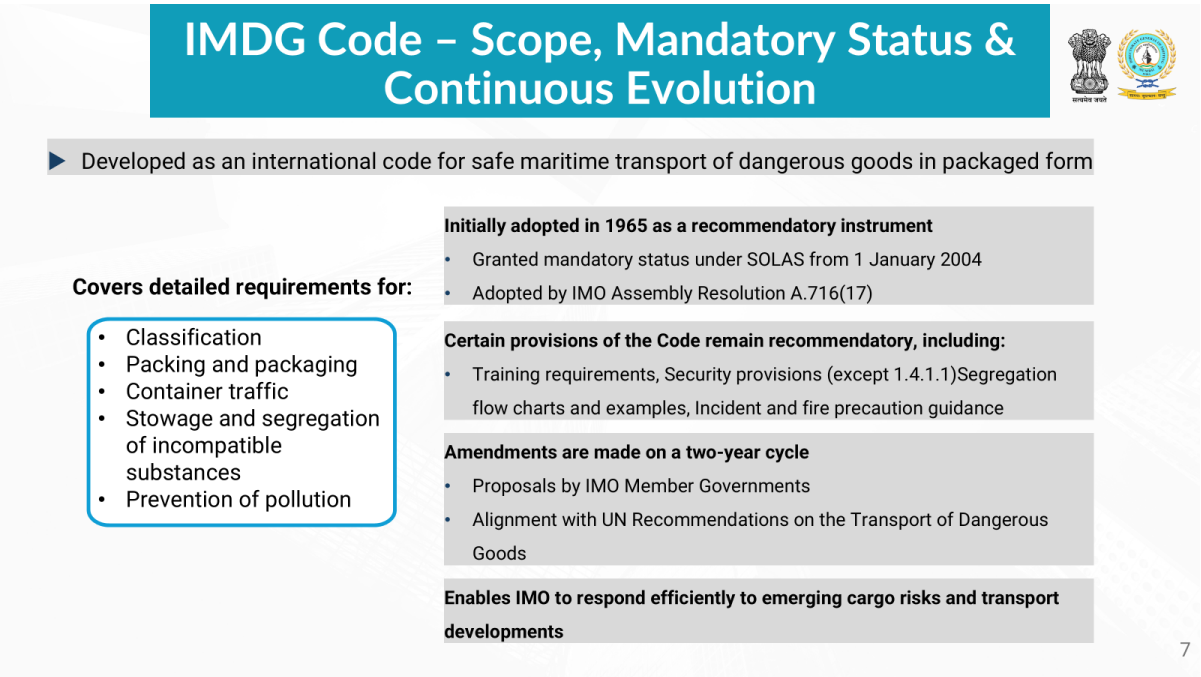
International Maritime Dangerous Goods (IMDG) Code: Legal Framework

The carriage of dangerous goods in packaged form by sea is governed by the SOLAS Convention, 1974 (as amended), specifically Chapter VII, which lays down mandatory requirements for their safe transport.

The IMDG Code functions as an operational extension of SOLAS Chapter VII, providing detailed and standardized procedures to ensure compliance.

In parallel, the MARPOL Convention (1973/78), under Annex III, regulates the prevention of pollution by harmful substances carried in packaged form. Carriage of such substances is permitted only in accordance with Annex III, with the IMDG Code elaborating its technical and procedural requirements.

Overall, the IMDG Code is an internationally accepted code for the safe transport of dangerous goods by sea. It aims to protect human life, ships, and the marine environment, covering the entire lifecycle of dangerous goods carriage, including classification, packaging, marking, documentation, stowage, segregation, and emergency response.



