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ABU DHABI QUALITY AND CONFORMITY COUNCIL

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دليل أبوظبي الإرشادي

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Abu Dhabi Guidelines for Transport of Dangerous Goods

دليل أبو ظبي الإرشادي لنقل المواد الخطرة

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1. Amendment Page

To ensure that each copy of this technical document (Abu Dhabi Guideline) contains a complete record of amendments, the Amendment Page is updated and issued with each set of revised/new pages of the document. This ADS is a live document which can be amended when necessary. QCC operates Abu Dhabi Transport of Dangerous Goods Guidelines Manual Group which prepared this document and can review stakeholder comments to review and amend this document and issue an updated version when necessary.

Edition Number	Year of Approval	Number of pages	Sections Changes	Notes
1	2022	223	-	New document

2. About the Abu Dhabi Quality and Conformity Council

Abu Dhabi Quality and Conformity Council (QCC) is an Abu Dhabi government entity established in accordance with Local Law No. (3) of 2009 to raise the quality of Abu Dhabi's exports and products traded locally. QCC consists of a council of regulators and industry with a mandate to ensure provision of quality infrastructure in line with global standards.

- QCC's functions are divided into six key areas:
  - Developing standards and specifications
  - Capacity building of metrology systems
  - Strengthening testing infrastructure
  - Launching conformity schemes
  - Protecting consumer interests
  - Ensuring fair trade
- QCC's key stakeholders include regulatory authorities, consumers, retailers and wholesalers, industry, conformity assessment bodies (CABs) and importers.

QCC supports regulators and government organizations through offering quality and conformity facilities, expertise and resources that allow them to implement products safety and compliance requirements and regulations. Additionally, QCC works towards promoting a culture of quality and protecting the interests of consumers. In doing this, QCC seeks to promote the Emirate's competitiveness to become one of the world's most attractive regions for investments and human capital, and to support the competitiveness of national industries in world markets.

3. Acknowledgement

QCC would like to thank the members of the Working Group listed below.

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4. Foreword

This transport of dangerous goods guidelines manual covers the key procedural requirements for managing and controlling the dangerous goods mobility within the jurisdiction of Abu Dhabi Emirate.

Principal guidance is contained in the main body of the manual which are based in the national regulations as well as the international regulations such as “European Agreement concerning the International Carriage of Dangerous Goods by Road -ADR 2021”. Supporting detail such as dangerous goods list tables, forms and methodologies are given in the Appendices.

The guidelines specified in this manual are applicable for dangerous goods transportation by road within Abu Dhabi Emirate and should be supplemented with good knowledge, experience, and sound judgment in the dangerous goods transportation field.

This manual will be updated regularly as new data and experience with best practice become available from relevant stakeholders.

5. Working Group

The Professional Working Group was organized by Abu Dhabi Quality and Conformity Council and established in May 2022, which was requested by Integrated Transport Centre, to prepare Abu Dhabi Transport of Dangerous Goods Guidelines Manual in cooperation with the related stakeholders including representatives from government and private sectors.

6. Purpose

The purpose of this guidelines manual is to:

- Present the dangerous goods classifications,
- Identify the responsibilities of the supply chain parties
- Address the safety measures to be considered during the dangerous goods transportation,
- Exhibit the packing, marking and hazard labelling of dangerous goods, vehicles and tanks,
- Emphasize the training and training records,
- Demonstrate the provisions of dangerous goods transport,
- Illustrate the required documentation and recordkeeping,
- Clarify the requirements for the hazardous wastes handling and transport,
- Identify the requirements of dangerous goods transportation, and
- Clarify the enforcement requirements in terms of inspection, violations and penalties.

7. Scope

The scope of this guidelines manual is to provide a comprehensive document supporting the national regulations in the management and control dangerous goods transportation in Abu Dhabi Emirate through illustrating the roles and responsibilities of entities and transport chain members involved in the consignment, loading/unloading and carriage of dangerous goods by road. In addition, the manual provides appropriate information to ensure that dangerous goods are safely packaged as well as safety measures to those involved in carriage, the emergency services and responders, and end-users including those at work and consumers to prevent the dangerous goods risk to people, property and the environment in order to deliver an effective, safe, and secure transport system that serves the public interest and contributes to the economic growth, quality of life and environmental sustainability of the Emirate of Abu Dhabi.

8. Terms and definitions

Term		Definition
7.1	**ADR**	European Agreement concerning the International Carriage of Dangerous Goods by Road - Roads (Land) Transport Regulations.
7.2	**API**	American Petroleum Institute
7.3	**COR**	Chain of Responsibility
7.4	**DG**	Dangerous Goods
7.5	**DGSA**	Dangerous Goods Safety Advisor
7.6	**HAZMAT**	Hazardous Materials
7.7	**HMMT**	Hazardous Materials Management Team
7.8	**IHMMS**	Integrated Hazardous Materials Management System
7.9	**MEGC**	Multiple-element Gas Container
7.10	**MEMU**	Mobile Explosive Manufacturing Unit
7.11	**SDS**	Safety Data Sheet
7.12	**PLACARDS**	Large Hazard Labels used on Vehicles/Tanks
7.13	**PPE**	Personal Protective Equipment

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ABBREVIATIONS

ADCDA : Abu Dhabi Civil Defense Authority

ADNOC : Abu Dhabi National Oil Company

ADP : Abu Dhabi Police General Command

ADQCC : Abu Dhabi Quality and Conformity Council

ADR : European Agreement concerning the International Carriage of Dangerous Goods by Road - Roads (Land) Transport Regulations.

AND :International Agreement for the Transport of Dangerous Goods by Inland Waterway - Linland Waterway Transport Regulations.

BLEVE : Boiling-Liquid-Expanding-Vapor Explosion

COR : Chain of Responsibility

DG : Dangerous Goods

DGSA : Dangerous Goods Safety Adviser

DMT : Department of Municipalities and Transport

DOH : Department of Health

EAD : Environment Agency – Abu Dhabi

EDI : Electronic Data Interchange technique

EDP : Electronic Data Processing technique

FANR : Federal Authority for Nuclear Regulation

HAZMAT : Hazardous Materials

HAS : The Health and Safety Authority

IBC : Intermediate Bulk Container

ICAO/IATA : International Civil Aviation Organization / International Air Transport Association - Transport by Air Regulations

IMDG : International Maritime Dangerous Goods Code) is applicable for Transport by Sea.

ITC : Integrated Transport Centre

MEGC : Multiple-element Gas Container

MEMU : Mobile Explosive Manufacturing Unit

OSHC : Abu Dhabi Occupational Safety and Health Centre

Placards : Large Hazard Labels used on Vehicles/Tanks

PPE : Personal Protective Equipment

RID : Regulations concerning the International Carriage of Dangerous Goods by Rail,

WMC : Abu Dhabi Waste Management Centre (TADWEER)

1 INTRODUCTION

1.1 Overview

Dangerous goods (DG) are substances and articles which have been identified as hazardous for transport and present a danger to people, property and the environment. Dangerous goods might be in liquid, solid, or gaseous physical state and have been tested and assessed against internationally agreed criteria and found to be potentially dangerous (hazardous) when carried. Dangerous goods are assigned to different hazard classes depending on their predominant hazardous property.

Dangerous goods play an important role in the economic development in Abu Dhabi Emirate as they are used in a wide range of industrial and commercial activities (e.g., power generation, selling paints, pesticides, etc.) and must be properly handled to ensure the health and safety of employees and the public. In addition, transporting dangerous goods by roads involves possibilities of traffic accidents that might cause spillage of the hazardous materials, leading to hazards such as fire, explosion, chemical burn or environmental damage.

In order to manage the transportation of dangerous goods in Abu Dhabi, , the Integrated Transport Centre (ITC) prepared this “Transport of Dangerous Goods Guidelines Manual” through proper coordination with relevant stakeholders involved in the consignment, loading/unloading and carriage of dangerous goods by road aiming to manage and control their mobility in the Emirate to deliver an effective, safe and secure transport system that serves the public interest and contributes to the economic growth, quality of life and environmental sustainability of the Emirate of Abu Dhabi.

1.2 Hazardous Materials vs Dangerous Goods

Hazardous materials are classified based only on health effects (whether they are immediate or long term), while dangerous goods are substances or material that can pose an irrational risk to health, safety, and property when transported in commerce through their immediate physical or chemical effects, such as fire, explosion, corrosion and poisoning . Identifying dangerous goods is the first step to reduce the risks posed by the product with proper packaging, communication, handling, and stowage.

Hazardous materials (HAZMAT) have the potential to harm human health. They may be solids, liquids or gases. HazMat may be pure substances or mixtures. When used in the workplace, these substances may produce vapors, fume, dusts or mists. There are many industrial, laboratory and agricultural chemicals which are classified as hazardous. Hazardous substances may cause immediate or long-term health effects. Exposure could result in poisoning, irritation, chemical burns, sensitization, cancer, birth defects or diseases of certain organs such as the skin, lungs, liver, kidneys and nervous system.

Dangerous goods (DG) are substances that may be corrosive, flammable, explosive, spontaneously combustible, toxic, oxidizing, or water-reactive. These goods can be deadly and can seriously injure or kill people, damage property and the environment.

Hazardous materials and dangerous goods are covered by separate legislation, each focusing on controlling the different risks associated with them. Many hazardous materials are also classified as dangerous goods, so both pieces of legislation apply to these.

Generally, the dangerous goods are considered as hazardous materials when they have not been transported as such this manual shall concentrate on the transport of dangerous goods which are more related to the transport chain activities. In parallel, the hazardous materials shall be considered in the storage and packing as integral part of the chain activities

1.3 Purpose of The Manual

The purpose of this guideline's manual is to

- List the international, current federal and local laws, legislations and regulations related to dangerous goods transportation.
- Present the dangerous goods classifications based on their physical and chemical properties and packing groups.
- Give a brief summary about the economic activities related to hazardous materials as well as their management and control procedures in the Emirate.
- Identify the responsibilities of the supply chain parties and safety measures to be considered during the dangerous goods transportation to reduce the risks to the employees and the environment.
- Overview the requirements and specifications of electronic vehicle tracking system to be installed on the vehicles used in dangerous goods transportation.
- Aid the supply chain parties in minimizing the hazards of fires, explosions, toxic releases, spillages, occupational diseases, and injuries resulting from the improper storage, handling and transportation of dangerous goods.
- Exhibit the packing, marking and hazard labelling of dangerous goods, vehicles and tanks that comply with local and international standards and specifications, while sustaining work efficiency and production capabilities at the facilities.
- Emphasise the required requirements including the training and training records to ensure the provision of equipment and qualified employees to supervise the dangerous goods transportation
- Guide the supply chain parties to implement proper planning and risk assessment for dangerous Goods transportation.

- Demonstrate the provisions of dangerous goods transport in terms of mixed packing and loading as well as the restrictions for passing through tunnels or over /underneath bridges and parking areas.
- Illustrate the required documentation and recordkeeping for the transport of dangerous goods.
- Clarify the requirements for the hazardous wastes handling and transport as well as their management in terms of treatment, storage, land disposal and secure landfills.
- Identify the requirements of dangerous goods transportation permits in the Emirate for companies, vehicles, drivers, and routes.
- Clarify the Enforcement requirements in terms of inspection, violations and penalties.

This manual is developed taking into consideration the safety, protection, quality of roads without conflicting with the current Abu Dhabi Government manuals.

The guidelines specified in this manual are applicable for dangerous goods transportation by road within Abu Dhabi Emirate and should be supplemented with good knowledge, experience, and sound judgment in the dangerous goods transportation field.

This manual will be updated regularly every two years as new data and experience with best practice become available from relevant stakeholders.

1.4 Stakeholders

In order to ensure successful delivery and acceptance of this manual, the relevant stakeholders were engaged at different stages of preparation on different levels. The identified stakeholders for this manual are listed below:

- Integrated Transport Centre (ITC)
- Department of Municipalities and Transport (DMT)
- Environment Agency – Abu Dhabi (EAD)
- Abu Dhabi Civil Defense Authority (ADCDA)
- Abu Dhabi Police General Headquarter
- Abu Dhabi Waste Management Centre (WMC)
- Federal Authority for Nuclear Regulation (FANR)
- Department of Health (DOH)
- Abu Dhabi Public Health Centre (ADPHC)

- Abu Dhabi Agriculture and Food Safety Authority (ADFSA)
- Department of Economic Development – Abu Dhabi (DED)
- Abu Dhabi National Oil Company (ADNOC)
- Abu Dhabi Customs
- Abu Dhabi Quality and Conformity Council (ADQCC)

1.5 Content and Format

This manual is divided into the following thirteen chapters:

Chapter 1 provides the hazardous materials and dangerous goods definitions, the purpose of the manual, stakeholders list and the manual content and format.