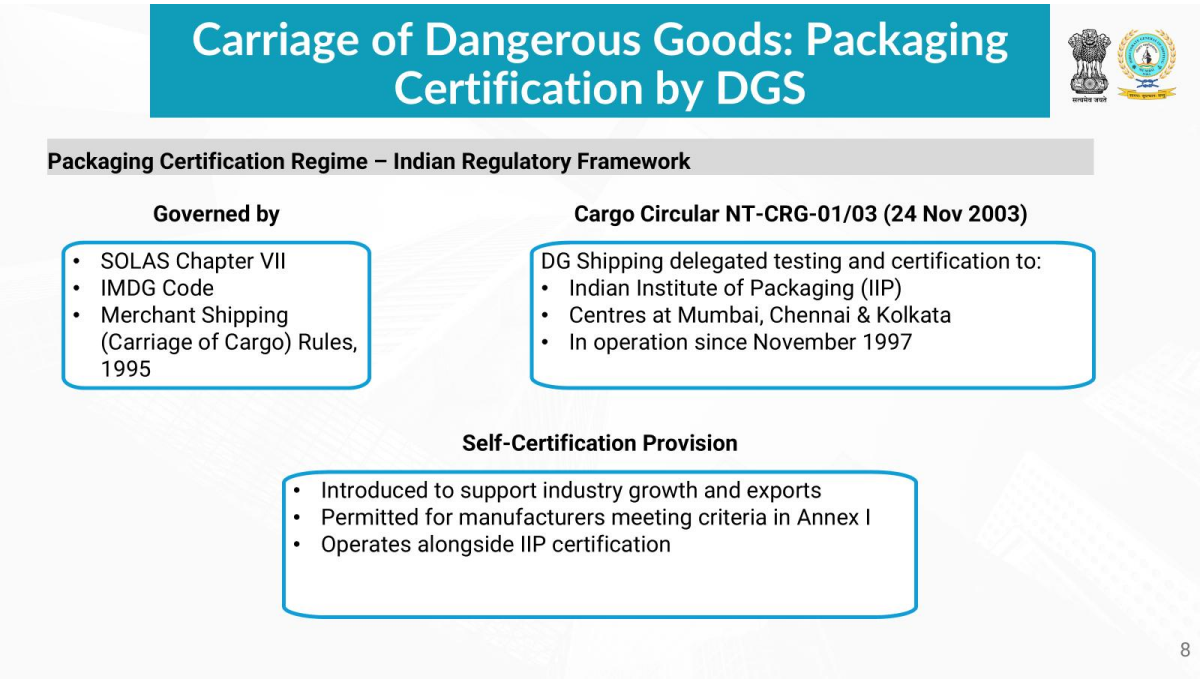
IMDG Code – Scope, Mandatory Status & Continuous Evolution

The IMDG Code was developed as an international framework to ensure the safe maritime transport of dangerous goods in packaged form. It provides comprehensive requirements covering classification, packing and packaging, containerized transport, stowage and segregation of incompatible substances, and prevention of pollution.

Initially adopted in 1965 as a recommendatory instrument, the Code was later given mandatory status under the SOLAS Convention with effect from 1 January 2004, following adoption by the IMO Assembly through Resolution A.716(17).

While most provisions are mandatory, certain elements remain recommendatory, including training requirements, security provisions (except paragraph 1.4.1.1), segregation flow charts and examples, and guidance on incidents and fire precautions.

The IMDG Code is continuously updated through a two-year amendment cycle, based on proposals from IMO Member Governments and aligned with the UN Recommendations on the Transport of Dangerous Goods. This ensures the Code remains responsive to emerging cargo risks and evolving transport practices

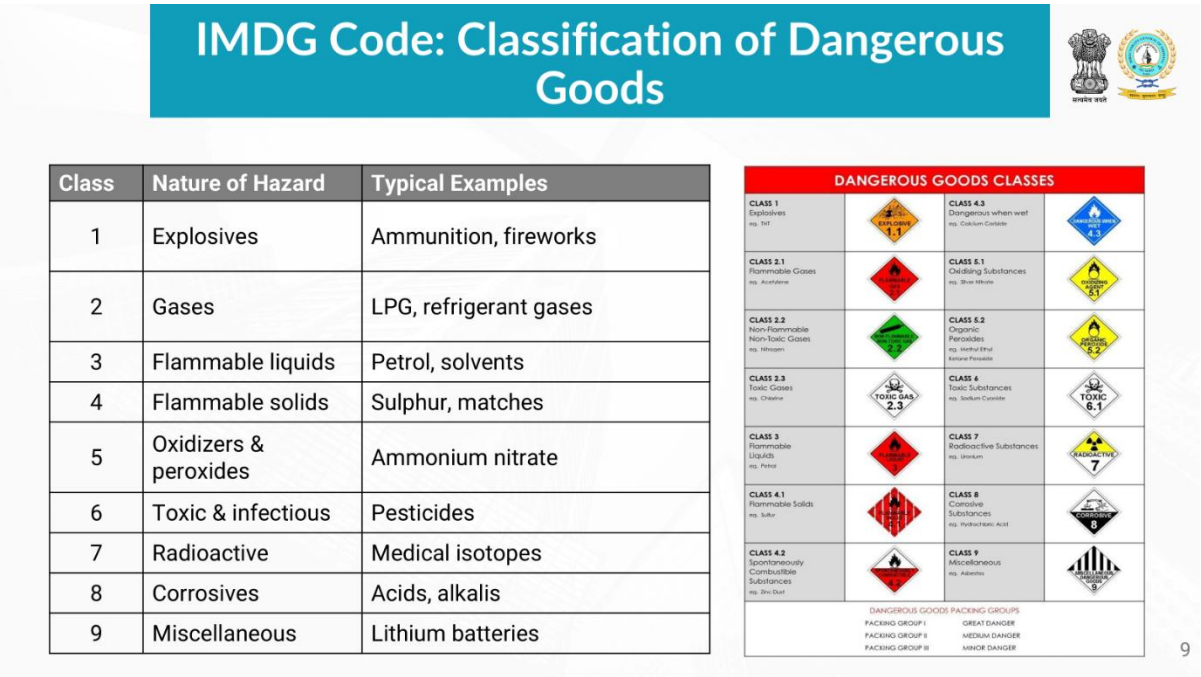


Carriage of Dangerous Goods: Packaging Certification by DGS

The packaging certification regime for dangerous goods in India is governed by **SOLAS Chapter VII** and the **IMDG Code**, and implemented domestically through the **Merchant Shipping (Carriage of Cargo) Rules, 1995**. Further regulatory guidance was issued through **Cargo Circular NT-CRG-01/03 dated 24 November 2003**.

Under this framework, the **Directorate General of Shipping** delegated the testing and certification of dangerous goods packaging to the **Indian Institute of Packaging (IIP)**, with centres located in **Mumbai, Chennai, and Kolkata**, operational since **November 1997**.

To promote industry growth and exports, a **self-certification provision** was introduced for manufacturers meeting the eligibility criteria specified in **Annex I**. This mechanism operates in parallel with the IIP certification system, providing flexibility while maintaining regulatory oversight.



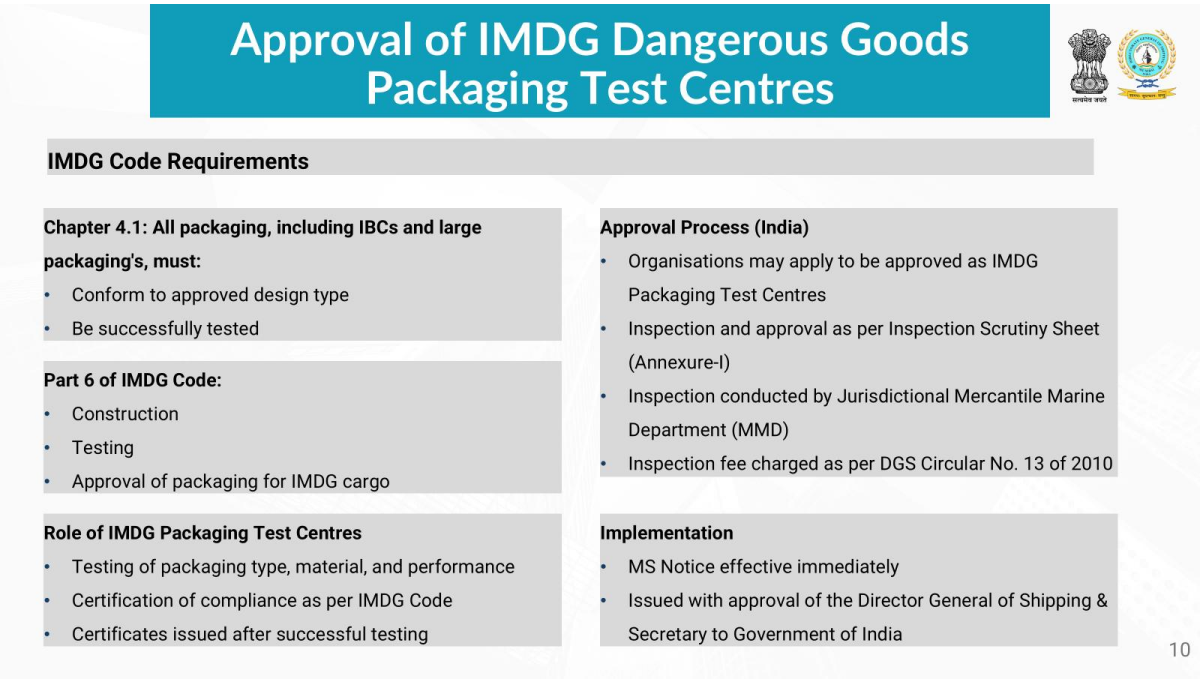
IMDG Code: Classification of Dangerous Goods