Chapter 2 discusses the mode of transport international regulations for dangerous goods as well as the relevant laws, regulations and guidance published in UAE related to the dangerous goods road transport.

Chapter 3 introduces the dangerous goods classifications, packing groups and dangerous goods restricted from transport without special treatment processes as well as economic activities related to hazardous materials and their management and control in the Emirate

Chapter 4 addresses the responsibilities of supply chain parties as well as the safety measures should be considered from the loading of the dangerous goods, transport up to the delivery at the end- point, including the cleaning of the vehicle afterwards.

Chapter 5 summarizes the dangerous goods exemption in the national transport

Chapter 6 describes training requirements for the vehicle's drivers and crew as well as the dangerous goods safety advisors and the required certifications.

Chapter 7 provides the packing, marking and labelling of dangerous goods as well as the vehicles and tankers used in transportation.

Chapter 8 discusses the quantitative risk assessment for dangerous goods transportation in terms of risk identification, analysis, evaluation and management.

Chapter 9 includes general provisions for dangerous goods transportation in terms of loading and unloading, mixed packing and load as well as tunnel and parking restrictions and supervision of vehicles.

Chapter 10 gives general documentation requirements in terms of transport document list, large container or vehicle packing certificate, instructions in writing and record keeping.

Chapter 11 discusses the hazardous wastes handling and transportation in terms consignor and carrier responsibilities, labelling of vehicle and package and hazardous waste management.

Chapter 12 presents the required dangerous goods transportation permits in the Emirate including Economic licensing, vehicle ownership, company activity permit, vehicle licensing, vehicle driver's license, vehicle licensing for transporting dangerous goods, and vehicle route permit.

Chapter 13 includes the enforcement processes in terms of inspection as well as offences and penalties

Appendices

2 LAWS, REGULATIONS AND GUIDANCE

This chapter provides the mode of transport international regulations for dangerous goods as well as the relevant laws, regulations and technical guidance documents published in UAE related to the dangerous goods road transport.

2.1 Modes of Transport International Regulations

Mode of transport is a term used to distinguish between different ways of transportation or transporting people or goods. The different modes of transport are air, water, and land transport, which includes rails or railways, road and off-road transport. Each mode of transport has a fundamentally different technological solution, and some require a separate environment. Each mode has its own infrastructure, vehicles, transport operators and operations.

The mode of transport of dangerous goods has a significant impact. Mechanical stress, humidity, pressure and many other factors can vary from one mode to another. Consequently, the transportation of dangerous goods is controlled and governed by a variety of different regulatory regimes, operating at both the national and international levels. Collectively, these regulatory regimes mandate how dangerous goods shall to be handled, packaged, labelled and transported in order to prevent, as far as possible, accidents to persons or property and damage to the environment.

The current international regulations for the transport of dangerous goods are divided into five categories as follows:

- **ADR regulations:** (European Agreement concerning the International Carriage of Dangerous Goods by Road) for **Roads (Land) transport**.
- **RID regulations:** (Regulations concerning the International Carriage of Dangerous Goods by Rail) for **rail transport**,
- **ADN regulations:** (International Agreement for the Transport of Dangerous Goods by Inland Waterway). for inland **waterway transport**,
- **IMDG code:** (International Maritime Dangerous Goods Code) is applicable for transport **by sea.**
- **ICAO/IATA** regulations (International Civil Aviation Organization / International Air Transport Association) are in force for transport **by air**.

In order to correctly manage the transport of dangerous goods, we must first know the corresponding regulations, which include provisions relating to every aspect as well as answers to any possible question. For example, ADR Regulations (by road) cover a multitude of topics, such as the classification of dangerous goods, characteristics of the packaging, qualification of drivers, vehicle and tank construction, requirements for transport units, etc. Each of these topics needs to

be properly managed when dealing with the specific requirements of each regulation as minor regulatory non-compliance could result in the shipment being stopped.

The topics covered in the modes of transport regulations must be always kept up to date with the changes, especially as they are updated every two years, with the exception of transport by air (IATA), which is updated annually.

In case of using two or more transport systems for the same shipment (e.g. dangerous goods travelling by land and then by sea) attention must be paid to ensure that the modes of transport are complying with the given regulations, supported by experts who can provide advice in the field.

It is worth mentioning that this Manual is based upon the ADR - 2021 regulations for Roads transport published in the following websites with proper modification to reflect Abu Dhabi Emirate conditions and context.

ADR – Volume 1: https://unece.org/sites/default/files/2021-01/ADR2021_Vol1e_0.pdf

ADR – Volume 2: https://unece.org/sites/default/files/2021-01/ADR2021_Vol2_Track_web.pdf

The relevant authorities and dangerous goods transport chain in Abu Dhabi Emirate should comply with the content of this manual and shall utilize the ADR regulations for any further information or clarifications.

2.2 Relevant Laws, Regulations and Guidance in UAE

Legislation governing the dangerous goods transport by road nationally and internationally is based on the ADR, which has been adopted by about 50 countries worldwide. This agreement was originally signed in Geneva in 1957 and is currently amended every two years.

The UAE regulations are consistent with ADR and are frequently amended to keep it in line with each new edition of them. This guidelines manual has been prepared with reference to the following current national laws, regulations and technical guidance documents, which provide for general handlers duties, the practical safe transport of dangerous goods, competent authorities, powers of enforcement, violations and penalties as well as the current edition of the ADR

- Federal Law No. 24 of 1999 - Protection and Development of the Environment.
- Federal Law by Decree No 6 of 2009, Regarding the Peaceful uses of Nuclear Energy.
- Federal Decree Law No. (17) for the year 2019 regarding Weapons, Ammunitions, Explosives, Military Materials and Hazardous Substances.
- Federal Law No. (14), 2017 regarding handling of petroleum materials.
- Federal Law No. 12 of 2018 regarding Integrated Waste Management.
- Cooperation Council Recommendations for the Arab States of the Gulf regarding the protective requirements for hazardous materials, 2012

- Ministerial Decree No. (714) of 2015 regarding the proper disposal of obsolete pesticides and empty pesticide containers.
- Ministerial Decree No. (36) of 2018 regarding banned and restricted pesticides in the United Arab Emirates.
- Ministerial Decree No. (783) of 2015 regarding banned and restricted industrial chemicals in the United Arab Emirates.
- Ministerial Decree No. (27) of 2018 regarding the procedures for registration and import of pesticides.
- Ministerial Decree No. (784) of 2015 regarding the executive by-law of Federal Law No. (39) of 1992 regarding production, import and handling of fertilizers and agriculture conditioners.
- Ministerial Decree No. (33) of 2012 regarding handling of hydrochlorofluorocarbon (HCFCs).
- Ministerial Decree No. 152 of 2013 regulating the passage and export of hazardous waste across state borders.
- Ministerial Decree No. (213) of 2017 to amend the regulations of Cabinet Decree No. (24) of 2012 regarding the organization of civil defense services in the country issued by ministerial Decree No. (505) of 2012
- Table of terms and requirements for trading petroleum products in UAE, Annex to Ministerial Decree No. 61 of 2020 regarding the Unified Regulatory Procedures for the Trading of Petroleum Products.
- Cabinet Decree No. (24) of 2012 regarding the regulation of civil defense services in the Country.
- Cabinet Decree No. (27) of 2012 regarding handling of public health pesticides.
- Cabinet Decree No. (16) of 2019 regarding the system for advertising pesticides.
- Cabinet Decree No. (33) of 2018 regarding handling of used oils.
- Cabinet Decree No. (37) of 2001 regarding handling of hazardous materials, hazardous waste, and medical waste.
- Cabinet Decree No. 35 of 2019 regarding the Executive Regulations of Federal Law No. (14) of 2017 for the trading of petroleum products.Concerning the Unified Regulatory Procedures for the Trading of Petroleum Products in the State
    - بشأن الإجراءات التنظيمية الموحدة لتجارة المنتجات البترولية في الدولة
    - On standardized regulatory procedures for handling petroleum products in the country

- بشأن الإجراءات التنظيمية الموحدة للتعامل مع المنتجات البترولية في الدولة
- Can't load full results
- Try again
- Retrying...
- Retrying...

- Transport, Handling and Storage of Dangerous Goods Guidelines for Port Users, August 2014, Issue 2, ADPC.
- Technical Guidance Document for Storage of Hazardous Materials, May 2020, EAD.
- Standard Operating Procedure for Permitting of Traders of Hazardous Materials, September 2011, EAD.
- Code of Practice for the Management of Dangerous Goods in the Emirate of Dubai, 1997.
- Technical Guideline No. 8 Disposal of Hazardous Waste, September 2020, Dubai Municipality.
- Technical Guideline No.11 Transportation and Handling of Hazardous Waste in the Emirate of Dubai, September 2020, Dubai Municipality.
- UAE Fire and Life Safety Code of Practice, 2011.
- Preventative Requirements for Hazardous Materials, 2015.

3 DANGEROUS GOODS CLASSIFICATIONS

This chapter provides the principles of dangerous goods classifications, the classes of dangerous goods, the dangerous goods restricted from transport without special treatment processes as well as economic activities related to hazardous materials and their management and control in the Emirate.

3.1 General

The dangerous goods classification is the most important step in the transport chain. In order to determine the safe transportation of dangerous goods, it is imperative to first determine the hazard classes as different dangerous goods require different measures to ensure that they are transported safely.

Commonly, the original manufacturer or supplier affords the dangerous goods classification through providing the classification information on proper labels, safety data sheets and transport documentation. In some circumstances, the consignor of dangerous goods could have a legal responsibility to classify substances or articles that may pose a danger because of the nature of the substance or article (e.g., mixing flammable paints or inks, manufacturing corrosive detergents as well as wastes like asbestos, batteries, or industrial effluent) for safe transport. In all cases, it is recommended to seek advice from a dangerous goods safety adviser when carrying out such classification.

It is worth mentioning that the legal responsibility to classify dangerous goods does not apply to logistics companies, freight forwarders, couriers, etc.

3.2 Principles of Classification

The dangerous goods classification is necessary to provide appropriate information to those involved in carriage (transport), the emergency services and responders, and end-users including those at work and consumers, and to ensure that goods are safely packaged.

The classification is determined by the type of risk involved to health, safety, property or the environment. The classification criteria for the carriage of dangerous goods by road are provided in the ADR (Volume 1, Part 2, Chapter 2), and, where required, further classification criteria are set out in the associated UN Manual of Tests and Criteria. These documents facilitate the classification of any substance, mixture, or article, including wastes. The dangerous goods has been classified into nine main hazard calssifications groups, some of which are subdivided, thus providing a total of thirteen classes, as set out in Figure 3.1, with a corresponding class or hazard label.

1. Explosive substances

2. Gases

3. Flammable liquids

4.1 Flammable solids

4.2 Substances liable to spontaneous combustion

4.3 Substances when in contact with water emit flammable gases

5.1. Oxidising substances

5.2 Organic peroxides

6.1 Toxic

6.2 Infectious

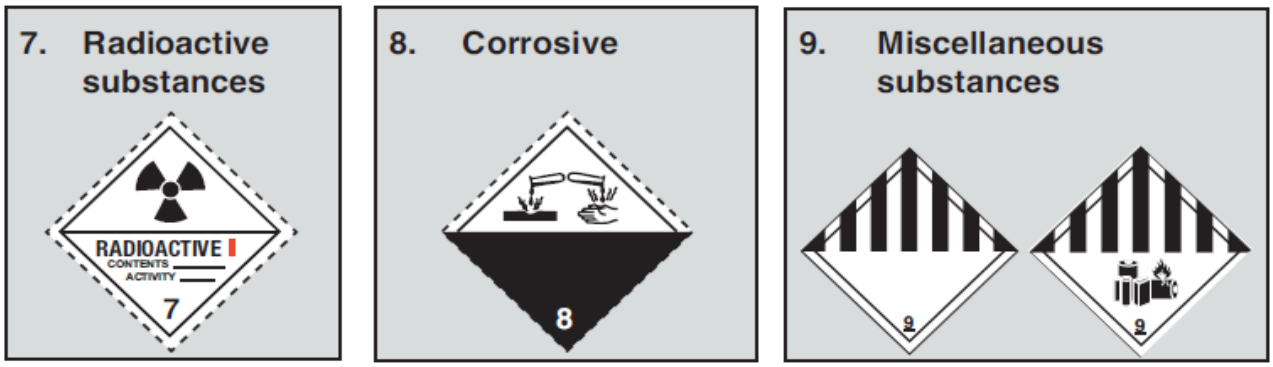


Figure 3-1: Dangerous Goods Classifications

The nine main hazard classification groups cover thousands of individual substances. Each individual substance or group of substances is given a unique number known as the "UN" number, (United Nations number). The objective of the UN definitions is to indicate which goods are dangerous and in which class, according to their specific characteristics, they should be included and not response to the degree of danger. These definitions have been devised to provide a common pattern which should prove possible to follow in the various national and international regulations.