The IMDG Code classifies dangerous goods into **nine hazard-based classes** to ensure uniform identification, handling, stowage, segregation, and emergency response during maritime transport. Each class reflects the primary risk posed by the substance and determines the applicable packaging, labeling, and documentation requirements.

- **Class 1 – Explosives:**
- Substances and articles capable of producing an explosion or pyrotechnic effect. This class includes ammunition, fireworks, and detonators, and is subject to the strictest controls on packaging, stowage, and segregation due to the high risk of mass explosion and projection hazards.
- **Class 2 – Gases:**
- Compressed, liquefied, or dissolved gases, including flammable, non-flammable, and toxic gases such as LPG and refrigerant gases. Risks include fire, explosion, asphyxiation, and pressure-related hazards.
- **Class 3 – Flammable Liquids:**
- Liquids with a low flash point that can easily ignite, such as petrol and industrial solvents. These cargoes present significant fire and vapor explosion risks, requiring controlled stowage and segregation from ignition sources.
- **Class 4 – Flammable Solids:**

- Substances liable to ignite through friction, absorb moisture and self-heat, or emit flammable gases on contact with water. Examples include sulphur and matches. Special precautions are required to prevent spontaneous ignition.
- **Class 5 – Oxidizing Substances and Organic Peroxides:**
- Materials that may cause or intensify combustion, such as ammonium nitrate. Organic peroxides are particularly sensitive to temperature and contamination, posing risks of fire and explosion.
- **Class 6 – Toxic and Infectious Substances:**
- Substances that can cause serious injury or death if inhaled, ingested, or absorbed, including pesticides and infectious materials. Strict packaging, labeling, and emergency response measures are mandated to protect crew and the environment.
- **Class 7 – Radioactive Material:**
- Materials emitting ionizing radiation, such as medical isotopes. Transport is tightly regulated with specialized packaging, shielding, and monitoring to minimize radiation exposure.
- **Class 8 – Corrosive Substances:**
- Substances that cause severe damage to living tissue and structural materials, including acids and alkalis. Risks include chemical burns and corrosion of ship structures.
- **Class 9 – Miscellaneous Dangerous Goods:**
- Substances presenting hazards not covered under other classes, such as lithium batteries, environmentally hazardous substances, and elevated temperature materials. This class has grown significantly due to emerging technologies and new cargo types.

This classification system forms the foundation of the IMDG Code, enabling consistent global application of safety, pollution prevention, and emergency response measures in maritime transport.



Approval of IMDG Dangerous Goods Packaging Test Centres

Under the **IMDG Code**, strict requirements are prescribed to ensure that packaging used for the carriage of dangerous goods by sea is safe, reliable, and fit for purpose.

As per **Chapter 4.1 of the IMDG Code**, all packaging—including **Intermediate Bulk Containers (IBCs)** and **large packagings**—must conform to an **approved design type** and be **successfully tested** before being used for the transport of dangerous goods. These requirements are further elaborated in **Part 6 of the IMDG Code**, which lays down detailed provisions relating to the **construction, testing, and approval** of packaging intended for IMDG cargo.

Role of IMDG Packaging Test Centres

IMDG Packaging Test Centres play a critical role in the regulatory framework by:

- Conducting testing of packaging design, materials, and performance characteristics,
- Verifying compliance with IMDG Code standards,
- Issuing **certificates of compliance** upon successful completion of prescribed tests, thereby authorizing the packaging for use in dangerous goods transport.

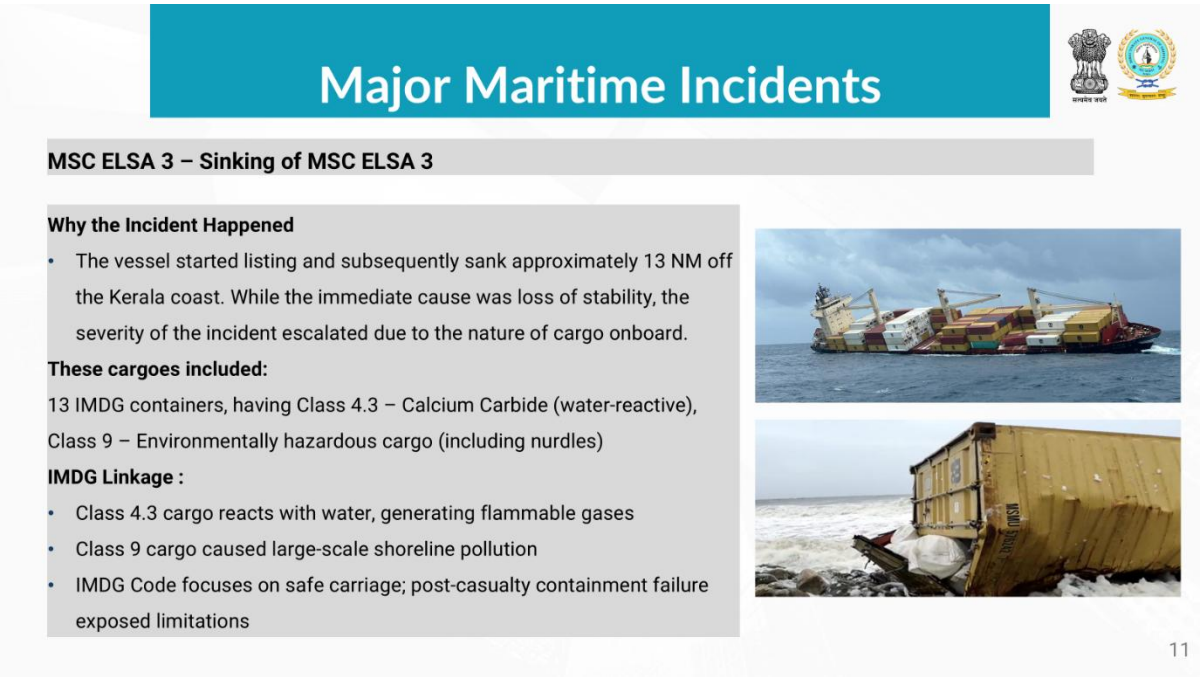
Approval Process in India

In India, organizations seeking recognition as **IMDG Packaging Test Centres** may apply to the competent authority for approval. The approval process involves:

- Scrutiny and inspection in accordance with the **Inspection Scrutiny Sheet (Annexure-I)**,
- Physical inspection carried out by the **Jurisdictional Mercantile Marine Department (MMD)**,
- Payment of inspection fees as prescribed under **DGS Circular No. 13 of 2010**.

Implementation

The relevant **Merchant Shipping (MS) Notice** is effective immediately upon issuance and is promulgated with the approval of the **Director General of Shipping and Secretary to the Government of India**, ensuring immediate regulatory applicability and enforcement.