UN numbers are four-digit numbers that identify dangerous goods, hazardous substances and articles (such as explosives, flammable liquids, toxic substances, etc.) in the framework of international transport.They are assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods. It is worth mentioning that some dangerous substances have their own UN numbers (e.g. acrylamide has UN 2074), while sometimes groups of chemicals or products with similar properties receive a common UN number (e.g. flammable liquids, not otherwise specified, have UN 1993). A chemical in its solid state may receive a different UN number than the liquid phase if their hazardous properties differ significantly and substances with different levels of purity (or concentration in solution) may also receive different UN numbers.

For example, petrol is a flammable liquid, "Class 3" and is assigned the unique UN number: UN 1203.

Substances are further categorised according to how dangerous they are by designating a "packing group" or "**PG**" as indicated in Table 3-1.

Packing Group	Description
PG I	High Danger
PG II	Medium Danger
PG III	Low Danger

Table 3-1: Dangerous Goods Packing Groups

For example, petrol is a flammable liquid and based on its properties (i.e. the flash point), petrol is allocated to PG II.

For transport, all dangerous goods must be identified correctly, and this information must be presented in a certain way (see clause 10.3). The entry on the transport document for petrol is as follows:

“UN1203, Petrol, 3, PG II” (the letters “PG” may be omitted)

For substances that have more than one dangerous property, additional hazard class (secondary hazard class) is added to the identification line in brackets after the primary hazard class”. For example,

“UN1230, Methanol, 3(6.1), PG II” i.e., a Class 3, flammable liquid with a secondary hazard, Class 6.1, toxic.

All substances must be classified prior to transportation by road or any other mode of transport. If shipping goods by air, sea, road or rail the appropriate modal classification requirements must be applied for each mode of transport and expert advice should be sought.

Note: The substances and articles are listed in tabular form namely “Dangerous Goods List - Table A” in ADR, Volume 1, Part 3, Chapter 3.2 which consists of 20 columns. Each column is dedicated to a specific subject (such as UN, class, PG, etc.) as indicated in the explanatory notes below the table. The intersection of columns and rows (cell) contains information concerning the subject treated in that column, for the substance(s) or article(s) of that row. The Table A format and explanatory notes below the table are shown in Appendix A.

3.3 Classes of Dangerous Goods

The dangerous goods nine classes are as follows:

3.3.1 Class 1 - Explosives

Explosives are materials or items which have the ability to rapidly conflagrate or detonate as a consequence of chemical reaction which produces gases at temperatures, pressures and speeds as to cause catastrophic damage through force and/or of producing otherwise hazardous amounts of heat, light, sound, gas or smoke.

The explosives substances could be divided into the followings six subdivisions as follows:

Division 1.1: Substances and articles which have a mass explosion hazard.

Division 1.2: Substances and articles which have a projection hazard but not a mass explosion hazard.

Division 1.3: Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both.

Division 1.4: Substances and articles which present no significant hazard, only a small hazard in the event of ignition or initiation during transport with any effects largely confined to the package

Division 1.5: Very insensitive substances which have a mass explosion hazard

Division 1.6: Extremely insensitive articles which do not have a mass explosion hazard

Examples of commonly transported explosives are
Ammunition/Cartridges, Fireworks/pyrotechnics, Flares, blasting caps/detonators, Fuse, Primers, Explosive charges (blasting, demolition etc), Detonating cord, Air bag inflators, Igniters, Rockets, TNT / TNT compositions, RDX / RDX compositions, PETN / PETN compositions.

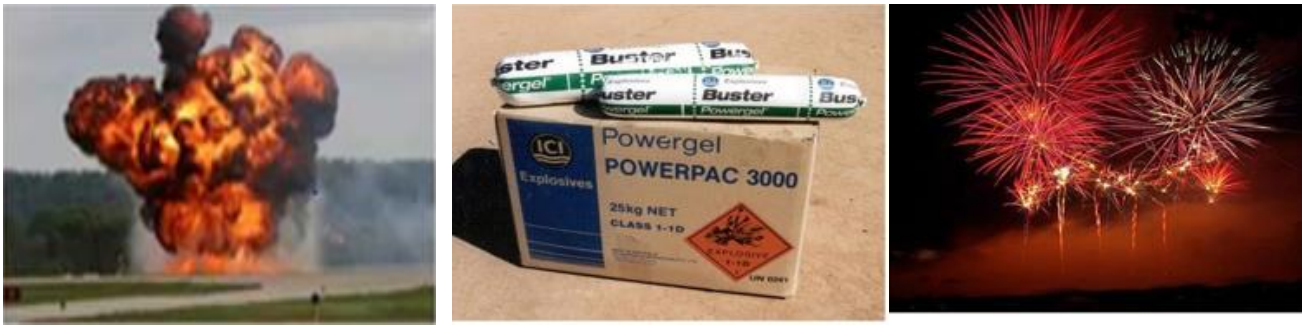


Figure 3-2: Examples of Class 1 - Explosive

Military ammunition, bombs, industrial explosives (dynamite) and fireworks.

3.3.2 Class 2 - Gases

Gases are defined by dangerous goods regulations as substances which have a vapour pressure of 300 kPa or greater at 50°c or which are completely gaseous at 20°c at standard atmospheric pressure, and items containing these substances. The class encompasses compressed gases, liquefied gases, dissolved gases, refrigerated liquefied gases, mixtures of one or more gases with one or more vapours of substances of other classes, articles charged with a gas and aerosols.

Gases are capable of posing serious hazards due to their flammability, potential as asphyxiants, ability to oxidize and/or their toxicity or corrosiveness to humans.

The gases substances could be divided into the followings three subdivisions as follows:

- **Division 2.1:** Flammable gases
- **Division 2.2:** Non-flammable, non-toxic gases
- **Division 2.3:** Toxic gases

Examples of commonly transported gases are Aerosols, Compressed air, Hydrocarbon gas-powered devices, Fire extinguishers, Gas cartridges, Fertilizer ammoniating solution, Insecticide gases, Refrigerant gases, Lighters, Acetylene / Oxyacetylene, Carbon dioxide, Helium / helium compounds, Hydrogen / hydrogen compounds, Oxygen / oxygen compounds, Nitrogen / nitrogen compounds, Natural gas, Oil gas, Petroleum gases, Butane, Propane, Ethane, Methane, Dimethyl ether, Propene / propylene, Ethylene.


Figure 3-3: Examples of Class 2 - Gases

Home use, industrial gases and Cryogenic fluids

3.3.3 Class 3 - Flammable Liquids

Flammable liquids are defined by dangerous goods regulations as liquids, mixtures of liquids or liquids containing solids in solution or suspension which give off a flammable vapour (have a flash point) at temperatures of not more than 60.5°C, liquids offered for transport at temperatures at or above their flash point or substances transported at elevated temperatures in a liquid state and which give off a flammable vapour at a temperature at or below the maximum transport temperature.

Flammable liquids are capable of posing serious hazards due to their volatility, combustibility and potential in causing or propagating severe conflagrations.

There are no subdivisions within Class 3, Flammable Liquids.

Examples of commonly transported flammable liquids are Acetone / acetone oils, Adhesives, Paints / lacquers / varnishes, Alcohols, Perfumery products, Gasoline / Petrol, Diesel fuel, Aviation fuel, Liquid bio-fuels, Coal tar / coal tar distillates, Petroleum crude oil, Petroleum distillates, Gas oil, Shale oil, Heating oil, Kerosene, Resins, Tars, Turpentine, Carbamate insecticides, Organochlorine pesticides, Organophosphorus pesticides, Copper based pesticides, Esters, Ethers, Ethanol, Benzene, Butanols, Dichloropropenes, Diethyl ether, Isobutanols, Isopropyls, Methanol, Octanes.



Figure 3-4: Examples of Class 3 - Flammable Liquids

Paints and lacquers, perfumery products and Organochlorine pesticides

3.3.4 Class 4 - Flammable Solids; Spontaneous Combustible; Dangerous when Wet' Materials

Flammable solids are materials which, under conditions encountered in transport, are readily combustible or may cause or contribute to fire through friction, self-reactive substances which are liable to undergo a strongly exothermic reaction or solid desensitized explosives. Also included are substances which are liable to spontaneous heating under normal transport conditions, or to heating up in contact with air, and are consequently liable to catch fire and substances which emit flammable gases or become spontaneously flammable when in contact with water.

Flammable solids are capable of posing serious hazards due to their volatility, combustibility and potential in causing or propagating severe conflagrations.

These substances could be divided into the followings three sub divisions as follows:

- **Division 4.1:** Flammable solids
- **Division 4.2:** Substances liable to spontaneous combustion
- **Division 4.3:** Substances which, in contact with water, emit flammable gases

Figure 3-5 Examples of Class 4 - Flammable Solids; Spontaneous Combustible; Dangerous when Wet' Materials

Flammable solids, sodium battery and Naphthalene

Examples of commonly transported flammable solids, spontaneous combustibles, and dangerous when wet' materials are Alkali metals, Metal powders, Aluminium phosphide ,Sodium batteries, Sodium cells, Firelighters, Matches, Calcium carbide, Camphor, Carbon, Activated carbon, Celluloid, Cerium, Copra, Seed cake, Oily cotton waste, Desensitized explosives, Oily fabrics, Oily fibres, Ferrocerium, Iron oxide (spent, Iron sponge/direct-reduced iron (spent) , Metaldehyde, Naphthalene, Nitrocellulose, Phosphorus, Sulphur.

3.3.5 Class 5 - Oxidiser; Organic Peroxide

Oxidisers are defined by dangerous goods regulations as substances which may cause or contribute to combustion, generally by yielding oxygen as a result of a redox chemical reaction. Organic peroxides are substances which may be considered derivatives of hydrogen peroxide

where one or both hydrogen atoms of the chemical structure have been replaced by organic radicals.

Oxidisers, although not necessarily combustible in themselves, can yield oxygen and in so doing cause or contribute to the combustion of other materials. Organic peroxides are thermally unstable and may release heat whilst undergoing exothermic autocatalytic decomposition. Additionally, organic peroxides may be liable to explosive decomposition, burn rapidly, be sensitive to impact or friction, react dangerously with other substances or cause damage to eyes.

These substances could be divided into the followings two subdivisions as follows:

Division 5.1: Oxidising substances

Division 5.2: Organic peroxides

Examples of commonly transported oxidisers and organic peroxides are Chemical oxygen generators, Ammonium nitrate fertilizers, Chlorates, Nitrates, Nitrites, Perchlorates, Permanganates, Persulphates, Aluminium nitrate, Ammonium dichromate, Ammonium nitrate, Ammonium persulphate, Calcium hypochlorite, Calcium nitrate, Calcium peroxide, Hydrogen peroxide, Magnesium peroxide, Lead nitrate, Lithium hypochlorite, Potassium chlorate, Potassium nitrate, Potassium chlorate, Potassium perchlorate, Potassium permanganate, Sodium nitrate, Sodium persulphate.

Figure 3-6: Examples of Class 5 - Oxidiser; Organic Peroxide

Chemical oxygen generators, Ammonium nitrate fertilizers and Chlorates

3.3.6 Class 6 - Toxic Substances; Infection Substances

Toxic substances are those which are liable either to cause death or serious injury or to harm human health if swallowed, inhaled or by skin contact. Infectious substances are those which are known or can be reasonably expected to contain pathogens. Dangerous goods regulations define pathogens as microorganisms, such as bacteria, viruses, rickettsia, parasites and fungi, or other agents which can cause disease in humans or animals.