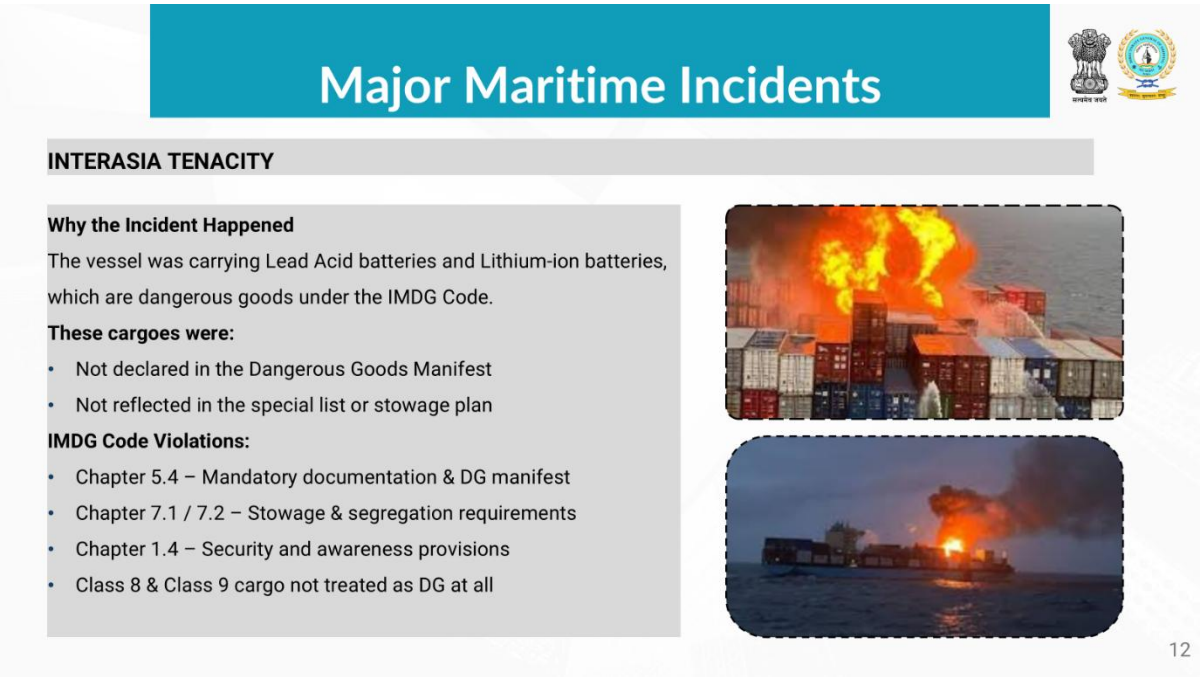


Major Maritime Incidents- MSC ELSA 3 – Sinking of MSC ELSA 3

The container vessel **MSC ELSA 3** developed a severe list and subsequently sank about **13 nautical miles off the Kerala coast**. Although the immediate cause of the casualty was **loss of stability**, the impact of the incident was significantly aggravated by the **dangerous nature of the cargo carried onboard**.

The vessel was transporting **13 IMDG containers**, including **Class 4.3 (Calcium Carbide)**, a water-reactive substance that generates flammable gases on contact with water, and **Class 9 environmentally hazardous cargo**, including plastic nurdles. Following the sinking, the interaction of Class 4.3 cargo with seawater heightened fire and explosion risks, while the Class 9 cargo resulted in **widespread shoreline pollution**.

From an IMDG perspective, the incident highlights that while the **IMDG Code effectively addresses safe carriage under normal conditions**, the post-casualty release of dangerous goods exposed **limitations in containment and environmental protection once structural failure occurs**.



Major Maritime Incidents- INTERASIA TENACITY

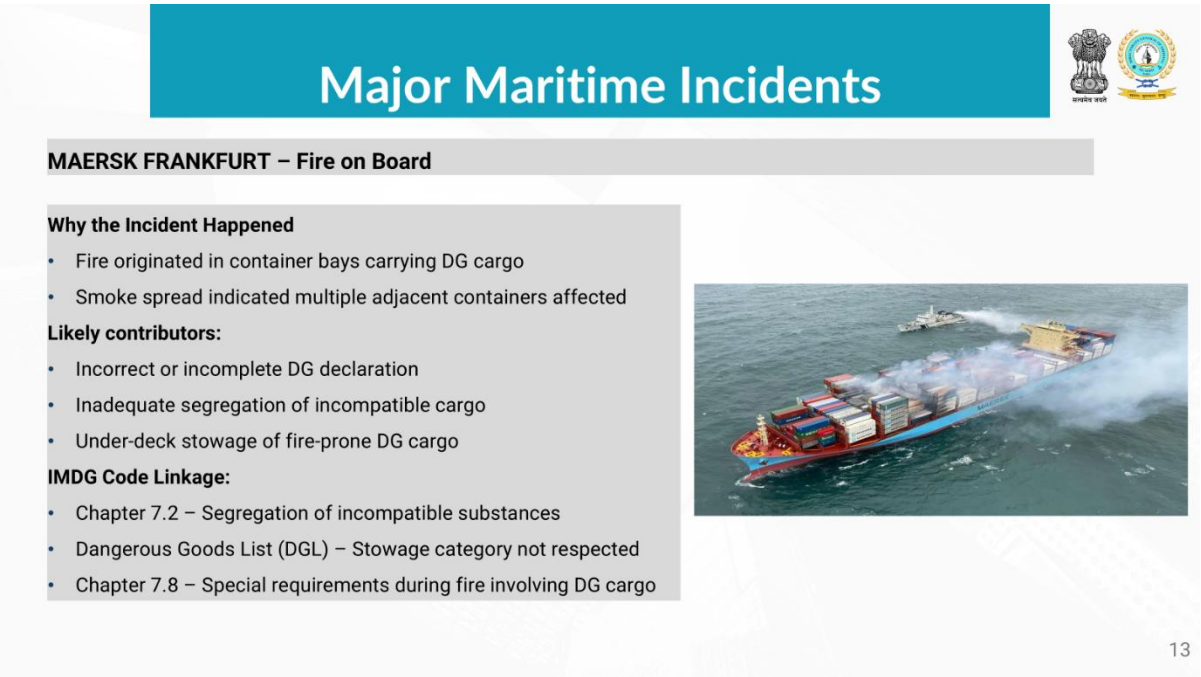
The incident onboard **INTERASIA TENACITY** occurred due to the carriage of **lead-acid batteries (Class 8)** and **lithium-ion batteries (Class 9)**, both of which are classified as dangerous goods under the **IMDG Code**.