Toxic and infectious substances can pose significant risks to human and animal health upon contact.

These substances could be divided into the followings two sub divisions as follows:

- **Division 6.1:** Toxic substances
- **Division 6.2:** Infectious substances

Examples of commonly transported toxic substances and infectious substances are Medical/Biomedical waste, Clinical waste, Biological cultures / samples / specimens, Medical cultures / samples / specimens, Tear gas substances, Motor fuel anti-knock mixture, Dyes, Carbamate pesticides, Alkaloids, Allyls, Acids, Arsenates, Arsenites, Cyanides, Thiols/mercaptans, Cresols, Barium compounds, Arsenics / arsenic compounds, Beryllium/ beryllium compounds, Lead compounds, Mercury compounds, Nicotine / nicotine compounds, Selenium compounds, Antimony, Ammonium metavanadate, Adiponitrile, Chloroform, Dichloromethane, Hexachlorophene, Phenol, Resorcinol.

Figure 3-7: Examples of Class 6 - Toxic Substances; Infection Substances

Clinical waste, Dyes and Mercury compounds

3.3.7 Class 7- Radioactive Materials

Dangerous goods regulations define radioactive material as any material containing radionuclides where both the activity concentration and the total activity exceeds certain pre-defined values. A radionuclide is an atom with an unstable nucleus, and which consequently is subject to radioactive decay.

Whilst undergoing radioactive decay radionuclides emit ionizing radiation, which presents potentially severe risks to human health.

There are no subdivisions within Class 7, Radioactive Material.

Examples of commonly transported radioactive materials are Radioactive ores, Medical isotopes, Yellowcake, Density gauges, Mixed fission products, Surface contaminated objects, Caesium radionuclides / isotopes, Iridium radionuclides / isotopes, Americium radionuclides / isotopes, Plutonium radionuclides / isotopes, Radium radionuclides / isotopes, Thorium radionuclides / isotopes, Uranium radionuclides / isotopes, Depleted uranium / depleted uranium products, Uranium hexafluoride, Enriched Uranium.

Figure 3-8: Examples of Class 7 - Radioactive Materials

Radioactive ores, Depleted uranium and Enriched Uranium

3.3.8 Class 8 - Corrosives

Corrosives are substances which by chemical action degrade or disintegrate other materials upon contact. Corrosives cause severe damage when in contact with living tissue or, in the case of leakage, damage or destroy surrounding materials.

There are no subdivisions within Class 8, Corrosives.

Examples of commonly transported corrosives are Acids/acid solutions, Batteries, Battery fluid, Fuel cell cartridges, Fire extinguisher charges, Formaldehyde, Flux, Alkylphenols, Amines, Polyamines, Sulphides, Polysulphides, Chlorides, Chlorosilanes, Bromine, Cyclohexylamine, Phenol / carbolic acid, Hydrofluoric acid, Hydrochloric acid, Sulfuric acid, Nitric acid, Sludge acid, Hydrogen fluoride, Iodine, Morpholine.

Figure 3-9: Examples of Class 8 - Corrosives

Acid solutions, Batteries, Battery fluid and flux

3.3.9 Class 9 – Miscellaneous Dangerous Goods

Miscellaneous dangerous goods are substances and articles which during transport present a danger or hazard not covered by other classes. This class encompasses, but is not limited to, environmentally hazardous substances, substances that are transported at elevated temperatures, miscellaneous articles and substances, genetically modified organisms and micro-organisms and (depending on the method of transport) magnetized materials and aviation regulated substances.

Miscellaneous dangerous goods present a wide array of potential hazards to human health and safety, infrastructure and/ or their means of transport.

There are no subdivisions within Class 9, Miscellaneous Dangerous Goods.

Examples of commonly transported miscellaneous dangerous goods are Dry ice / cardice / solid carbon dioxide, Expandable polymeric beads / polystyrene beads, Ammonium nitrate fertilizers, Blue asbestos / crocidolite, Lithium ion batteries, Lithium metal batteries, Battery powered equipment, Battery powered vehicles, Fuel cell engines, Internal combustion engines, Vehicles, Magnetized material, Dangerous goods in apparatus, Dangerous goods in machinery, Genetically modified organisms, Genetically modified micro-organisms, Chemical kits, First aid kits, Lifesaving appliances, Air bag modules, Seatbelt pretensioners, Plastics moulding compound, Castor bean plant products, Polychlorinated biphenyls, Polychlorinated terphenyls, Dibromo difluoromethane, Benzaldehyde.

Figure 3-10: Examples of Class 9 - Miscellaneous Dangerous Goods

Dry ice, Expandable polymeric beads and Blue asbestos

3.4 Dangerous Goods Forbidden from Transport

Dangerous goods forbidden from transport includes any substance or article that meets the definition of goods too (high) dangerous to be transported such as goods or combinations of goods for which the statement 'are not to be accepted for transport' applies in a special provision that is applied to the goods by column (6) of the Dangerous Goods List A or other goods that are so sensitive or unstable that they cannot be safely transported even if all relevant requirements are complied.

These dangerous good required special treatment processes followed by necessary precautions to prevent the possibility of a dangerous decomposition or polymerization under normal conditions of carriage and ensure that receptacles and tanks do not contain any substances liable to promote these reactions.

The transporter (carrier) must ensure that the considered dangerous goods are not forbidden from road transport and if that, the required treatment processes (if required) and the followed necessary precautions should be carefully studied and properly implemented.

The following are examples of dangerous substances and articles not accepted for carriage without proper treatment process and applying the necessary precautions:

- Explosive class 1 articles of compatibility group K shall not be accepted for carriage (1.2K, UN No. 0020 and 1.3K, UN No. 0021).
- Chemically unstable gases of Class 2 which are subject to the possibility of a dangerous decomposition or polymerization under normal conditions of carriage such as:
  - UN No. 2186 HYDROGEN CHLORIDE REFRIGERATED LIQUID.
  - UN No. 2421 NITROGEN TRIOXIDE / UN No. 2455 METHYL NITRITE.
  - Dissolved gases which cannot be classified under UN Nos. 1001, 2073 or 3318.
  - Aerosols where gases which are toxic or pyrophoric according to packing instruction are used as propellants.
  - Aerosols with contents meeting the criteria for packing group I for toxicity or corrosivity.
  - Receptacles, small, containing gases which are very toxic (LC50 lower than 200 ppm) or pyrophoric according to packing instruction.
- Substances of Class 3 which are liable to form peroxides easily (as happens with ethers or with certain heterocyclic oxygenated substances) if their peroxide content, calculated as hydrogen peroxide (H2O2), exceeds 0.3%.
- Radioactive materials unless the necessary precautions addressed in FANR regulations have been implemented.

3.5 Economic Activities related to Hazardous Materials

As discussed in clause 1.2, the hazardous materials are considered as dangerous goods when they have transport. Hazardous materials are participated in several economic activities in Abu Dhabi Emirate as illustrated in Table 3-2. Each activity is inspected and controlled by authorized governmental entity through Hazardous Materials Management Team (see clause 3.6)

P. N	Economic Activity	Authorized Entity
1	Wholesale of tar and asphalt trading	Environment Agency- Abu Dhabi
2	Wholesale of synthetic cleanser trading	
3	Gas and Petroleum Materials Storing	
4	Wholesale of synthetic gas trading	
5	Wholesale of synthetic chemical trading	
6	Wholesale of dyeing and canning material trading	
7	Wholesale of chemical material trading for building purposes	
8	Chemical Material Storage	
9	Wholesale of acid and alkalis trading	

10	Wholesale of laboratory and factory chemicals trading	
11	Wholesale of water treatment and purification chemicals trading	
12	Wholesale of oil well chemicals trading	
13	Wholesale of Petrochemical Material Trading	
14	Wholesale of Chemical Fertilizers Trading	Abu Dhabi Agriculture and Food Safety Authority
15	Retail Sale of Chemical Fertilizers	
16	Retail Sale of Natural Fertilizers and Agricultural Reclamation Material	
17	Wholesale of Natural Fertilizers and Agricultural Reclamation Material Trading	
18	Retail Sale of Agricultural and Veterinary Pesticides	
19	Wholesale of Agricultural and Veterinary Pesticides	
20	Wholesale of House Pesticides Trading	Ministry of Climate Change and Environment
21	Retail Sale of House Pesticides	None
22	Public Health Pests Control Services	Abu Dhabi Waste Management Centre (TADWEER)
23	Termite Control	
24	Chemical Wastes Collection	
25	Activities related to Hazardous Waste Handling and Transport • Transportation of Chemical Waste • Chemical Waste Treatment • Collection and Transportation of Lubricant Oil • Processing of Liquid Batteries Waste • Processing of Metal Waste for Material Recovery • Dismantling of automobiles, devices and equipment's for materials recovery • Transportation of Medical Waste • Trading of Used Batteries Waste • Transportation of Poisonous Waste • Treatment of Medical Waste • Transportation of Ships Waste Oils • processing of waste ships oil • Collection of electronic and electrical waste • Trading of Waste Electrical and Electronic Equipment • Transportation of Used Batteries • Trading of Lubricant Oil Waste • Transportation of Asbestos Waste • Reclaiming of Chemicals from Chemical Waste • Incineration of Dead Animals • Oil-Based Lubricating Oils or Greases Manufacturing	
26	Transport of Hazardous Materials	ITC -DMT and Ministry of Energy and infrastructure

27	Transport of Radioactive Materials	Federal Authority for Nuclear Regulation / Ministry of Energy and infrastructure
28	Transport of Explosive material and fireworks	Abu Dhabi Police General Command – Explosives Division

Table 3-2: Economic Activities Related to Hazardous Materials in Abu Dhabi Emirate

3.6 Management and Control of Hazardous Materials

3.6.1 Integrated Hazardous Materials Management System (IHMMS)

The management of hazardous materials is one of the most critical priorities in the Emirate of Abu Dhabi. This comes in accordance with the requirements of federal and local laws related to security, safety and the environmental protection, as well as the directions of the Abu Dhabi government to impose control on hazardous materials to protect society, and the environment from the dangers that might arise from these materials. Accordingly, IHMMS is established as a computerized electronic and integrated system used as a tool for the management and control of hazardous substances imported and produced in Abu Dhabi Emirate as shown in the link https://www.hazmat.ae/.

The system is an electronic model for the integrated and core management of hazardous materials (chemicals, radioactive, pesticides… etc.), as well as to provide the necessary information in an integrated manner for the involved decision-makers on the types, locations and quantities of hazardous materials used. The system has been launched according to Decree No. 20G 9/2008 issued by the Executive Committee of the Executive Council of the Emirate of Abu Dhabi.

This system includes an electronic database for the management of hazardous materials as well as many other functions, including:

- Management of the unified list of banned and restricted materials in the United Arab Emirates through concerned authorities.
- Monitoring of banned and restricted materials entering the Abu Dhabi Emirate.
- Provision of Safety Data Sheets for chemical materials (SDS).
- Tracking of materials and facilities that deal with hazardous materials.
- Provision of a data base of hazardous materials incidents.
- Provision of a data base of violations related to hazardous materials.
- Provision of instant reports and statistics related to hazardous materials.

The system also ensures a link between hazardous materials concerned authorities and determines their roles in order to avoid duplication in jurisdiction which eases the permitting requirements for HazMat trader. It also supports the integration of their work and cooperation in the management of hazardous materials.

At the same time, the system enhances the competencies, capacities, and mechanisms of relevant institutions in the management of hazardous materials, as well as the exchange of information and internal documentation. The system has an advantage of being flexible and can accommodate enhancement and inclusion of other ministries and governmental institutions concerned in the future.

3.6.2 Hazardous Materials Management Team (AD-HMMT)

Abu Dhabi Hazardous Materials Management Team (AD-HMMT) has been established to prepare and implement proper executive plan to manage hazardous resources in the Emirate of Abu Dhabi.

The team's main role is to identify and manage hazardous materials in the Emirate. It keeps detailed records of all dealings with such materials and coordinates with other authorities to draft relevant legislations. Other responsibilities include developing the Emirate's governance system and assessing risks related to retail outlets which handle hazardous materials .

The team's work involves the followings:

- Conducting gap analysis and reviewing the current challenges in the management of hazardous materials, as well as looking into the global best practices to prepare and approval of a governance system, list of materials of security concern, as well as management procedures based on governance systems and security were developed.
- Preparing emergency response plans to respond to accidents of hazardous materials transport vehicles, accidents in stores and facilities.
- Ensuring the implementation of the requirements for drivers of hazardous materials vehicles and tracking system for vehicles transporting these materials .
- Dissemination of the implementation of the Integrated Hazardous Materials Management System (IHMMS) at the Emirate level by the authorities.

Currently, the number of companies and factories that have been considered in the team implementation plan is about 1840 as addressed in table 3-2. The aim of the team in the concerned authorities is to follow up on the establishments' inclusion of hazardous materials within the system and ensure the start by companies and factories to fill in the Integrated Hazardous Materials Management System (IHMMS).

4 SAFETY MEASURES AND SUPPLY CHAIN RESPONSIBILITIES

This chapter provides all parties in the transport supply chain with the safety measures to be considered in the transport of HazMat, the required personal protective and vehicle safety equipment, security provisions particularly for high-risk dangerous goods and the emergency response actions including the incident reports.

4.1 General

The rule pertaining the carriage of dangerous goods by road set out the responsibilities of all parties in transport supply chain. The parties /duty holders with specific legal duties are the consignor, carrier, driver and vehicle crew, packer, filler, loader, unloader, tank container/ portable tank operator, consignee and the safety advisers (DGSA). There are generally several duty holders in a particular transport chain. For example, HazMat manufacturing facility as the "consignor" could deliver the product to another courier company or be also a carrier If they employ a driver and use a company truck.

It worth mentioning that any duty holder acts on behalf of parties, a clear contract of carriage, outlining all transfers of duties under the national regulation, should be agreed and signed by all parties involved.

4.2 General Safety Measures

All supply chain parties who are responsible for transport of HazMat are responsible for complying with the national regulations of dangerous goods transportation. They must take reasonable steps to prevent breaches of mass, dimension, loading, speed and fatigue rules. Currently, this is expanded to include vehicle standards and maintenance.

The chain of responsibility (COR) rules should improve safety and compliance, require parties to manage risk, create a level playing field and increase productivity, protect infrastructure, and protect against the demands of off-road parties that can lead to breaches of the regulations. In contrast, COR obligations can be breached in many ways such as:

- Applying business practices or demands that cause a driver to breach fatigue management requirements, or speed limits,
- Failing to weigh, measure or secure loads,
- Setting schedules with unrealistic timeframes,
- Causing delays in loading and unloading,
- Packing goods incorrectly,
- Failing to consult or engage with other parties to ensure safe practices, and
- Failing to assess driver fitness for duty.

- The participants in the carriage of dangerous goods shall take appropriate measures according to the nature and risks of the consignment to avoid damage or injury and, if necessary, to minimize their effects. They shall, in all events, comply with the requirements of national laws and regulations in their respective fields.

When there is an immediate risk that public safety may be jeopardized, the drivers shall immediately notify the emergency services and shall provide them with all available information in order to take action."

This general provision means that all participants must ensure that they take all necessary actions to reduce the risk of an accident involving dangerous goods. In general, a drivers must:

- Ensure that a person employed for the duties concerning the carriage of dangerous goods, has received the appropriate training.
- Keep records of such training.
- Comply with specified legal duties.
- Take appropriate measures to avoid damage or injury.
- Notify emergency services of an immediate risk to public safety.

The following subclauses discuss the roles and responsibilities of supply chain parties in terms of safety measures according to the international best practices and ADR business guide.

4.2.1 Consignor

The consignor is the enterprise handing over (or has control of) the dangerous goods prior to transportation such as a manufacturer, supplier, forwarding warehouse, etc.

The consignor must provide the transport documents and accompanying documents according to the national regulations. When the consignor acts on behalf of a third party, the latter must inform the consignor in writing that dangerous goods are involved and make available to him all the information and documents needed to perform the consignor's obligations.

The consignor must have a place of business in the Emirate. If no person in the Emirate satisfies this requirement, the consignee (customer) of the goods assumes the duties of the consignor.

According to national and international regulations, the consignor must in particular:

a) Ascertain that the dangerous goods are classified (see clause 3.3) and authorized for carriage in accordance with national regulations.

b) Furnish the carrier with information and data and, if necessary, the required transport documents and accompanying documents (authorizations, approvals, notifications, certificates, safety data sheet (SDS), etc). The consignor must ensure that a carrier is informed in advance of the nature of the dangerous goods to be picked up and, when a driver arrives on site, ensure that all necessary documentation is provided.

c) Use packaging, large packaging, intermediate bulk containers (IBCs) and tanks (tank-vehicles, demountable tanks, battery-vehicles, MEGCs, portable tanks and tank-containers) approved for and suited to the carriage of the substances concerned and bearing the markings prescribed by national regulations.

d) Comply with the requirements on the means of dispatch and on forwarding restrictions addressed in the national regulations (See chapter 9).

e) Ensure that even empty, uncleaned and not degassed tanks (tank-vehicles, demountable tanks, battery-vehicles, MEGCs, portable tanks and tank-containers) or empty, uncleaned vehicles and large and small bulk containers are appropriately marked and labelled and that empty uncleaned tanks are closed and are leakproof to the same degree as when they are full.

f) Comply with security provisions as appropriate (see clause 4.6).

g) Ensure that on handing dangerous goods over to a driver, he is carrying an appropriate driver training certificate and photo identification.

h) Ensure emergency procedures are in place (see clause 4.7).

i) Ensure all employees are appropriately trained and certified to work with dangerous goods (see chapter 6).

If the consignor uses the services of other parties (packer, loader, filler, etc.) such as ports, appropriate measures must be taken to ensure that the consignment meets the requirements of national regulations. The consignor may, however, in the case of (a), (b), (c) or (e), rely on the information and data made available by other participants.

4.2.2 Carrier

The carrier is the entity performing the actual carriage of dangerous goods in or on a vehicle (with or without a transport contract), for example a logistics company, courier, vehicle owner/operator (who may also be the consignor or driver, as a self-employed vehicle owner/operator).

According to national and international regulations, the carrier must ensure that:

a) Dangerous goods to be carried are authorized for carriage in accordance with national regulations (by means of confirmation from the consignor, or otherwise).

b) All information prescribed in national regulations related to the dangerous goods to be carried has been provided by the consignor before carriage (see chapter 10) and that the prescribed documentation is on board the transport unit or, if electronic data processing (EDP) or electronic data interchange (EDI) techniques are used instead of paper documentation, that data is available during transport in a manner at least equivalent to that of paper documentation.

c) Vehicles and loads have no obvious defects, leakages or cracks, missing equipment, etc. and ensure this is carried out by putting in place a monitoring/audit procedure to assess vehicles and equipment.

d) The date of the next test for tank-vehicles, battery-vehicles, demountable tanks, portable tanks, tank-containers and MEGCs has not expired (see clause 10.6). As in (c) above, build inspection checks into regular monitoring/audit function.

e) The vehicles are not overloaded.

f) The hazard labels and markings prescribed for the vehicles have been affixed (see chapter 7).

g) The equipment prescribed in the written instructions for the driver is on board the vehicle (see clause 10.5). This must also take account of fire extinguisher requirements (see clause 4.5).

h) Comply with security provisions as appropriate (see clause 4.6).

i) Ensure emergency procedures are in place (see clause 4.7).

j) The driver and crew are well trained in regard to work involving dangerous goods. Drivers must also hold an appropriate driver training certificate (see chapter 6 & clause 12.3).

Documented procedures including periodic audits will ensure the vehicle and other transport equipment are in a suitable condition for use.

The carrier may, however, in the case of (a), (b), (e) or (f), rely on information and data made available by other parties (e.g. consignor, loader, packer or filler).

If the carrier observes an infringement of the requirements of national regulations, the consignment must not be forward until the matter has been rectified.

If during the journey, an infringement which could jeopardise the safety of the operation is observed, the consignment must be halted as soon as possible, bearing in mind the requirements of traffic safety, the safe immobilisation of the consignment and public safety. The transport operation may only be resumed once the consignment complies with applicable regulations.

4.2.3 Driver and Vehicle Crew

The driver is the person who is in immediate control of the vehicle and fulfils the driving function. Crew members also have responsibilities and must have appropriate training in line with their duties and responsibilities. Note that if any crew member drives the vehicle, he must hold an appropriate driver training certificate.

According to national and international regulations, the driver and vehicle crew must in particular:

a) Ensure that their personnel carry the official training certificate (drivers) and photo ID. (all crew members).

b) Ensure that they have read and understood transport documentation provided in advance of any transport operation. If an issue does arise with the documentation the crew members must raise and rectify any matter prior to driving the vehicle.

c) Keep written emergency instructions readily available in the vehicle.

d) Ensure all vehicle safety equipment and PPE is available and report i any deficiency or missing items with the carrier.

e) Ensure the vehicle is properly plated, placard and marked. Ensure orange plates, placards and marks are kept clean. And when they are not required remove or cover plates, placards and marks.

f) Ensure that damaged or leaking packages are not loaded.

g) Ensure not to drive a vehicle that is not in compliance with national regulations and report and rectify any non-conformity issues prior to driving the vehicle.

h) Ensure that only crew members are available in the vehicle, no passengers are allowed in transport vehicles carrying dangerous goods.

i) Ensure that members of the vehicle crew are trained to use emergency response equipment (e.g.: fire extinguishers, spill kits, etc).

j) Not to open a package containing dangerous goods.

k) Ensure that only spark-proof lighting apparatus are used.

l) Ensure that smoking is prohibited during handling operations (inside and in the vicinity of vehicles).

m) Ensure that the engine is shut off during loading and unloading operations except where it must be used to drive the pumps or other appliances for loading or unloading the vehicle and the laws of the country in which the vehicle is operating permit such use.

n) Ensure that no vehicles carrying dangerous goods are parked without the parking brakes being applied. Vehicle operators to set their truck and trailer brakes and block their wheels to prevent vehicle movement. Wheel chocks should be placed under the rear wheels, which means two chocks should be used – chocking just one wheel isn't enough.

o) Ensure that in the case of a transport unit equipped with an anti-lock braking system consisting of a motor vehicle and trailer, the electrical connections always connect the towing vehicle and the trailer during carriage.

p) In cases of tank filling or emptying, ensure as may be appropriate (e.g. for flammable liquids) that there is a good electrical connection to the earth prior to the emptying or filling operation (see subclause 4.2.5).

q) Ensure no dangerous residues of the filling substance adhere to the outside of tanks filled or emptied (see subclause 4.2.5).

r) If involved in the loading operation, initially or during the transport operation, ensure dangerous goods are properly secured to the vehicle. If released to unload part of the shipment, remaining dangerous goods must properly be re-secured to the vehicle (see chapter 9).

s) Ensure that vehicle supervision provisions are adhered (see clause 9.8).

4.2.4 Packer

The packer (an individual or business) is the party who is responsible for the final packaging of dangerous goods prior to transportation.

According to national and international regulations, the packer must in particular:

a) Comply with requirements concerning packing provisions, or mixed packing provisions (these requirements vary and may require input from a DGSA, please refer also to clauses 9.3 and 9.4).

b) Comply with the requirements concerning marking and labelling of the packages when preparing packages for carriage (see chapter 7).

4.2.5 Filler

The filler is the party (individual or business) who is responsible for filling tanks or containers (for carriage in bulk) with dangerous goods prior to transportation.

According to national and international regulations, the filler must in particular:

a) Ensure, prior to the filling of tanks, that the tanks and their equipment are in a satisfactory technical condition.

b) Ensure that the date of the next test for tank-vehicles, battery-vehicles, demountable tanks, portable tanks, tank-containers and MEGCs has not expired.

c) Only fill tanks with the dangerous goods authorised for carriage in those tanks;

d) In filling the tank, comply with the requirements concerning dangerous goods in adjoining compartments.

e) During the filling of the tank, observe the maximum permissible degree of filling or the maximum permissible mass of contents per litre of capacity for the substance being filled.

f) After filling the tank, check that the closing devices are leakproof.

g) Ensure that no dangerous residue of the filling substance adheres to the outside of the tanks filled by him or her.

h) Ensure that, in preparing the dangerous goods for carriage, the orange plates and placards or labels prescribed are affixed on the tanks, on the vehicles and on the large and small containers for carriage in bulk in accordance with the requirements.

i) Ensure compliance with the relevant provisions of national regulations when filling vehicles or containers with dangerous goods in bulk (see chapter 9).