These dangerous cargoes were **not declared in the Dangerous Goods Manifest** and were **omitted from the special list and stowage plan**, resulting in a complete lack of crew awareness regarding their presence onboard.

IMDG Code Violations Identified

- **Chapter 5.4:** Failure to provide mandatory dangerous goods documentation and manifest
- **Chapters 7.1 and 7.2:** Non-compliance with prescribed stowage and segregation requirements
- **Chapter 1.4:** Breach of security and awareness provisions

As a result, **Class 8 and Class 9 cargoes were not treated as dangerous goods at all**, leading to improper stowage, delayed fire detection, and increased risk to the vessel, crew, and environment. This incident underscores the critical importance of accurate declaration, documentation, and compliance with IMDG requirements at the planning stage



Major Maritime Incidents- MAERSK FRANKFURT – Fire on Board

The fire onboard **MAERSK FRANKFURT** originated in container bays carrying **dangerous goods cargo**, reportedly involving **sodium cyanide**. The pattern of smoke spread suggested that **multiple adjacent containers** were affected, indicating escalation beyond a single unit.

Likely Causes

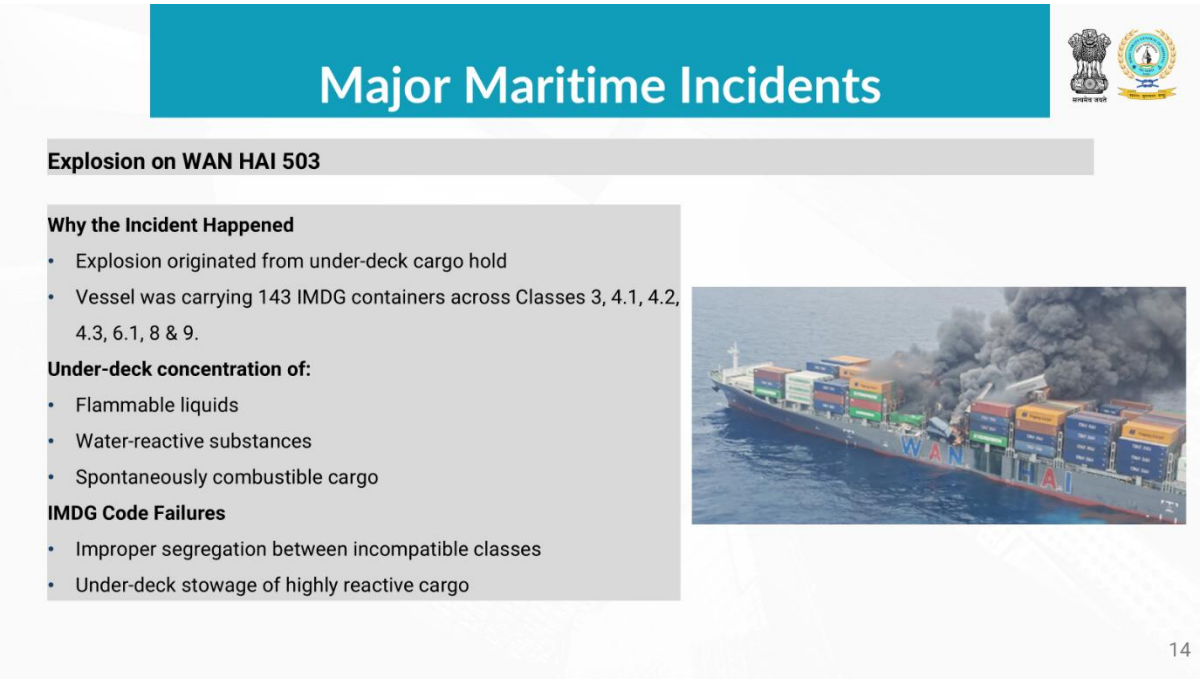
The incident was likely exacerbated by:

- **Incorrect or incomplete dangerous goods declaration**,
- **Inadequate segregation of incompatible cargo**, and
- **Under-deck stowage of fire-prone dangerous goods**, which increased the difficulty of detection and firefighting.

IMDG Code Linkage

- **Chapter 7.2:** Non-compliance with segregation requirements for incompatible substances
- **Dangerous Goods List (DGL):** Failure to adhere to prescribed stowage categories
- **Chapter 7.8:** Special provisions applicable during fires involving dangerous goods cargo

This incident highlights how deficiencies in **declaration, segregation, and stowage planning** can rapidly escalate a dangerous goods fire, posing severe risks to the vessel, crew, and environment.



Major Maritime Incidents- Explosion on WAN HAI 503

The explosion onboard **WAN HAI 503** originated from an **under-deck cargo hold**, where a large concentration of dangerous goods was stowed. The vessel was carrying **143 IMDG containers** spanning multiple hazard classes, including **Classes 3, 4.1, 4.2, 4.3, 6.1, 8, and 9**.

Contributing Factors

A significant under-deck accumulation of:

- **Flammable liquids**,
- **Water-reactive substances**, and
- **Spontaneously combustible cargo**

created a highly unstable and hazardous environment, increasing the likelihood of escalation once an initiating event occurred.

IMDG Code Failures

- **Improper segregation** between incompatible dangerous goods classes, in violation of segregation requirements
- **Under-deck stowage of highly reactive cargo**, contrary to safe stowage principles

This incident demonstrates how **concentrated under-deck stowage and segregation failures** involving multiple reactive IMDG classes can lead to catastrophic explosions, highlighting critical gaps in dangerous goods planning and compliance.

Preventive Measures for Safe Carriage of Dangerous Goods (Explanation)

The slide highlights key **preventive controls under the IMDG Code** to reduce the risk of fires, explosions, and pollution incidents during the carriage of dangerous goods:

1. **Correct IMDG Classification & Declaration**
    - Accurate identification of cargo hazard class, UN number, and packing group
    - Proper marking, labeling, and completion of Dangerous Goods documentation
    - Ensures crew awareness and correct stowage and emergency response planning
2. **Proper Packing & Container Stuffing**
    - Use of IMDG-approved packaging and containers
    - Adequate securing, cushioning, and bracing of cargo inside containers
    - Prevents leakage, movement, damage, and escalation during voyage
3. **IMDG-Compliant Stowage Plans**
    - Stowage in accordance with IMDG Code requirements and the Dangerous Goods List

- Consideration of location, ventilation, temperature sensitivity, and accessibility
- Reduces risk to ship structure, crew, and other cargo

4. **Strict Segregation of Incompatible Cargo**
    - Separation of substances that may react dangerously with each other (e.g. acids and flammables)
    - Maintenance of prescribed segregation distances and barriers
    - Prevents chain reactions and multi-container escalation
5. **Preference for On-Deck Stowage of High-Risk DG Cargo**
    - Facilitates early detection, monitoring, and firefighting
    - Minimizes the risk of concealed under-deck fires and internal spread
    - Enhances emergency response effectiveness

Overall Message:

Effective prevention relies on **accurate declaration, compliant packaging, corrects to wage and segregation, and informed planning**. Most major DG incidents stem from failures at the **planning and documentation stage**, making preventive compliance the most critical safety measure.