4.2.6 Loader

The loader is the entity (individual or business) who is responsible for loading dangerous goods onto a vehicle prior to transportation.

According to national and international regulations, the loader must in particular:

a) Hand over the dangerous goods to the carrier only if they are authorized for carriage in accordance with national regulations.

b) When handing over packaged dangerous goods or uncleaned empty packagings, check whether the packaging is damaged. Damaged packaging must not be handed over, especially if it is not leakproof and there are leakages or the possibility of leakages of the dangerous substance, until the damage has been repaired.

c) When loading dangerous goods into a vehicle, a large or small container, loader must comply with the special requirements concerning loading and handling of certain classes indicated in Column (18) of Table A as advise by the dangerous goods safety advisor (DGSA).

d) After loading dangerous goods into a container, comply with the requirements concerning hazard markings conforming to the regulations (see chapter 7).

e) When loading packages, comply with the prohibitions regarding mixed loading considering dangerous goods already in the vehicle or large container and requirements concerning the segregation requirements. These requirements may not be required for foodstuffs and other articles of consumption or animal feedstuffs (see chapter 5).

The loader may, however, in the case of (a), (d) or (e), rely on information and data made available to him by other participants.

4.2.7 Tank- container / Portable Tank Operator

The tank-container/portable tank operator is the entity (individual or business) who is responsible for the operation of a tank-container/portable tank.

According to national and international regulations, the tank-container / portable tank operator must in particular:

a) Ensure compliance with the requirements for construction, equipment, tests and marking.

b) Ensure that the maintenance of shells and their equipment is carried out in such a way as to ensure that, under normal operating conditions, the tank-container/ portable tank satisfies the requirements of national regulations until the next inspection.

c) Implement detailed inspection when the safety of the shell or its equipment is liable to be impaired by a repair, an alteration or an accident.

4.2.8 Unloader

The unloader is the participant (individual or business) who is responsible for the removal of dangerous goods from a vehicle, the unloading or discharge of dangerous goods from a tank, container or vehicle.

According to ADR international regulation, the unloader must in particular:

a) Ensure that the correct goods are unloaded. Unloader should refer to the relevant information in the transport document with the information on the package, container, tank, MEMU, MEGC or vehicle.

b) Before and during unloading, check whether the packagings, the tank, the vehicle or container have been damaged to an extent which would endanger the unloading operation. In case of damage, ensure that unloading is not carried out until appropriate measures have been taken.

c) Comply with all relevant requirements concerning unloading.

d) After the unloading of the tank, vehicle or container:

   I. Remove any dangerous residues which have adhered to the outside of the tank, vehicle or container during the process of unloading; and
   II. Ensure the closure of valves and inspection openings.

e) Ensure that the prescribed cleaning and decontamination of the vehicles or containers is carried out.

f) Ensure that the containers once completely unloaded, cleaned and decontaminated, no longer display danger markings conforming to national regulations (See chapter 7).

g) If the unloader makes use of the services of other participants (cleaner, decontamination facility etc) he must take appropriate measures to ensure that the requirements of national regulations have been complied with.

4.2.9 Consignee (Customer or Recipient)

The consignee is the entity (individual or business) who takes charge of the dangerous goods when delivered.

According to ADR international regulation, the consignee has the following obligations:

a) Not to defer acceptance of the goods without compelling reasons and to verify, after unloading, that the requirements of ADR placed on the consignee have been complied with;

b) In the case of a container, this verification identifies any infringement from the requirements of national regulations, the consignee must return the container to the carrier only after the infringement has been remedied. and

c) If the consignee makes use of the services of other entities (unloader, cleaner, decontamination facility, etc), appropriate measures must be taken to ensure that the requirements of (a) and (b) have been complied with.

4.3 Safety Data Sheet (SDS)

A Safety Data Sheet is a detailed informational legal document prepared by the manufacturer or importer of products, substances or chemicals that classified as are hazardous materials or dangerous goods describing their physical and chemical properties provided to customers by substances production or sales enterprises in accordance with legal requirements. The SDS are mainly used in:

- Provide information on the hazards of substance to protect users of the products including physical data (melting point, flash point, boiling point, etc.), disposal considerations, toxicity, reactivity, health effects, first aid, protective equipment, etc.
- Ensure safe operation and provide technical information for the formulation of safe management procedures for hazardous substances.
- Provide technical information helpful for emergency rescue and emergency handling of accidents.
- Guide the safe circulation and safe use of the substances.
- It is an important information source for substance registration management.
- It plays a very important role in the customs declaration, transportation, customs, air transportation, land transportation and other links of import and export.

The consignor is responsible for obtaining the SDS from the original manufacturer or supplier, ensuring their compliance with the national rules and affording it to the concerned parties in the transport supply chain (drivers, vehicle crew, workers, DGSA, emergency team, etc.). The information in the SDS should be presented using the following 16 headings in order given below:

1. Identification of the substance/mixture
2. Hazards identification
3. Composition/information on ingredients
4. First aid measures
5. Firefighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

An example of SDS is presented in Appendix H. In addition, IHMMS include SDS for huge numbers of materials.

It is worth mentioning that the **Globally Harmonized System (GHS)**, developed by a United Nations (UN), is commonly used for the classification, and labelling of chemicals according to two major standardized elements:

- Rules for classifying the hazards of chemical products (i.e., substances, materials, or mixtures)
- Hazard communication tools such as:
  - format for safety data sheets (SDSs),
  - content for label and SDSs with
    - hazard and precautionary statements
    - symbols

- signal word

GHS covers all hazardous chemicals products, such as those used for industrial chemicals consumer chemical products, pesticides, agricultural chemicals and pharmaceuticals. The target audiences for GHS include workers in many different industries (e.g., warehouses, construction, chemical manufacturing, transportation), emergency responders, and consumers.

4.4 Safety Advisers for Dangerous Goods

Businesses whose activities include the consignment, carriage or the related filling and emptying, packing, loading or unloading of dangerous goods must appoint one or more dangerous goods safety advisers (DGSAs).

The role of the safety adviser is to help control the risks inherent in such activities in regard to persons, property and the environment. DGSAs generally complete training and must be successful in passing specified exam(s) to gain the qualification, which must be renewed every two years or as requested by the competent authority (see clause 6.4 & clause 9.5).

The main duties of a DGSA are as follows:

- Advising on the safe transport of dangerous goods by road.
- Monitoring compliance with the requirements / regulations governing the carriage of dangerous goods.
- Preparing an annual report to management or a local public authority, as appropriate, on the activities involving the carriage of dangerous goods. Such annual reports must be preserved for five years and made available to the national authorities at their request.
- Investigating any accidents or infringements of regulations and preparing reports.
- Monitoring the provision of training and advice to any staff involved in the transport of dangerous goods.

There are exemptions provided for businesses with limited exposure to these activities so that they are not required to formally appoint a DGSA, for example

- Where the amounts of dangerous goods handled are so small (see clause 5.3) or are so infrequently consigned, that the appointment of a DGSA might be unreasonable.
- For operations that can avail of the exemptions permits in the national regulations known colloquially as the ‘load limit exemption’ or the ‘carrier exemption’ refer to chapter 5 in this guideline.

The assessment of whether businesses are required to legally appoint a DGSA should be carried out by the competent authority (see clause 9.5) and should be documented, and the particular circumstances should be reviewed periodically to ensure that the initial assumptions and criteria

are still valid and applicable. However, where businesses are not required to appoint a DGSA, it is highly recommended to seek advice or guidance from a qualified DGSA from time to time as required.

A formally appointed DGSA may be an employee, the head of the business or an external consultant. The DGSA must be certified and have access to all relevant aspects of the business to carry out this function.

4.5 Personal Protective and Vehicle Safety Equipment

Safety equipment are essential for personal protection whether during routine activities or during emergencies. The personal protective equipment for drivers and crew and safety equipment to be carried on vehicles for use by the crew are specified in the international regulations and this guidelines manual to ensure that, in the event of an accident or incident, the personnel transporting the dangerous goods:

- have adequate protection to prevent injuries.
- can effectively respond to either control the situation or mitigate the effects while waiting for the arrival of emergency services or the approved emergency responder.

It is the responsibility of carriers to supply safety equipment and ensure it is provided and maintained in good working order. All safety equipment must be stowed in an accessible position in the vehicle except for respiratory protective equipment, which must be carried securely and in an accessible position in the vehicle cabin. The safety data sheet for particular substances may specify additional personal protective equipment.

4.5.1 Mandatory Equipment

The following equipment is mandatory for each vehicle:

- A suitable pair of wheel chocks.
- Two self-standing warning signs;
- Eye wash (2x 500ml – not required for goods with danger label numbers 1, 1.4, 1.5, 1.6, 2.1, 2.2 and 2.3).

The following equipment is mandatory for each member of the vehicle crew:

- A warning (reflective) vest.
- Spark-proof torch.
- Protective gloves. and

- Safety glasses/goggles.

Additional equipment for certain classes:

- An emergency escape mask for each crew member in vehicles carrying goods with danger label numbers 2.3 or 6.1.
- A shovel drain seal and plastic collecting container in vehicles carrying goods with danger label numbers 3, 4.1, 4.3, 8 and 9.

In addition to the above items the driver should carry a first aid kit and any other safety items identified in the risk assessment (e.g. chemical spill kit, chemical over suit, protective overalls, safety boots, hard hat, etc.).

Table 4.1 shows more details the safety equipment required for transporting each class or division of dangerous goods (X = required item).

Class/ Division	Escape breathing apparatus	Gas tight goggles/ face shield	Eyewash kit (d)	Chem-resistant gloves	Thermal gloves	Chem-resistant coveralls	Chem-resistant boots	Torch	Flame-proof torch
2.1 (a)		X (c)			X				X
2.2		X (c)			X			X	
2.3	X (b)	X	X		X			X	
3 / 4			X	X					X
5.1 Solids			X	X				X	
5.1 Liquids		X	X	X		X	X	X	
5.2		X	X	X		X	X		X
6.1 and 8	X (b)	X	X	X		X	X	X	
6.2				X				X	
9			X	X	X (e)			X	

(a) gas detector required for un-odorized LPG

(b) short-term air supplied breathing apparatus equipment is required, unless there is no possibility of harmful vapors, gases or dusts even in an emergency

(c) if the receptacle carries more than 500 liters or contains cryogenic liquid

(d) an eyewash kit must be of at least 250ml capacity, filled and ready for use

(e) if elevated temperature substance or dry ice

Table 4-1: Safety Equipment Required for Transporting Each Class of Dangerous Goods

Respiratory protection is required when transporting a placard load of Division 2.3, 6.1 or Class 8 dangerous goods (see clause 4.6) that may give rise to harmful vapors, gases or dusts. The minimum requirement is an air supplied short-term breathing apparatus suitable for escape purposes. Where the driver also attends to the loading or the transfer of the goods then a Self-Contained Breathing Apparatus with a duration greater than 15 minutes may be required.

Note: Instructions in writing (or transport emergency card) contain emergency action information for crew members, and a list of mandatory personal and vehicle safety equipment (excluding fire extinguisher requirements). Such mandatory equipment is listed on the instructions in writing (see chapter 10 and Appendix B). See also chapter 10, which outlines what documentation should be carried on the vehicle.

4.5.2 Fire Fighting Equipment

Table 4.2 outlines the specific fire extinguisher requirements for various transport units carrying dangerous goods.

Scenario	Requirement
All transport units.	Minimum of a 2 kg dry powder (or equivalent) extinguisher – suitable for fighting a cab or engine fire.
Units with max. permissible mass of more than 7.5 tons.	One or more portable fire extinguishers with minimum total capacity of 12 kg dry powder (or equivalent) – at least one extinguisher being minimum of 6 kg capacity.
Units with max. permissible mass of more than 3.5 tons up to and including 7.5 tons.	One or more portable fire extinguishers with minimum total capacity of 8 kg dry powder (or equivalent) – at least one extinguisher being minimum of 6 kg capacity
Units with max. permissible mass of up to and including 3.5 tons.	One or more portable fire extinguishers with minimum total capacity of 4 kg dry powder (or equivalent).
Transport Units exempted under Small Load Exemption (ADR 1.1.3.6).	Minimum of a 2 kg dry powder (or equivalent) extinguisher – suitable for fighting a cab or engine fire.

Table 4-2: Fire Extinguisher Requirements for Transport Units Carrying Dangerous Goods

Extinguishers must be maintained and inspected periodically as specified by the manufacturer. Extinguishers must be stowed securely in/on the vehicle in a quick-release bracket and be readily accessible, i.e. not locked in storage compartments in the vehicle. The placement of fire extinguisher could be as follows:

- Where only one extinguisher is required for the unite, locate it on the discharge side of a tank vehicle.
- For other vehicles, locate it near the driver's door or at the front of the trailer with a placard load.
- Where two or more extinguishers are required for the unit, mount one on the near side towards the rear and one on the offside near the front.

4.6 Security Provisions

In relation to the transport of dangerous goods, security means measures or precautions to be taken to minimize theft or misuse of dangerous goods that may endanger persons, property or the environment as well as possible terrorist risks.

Security measures should be an integral part of the safety and quality management system of every company involved with the transport of dangerous goods as well as their risk assessment outcomes. All persons engaged in the carriage of dangerous goods must consider the security requirements commensurate with their responsibilities.

The dangerous goods storage areas must be properly secured and well-lit as well as inaccessible to the public. The restricting access areas could be achieved through physically controlling access to locations housing dangerous goods, requiring staff to wear photo ID passes at all times and controlling unsupervised access by contract/agency staff to particular areas.

Dangerous goods must only be offered for carriage to carriers that have been appropriately identified and permitted from relevant authority in the Emirate according to proper procedures must be put in place to verify companies and persons to whom you hand over dangerous goods.

Drivers and vehicle crew must carry with them means of identification, including their photograph, during carriage of dangerous goods. This is satisfied when carrying the new driver training certificate or separate company i.d. card or driving licence.

Employers must also keep records of all security training when provided and to make these records available, to the employee, upon request. Records must be kept by the employer for a period established by the competent authority. This period must be the duration of employment and for a further period of not less than one year following the termination of employment.

4.6.1 Provisions for High Consequence Dangerous Goods

"High consequence dangerous goods" are those which have the potential for misuse in a terrorist incident and which may, as a result, produce serious consequences such as mass casualties or mass destruction. Table 4.3 provides a list of goods which are considered high consequence dangerous goods when carried in quantities greater than those indicated therein.

Class	Division	Substance or article	Quantity		
			Tank (litters) [c]	Bulk (kg) [d]	Packages (kg)
1	1.1	Explosives	a	a	0
	1.2	Explosives	a	a	0
	1.3	Compatibility group C explosives	a	a	0
	1.4	Explosives1 of UN Nos. 0029, 0030, 0059, 0065, 0073, 0104, 0237, 0255, 0267, 0288, 0289, 0290, 0360, 0361, 0364, 0365, 0366, 0440, 0441, 0455, 0456 and 0500	a	a	0
	1.5	Explosives	0	a	0
2		Flammable gases (classification codes including only the letter F)	3000	a	b
		Toxic gases (classification codes including letters T, TF, TC, TO, TFC or TOC) excluding aerosols	0	a	0
3		Flammable liquids of packing groups I and II	3000	a	b
		Desensitized explosives	0	a	0
4	4.1	Desensitized explosives	a	a	0
	4.2	Packing group I substances	3000	a	b
	4.3	Packing group I substances	3000	a	b
5	5.1	Oxidizing liquids of packing group I	3000	a	b
	5.2	Perchlorates, ammonium nitrate, ammonium nitrate fertilizers and ammonium nitrate emulsions or suspensions or gels	3000	3000	b
6	6.1	Toxic substances of packing group I	0	a	0
	6.2	Infectious substances of Category A (UN Nos. 2814 and 2900, except for animal material)	a	0	0
7		Radioactive material	3000 A1 (special form) or 3000 A2, as applicable, in Type B(U), B(M) or C packages		
8		Corrosive substances of packing group I	3000	a	b

Table 4-3: List of High Consequence Dangerous Goods

a: Not relevant.
b: The provisions shown in the table do not apply, whatever the quantity is.
c: A value indicated in this column is applicable only if carriage in tanks is authorized, in accordance with ADR Chapter 3.2, Table A (List of dangerous goods), column 10 (Portable tank and bulk container) or column12 (Tank code for ADR tanks) which is available in internet website. For substances that are not authorized for carriage in tanks, the instruction in this column is not relevant.
d: A value indicated in this column is applicable only if carriage in bulk is authorized, in accordance with Chapter 3.2, Table A, column (10) or column 17 (Special provisions for carriage-Bulk). For substances that are not authorized for carriage in bulk, the instruction in this column is not relevant.

AD-HMMT prepared a list of security chemicals (461 materials) based on certain local criteria and international best practice. Carriers, consignors and other participants engaged in the carriage of high consequence dangerous goods must adopt, implement and comply with a security plan.

The company is in the business of carrying high consequence dangerous goods must appoint a DGSA.

4.7 Emergency Actions

Emergency actions depend on the circumstances of each particular incident. The most important aspect of any procedure is the training provided, whether it is dealing with a spill during unloading or a vehicle roll over spilling the load across a busy carriageway.

All employers have a responsibility to carry out a risk assessment and put in place procedures to minimize and control hazards. This should be supported by written procedures, information, supervision and training.

Businesses that consign, store and/or carry dangerous goods must have procedures as appropriate to manage, amongst others, with the following:

- Chemical spills;
- Fire/explosion;
- Road traffic incidents involving dangerous goods;
- Personal and/or environmental contamination;
- Security incidents/Loss of dangerous goods.

Such businesses must prepare emergency response manuals that identify risk scenarios and actions to be taken in emergencies. This information is available and applicable to all staff, whether they are crew members or ground staff. In addition, business owners are responsible for notifying the emergency services of any immediate risk to public safety, property or the environment.

It is worth mentioning that Abu Dhabi Police is responsible for the initial response to road accidents, including ordinary vehicles or vehicles of a special nature such as dangerous goods transport vehicles via emergency number 999. The members of the security patrols responding to road accidents should have proper training courses to ensure their ability to deal properly with these incidents as well as the ability to identify the type of accidents and request a specialized responder to deal with the event.

Under each foreseeable emergency, the businesses should consider the followings within their procedures:

- Outlining the emergency.
- Identifying employee(s) with responsibilities (e.g. co-ordinator, primary contact).
- Key actions, (e.g. notifying emergency services/local authority/local doctor, etc).
- Collecting information and taking appropriate action.
- Contacting appropriate specialist contractors (chemical spill/waste contractor, vehicle recovery).
- Notifying insurance company.
- Reviewing actions (accident investigation including a formal incident report – see reportable incidents below) and planning for resumption of normal business.

4.7.1 Emergency Action Code

The emergency action code (EAC) is designed to cover the first vital step and gives an immediate indication of any actions that could be taken should it be necessary to proceed immediately without waiting for reference materials or expert advice.

The international common practices for transport units carrying hazardous substances is transmitted by the International Technical Committee for the Prevention and Extinction of Fire (CTIF) to:

- be appropriate for use by all emergency services.
- give guidance to firefighters to allow them to start and sustain safe actions in hazmat incidents to minimize danger to themselves and to other persons, to property and the environment particularly for the initial stage until more valid and detailed information and support becomes available.
- contain guidance on the correct medium for fighting fire and to control leakage or escape of a hazardous substance, in order to protect the environment.
- give guidance to protect rescue personnel from the risks to their respiratory systems and to their bodies.

- give guidance on actions to be taken for the immediate protection of the public and the environment.

Nationally, the proposed code is made up of three characters which contain guidance and warning about the following five areas:

- Firefighting or controlling media.
- Personal protective equipment.
- Possibility of violent or explosive reaction (including fire).
- Possibility of public safety hazard.
- Containment or dilution of substance to protect the environment.

The first character of the code (numbers 1-6) denotes the firefighting or controlling media. The second character of the code (letters C-G and K-Q denotes both the level of personal protection required and whether the substance is likely to be violently reactive. The third character of the code (numbers 6-9) denotes whether the substance should be contained and also whether there could be a public safety hazard outside the immediate area of the incident.

The chart shown in Figure 4.1 is intended to be carried by emergency service personnel in the form of a pocket card, all the above risks and necessary actions can be quickly established. For example, a code 2D9 will show that a fine water spray should be used as a firefighting or diluting media, that liquid-tight chemical protective clothing should be worn, that there is no a likelihood of a violent reaction, that the substance should be contained and that there may be a public safety hazard outside the immediate area of the incident.

1	Coarse Spray	2	Fine Spray	3	Alcohol Resistant Foam or Fine Spray
4	Normal Foam	5	Alcohol Resistant Foam or normal Foam	6	Dry Agent
C	Breathing Apparatus				
D	Liquid Tight Chemical Protective Clothing				
E	Liquid Tight Chemical Protective Clothing + Thermal Protection				
F	Gas Tight Chemical Protective Clothing				
G	Gas Tight Chemical Protective Clothing + Thermal Protection				
K	Breathing Apparatus				Violent Reaction
L	Liquid Tight Chemical Protective Clothing				
M	Liquid Tight Chemical Protective Clothing + Thermal Protection				
N	Gas Tight Chemical Protective Clothing				
Q	Gas Tight Chemical Protective Clothing + Thermal Protection				
6	No Public Safety Hazard				Dilute
7	Public Safety Hazard				
8	No Public Safety Hazard				Contain
9	Public Safety Hazard				

Figure 4-1: CTIF Emergency Action Code – Decode Chart

The use of an emergency action code system would offer the following benefits:

- It is of secondary importance to have detailed information on the hazardous substance in the initial stages and an emergency action code can be implemented immediately, thus avoiding delays while basic essential information is being obtained on the substance concerned.
- Valuable time can be saved by emergency personnel wearing the correct protective clothing from the outset preventing associated dangers of being under protected whilst eliminating the costly and time-consuming use of over protection.
- The code will indicate immediately whether there is a hazard that might spread to the surrounding area enabling immediate steps to be taken to carry out any necessary actions to protect the public.
- The code will indicate if it is essential to contain a spillage to protect the environment or if it can be safely diluted saving valuable time and resources and reducing a potential danger of the incident escalating more rapidly.
- The code will take account of the type of danger involved i.e. for toxic substances it will consider the danger from skin absorption as opposed to inhalation and also the degree of toxicity of the substance.
- The code is flexible enough to be able to provide advice on the appropriate action where mixed loads are involved.
- A risk assessment of every substance will have already been undertaken and therefore there will be no need to carry out a risk assessment for initial actions, saving valuable time and reducing the subjectivity required by non-specialist first responders.
- The code can easily be used by both sophisticated well-trained and equipped first responders or by the volunteer services and other emergency services.
- It does not rely on radio or other communication systems in order to obtain advice and guidance, which can be unreliable in some cases.
- It does not require the driver to provide information or for an information card to be obtained from the cab of the vehicle.
- Because immediate action can be taken using the correct firefighting medium and protective clothing, together with action to protect the environment and the public, the use of emergency action codes is likely to result in the saving of lives.
- The code would be savings in terms of dealing with incidents more efficiently, having regard to safety and environment and thus reducing costly clean-up operations and possible

litigation costs. As it is generally the polluter who pays, any reduction in the time and operational costs involved in an incident will be of benefit to industry.

- Although there would be an initial training cost to emergency services and operators, the simplicity of the system might well mean that ongoing training costs could be less than those required to train responders to use other system.

The following are examples of how the emergency action code would be used

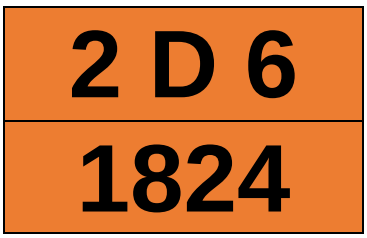
UN 1203 Petroleum

The proposed emergency action code would show 4K9. This will indicate the use of a foam as a firefighting media, that they should wear breathing apparatus and firefighting kit, that it is violently reactive, that the substance should be contained and that there is the like hood of a public safety hazard outside the immediate area.

UN 1017 Chlorine

The proposed emergency action code would show 2G9. This will indicate the use of a fine water spray to knock down any gas cloud, that gastight chemical protection with thermal protection (for the low boiling point liquefied gas) should be worn, that there is not a danger from a violent reaction, that the substance should be contained and that there is the likelihood of a public safety hazard outside the immediate sea.

Figure 4.2 shows possible system for the identification of the product, the hazard and the emergency actions



UN 1824 Sodium Hydroxide solution	
2	**Fine Spray for dilution**
D	**Liquid Tight Chemical Protective Clothing – No Violent Reaction**
6	**No Public Safety Hazard Dilute: Spillage may be washed to drain with large quantities of water**
Label 8 Corrosive	

Figure 4-2: Orange Plate with UN-Number and Emergency Action Code

Internationally, The ADR Hazard Identification Number HIN, also known as the Kemler Code, is to be used on road vehicles with tanks etc. carrying bulk loads of dangerous substances. The ADR plate displays the HI Number in the top section and the UN number, which identifies the substance, at the bottom as shown in Figure 4.3.

Figure 4-3: ADR Hazard Identification Numbers

The HI number consists of two or three figures. The first figure of the Kemler Code indicates the primary hazard, the second and third figures generally indicate secondary hazards. Doubling of a figure indicates an intensification of that particular hazard. Where the hazard associated with a substance can be adequately indicated by a single figure, this is followed by a zero.

If a hazard identification number is prefixed by the letter 'X', this indicates that the substance will react dangerously with water.

Both the EAC and HI numbers are published every year in the National Chemical Emergency Centre (NCEC) Dangerous Goods Code Emergency Action Code List.

4.7.2 American Petroleum Institute (API) Colour Code

API is the worldwide leading standards setting body for the oil and natural gas industry. With just a few exceptions, most petroleum-based fuels look the same. That's why American Petroleum Institute requires each fuel type to be clearly marked both with text but also with API Colour Codes and symbols for quick identification. The API colour coding system is the national and universal underground fuel storage tanks, fills, piping, equipment and vehicles at gas stations, service stations, warehouses, and distribution terminals. The purpose of using a uniform colour code is to prevent mix-ups in the delivery of petroleum products – to prevent diesel fuel, for example, from being dropped into a gasoline storage tank, or to prevent gasoline from being dropped into a monitoring well. The colour code is used for marking manhole covers in retail outlets. API Colour Code Sign is printed on one side, in a bold full colour on 0.40 Aluminium with size 12"w x 24"h (30 cm w x 60 cm h). The colour code shall be implemented upon the request of the Abu Dhabi Civil Défense. The API colour code is shown in Figure .4.

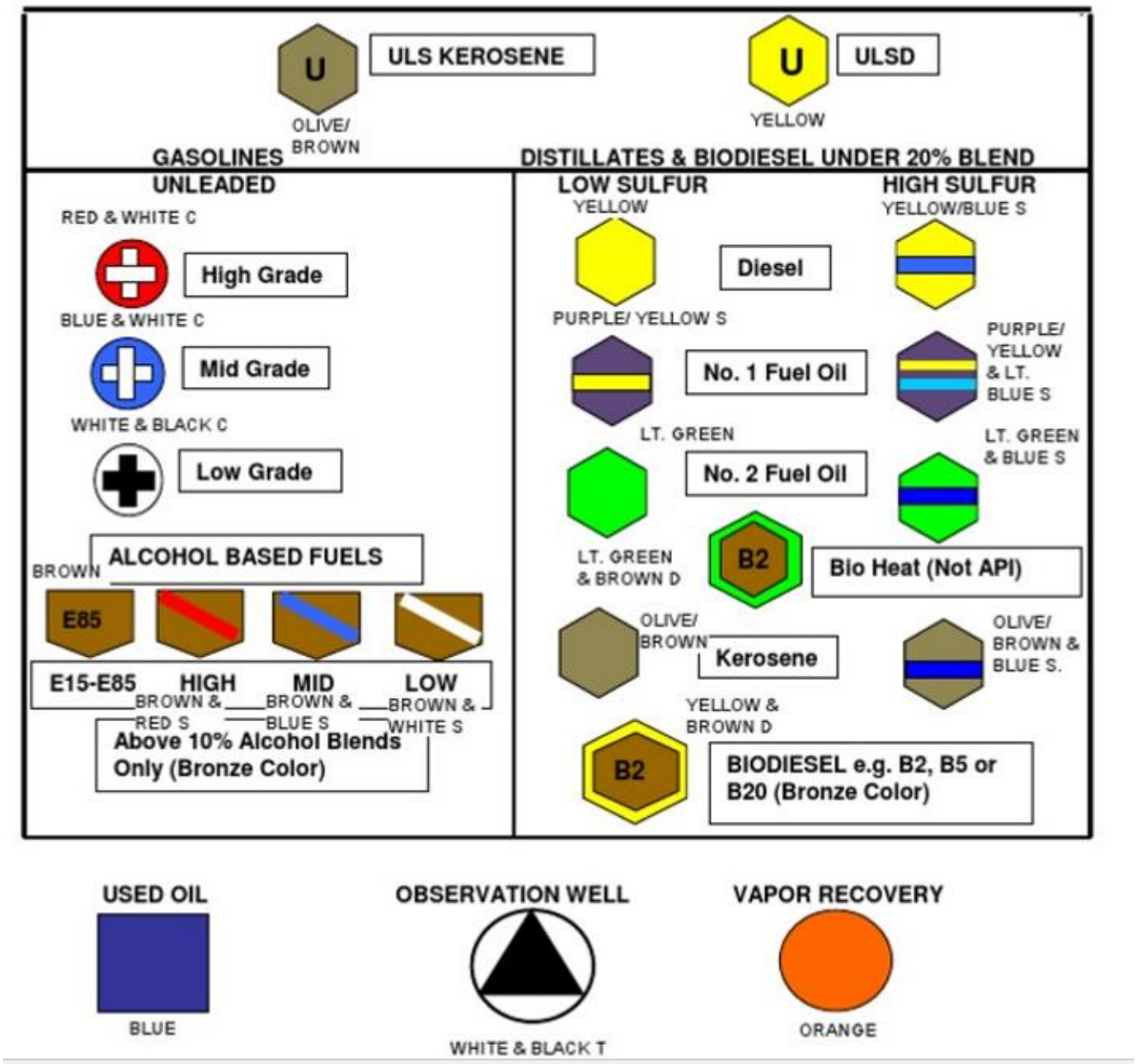


Figure 4-4 : API Colour Code

4.7.3 Report Incidents

If a serious accident or incident takes place during loading, filling, carriage or unloading of dangerous goods, the loader, filler, carrier or consignee, respectively, must ascertain that a report conforming to and fulfilling the requirements of Abu Dhabi Occupational Safety and Health System Framework, (OSHAD-SF) – Mechanisms, Mechanism 11.0 – Incident Notification, Investigation and Reporting which is available in the following website is completed and submitted to the Competent Authority of Health and Safety (ADPHC) :

https://www.adphc.gov.ae/-/media/Project/ADPHC/ADPHC/PDF/OSHAD-SF/Mechanisms/11---Incident-Notification-Eng.pdf

The company shall also prepare an incident report for their documentation and future enhancement. Appendix C shows the ADR (1.8.5) model for report on occurrences during the carriage of dangerous goods as a simple guide example of incident report.

An event subject to report has occurred if dangerous goods have been released or if there has been an imminent risk of loss of product, or if personal injury, or material or environmental damage has occurred, or if the authorities have been involved and one or more of the following criteria has been met:

Personal injury means an occurrence in which death or injury directly relating to the dangerous goods carried has occurred and where the injury:

- Requires intensive medical treatment.
- Requires a stay in hospital of at least one day.
- Results in the inability to work for at least three consecutive days.

Loss of product means the release of dangerous goods:

- Of transport category 0 or 1 in quantities of 50 kg /50 litres or more.
- Of transport category 2 in quantities of 333 kg /333 litres or more.
- Of transport category 3 or 4 in quantities of 1,000 kg/1,000 litres or more.

The transport categories according to national and ADR regulations are show in Appendix D.

The loss of product criterion also applies if there was an imminent risk of loss of product in the above-mentioned quantities. As a rule, this has to be assumed if, owing to structural damage, the means of containment is no longer suitable for further carriage or if, for any other reason, a sufficient level of safety is no longer ensured (e.g. owing to distortion of tanks or containers, overturning of a tank or fire in the immediate vicinity). Also:

- If dangerous goods of Class 6.2 (infectious substances) are involved, the obligation to report applies without quantity limitation.
- In occurrences involving Class 7 (radioactive substances), the criteria for loss of product are:

(a) Any release of radioactive material from the packages.

(b) Exposure leading to a breach of the limits set out in the national regulations for protection of workers and members of the public against ionising radiation.

(c) Where there is reason to believe that there has been a significant degradation in any package safety function (containment, shielding, thermal protection or criticality) that may have rendered the package unsuitable for continued carriage without additional safety measures.

Material damage or environmental damage means the release of dangerous goods, irrespective of the quantity, where the estimated amount of damage exceeds a certain limit (Say €50,000 as per ADR). Damage to any directly involved transport equipment (means of carriage) containing dangerous goods and to the modal infrastructure (e.g. roadway, bridge) must not be considered for this purpose.

Involvement of authorities means the direct involvement of the authorities or emergency services during the occurrence involving dangerous goods and the evacuation of persons or closure of public traffic routes (roads/railways) for at least three hours owing to the danger posed by the dangerous goods. If necessary, the Competent Authority of Health Safety may request further relevant information.

5 EXEMPTIONS IN NATIONAL TRANSPORT

This chapter provides the exemption in dangerous goods transport as common, small packages, national and limited quantities exemptions.

5.1 General

The national regulations state exemptions / derogations regarding the dangerous goods national transport. Some exemptions totally remove the legal burden for some operations, while others give less difficult transportation requirements.

5.2 Common Exemptions

According to the international best practice and ADR, the following activities are exempt and therefore **not subject** to the national regulations or ADR provisions:

- Carriage of dangerous products by private individuals when the goods are packed for retail sale and intended for personal or domestic use, recreation, or sporting activities. The total quantity of flammable liquids carried in refillable receptacles cannot exceed 60 litres per receptacle or 240 litres per transport unit.

- The carriage of machinery or equipment not specified in national regulations or ADR (you may need confirmation from a DGSA) which happen to contain dangerous goods in their internal or operational equipment, provided that measures have been taken to prevent any leakage of contents in normal conditions of carriage (e.g., transporting old fridges which contain refrigerant gases).

- The carriage undertaken by enterprises which is ancillary to their main activity, such as deliveries to or returns from building or civil engineering sites, or in relation to surveying, repairs and maintenance, in quantities of not more than 450 litres per packaging and within the maximum quantities specified as small load exemptions in Section 5.3. Measures must be taken to prevent any leakage of contents in normal conditions of carriage. These exemptions do not apply to Class 7 (radioactive materials). This exemption is not available for transport (supply and distribution) or courier companies, irrespective of the quantity of dangerous goods.

  The followings are qualifying examples:

  - Carriage of small quantities of fuel in drums for use in machinery on a building site, road works or maintenance work.

  - Carriage of oxygen and acetylene for welding/maintenance/repair work.

  - Carriage of oxygen cylinders for use in emergency situations / first aid.

  - Carriage of flammable paints and varnish by a painter.

- Carriage of farm supplies by the farmer.
- Community nurses/doctors carrying clinical waste.
- Sales reps carrying “example” samples not for distribution.

In all cases the materials are required by, and typically are for immediate use by, the company, their driver and/or vehicle crew.

It is worth mentioning that the carriage done by such firms for their own supply or external or internal distribution does not fall within the scope of this exemption and may be subject to the national regulations and provisions. This is most often the case for larger companies with a specialized distribution vehicle.

For example:

- If you purchase flammable paints directly from a wholesaler and load these into the vehicle for immediate use or delivery to your place of work or a job site, then this activity qualifies for the exemption. However, if the purpose of collecting flammable paints from a wholesaler is to deliver them to your own depot or to distribute to one or more sites and this activity is the main job of the driver and vehicle (distribution/supply of material which includes dangerous goods), then this would not be considered as qualifying for this exemption

  Attaching labels to the vehicle to indicate the hazards associated with the dangerous goods being transported is common good practice. When the vehicle is no longer carrying dangerous goods, such labels (magnetic or otherwise) should be removed.

- The carriage of uncleaned empty static storage vessels which have contained gases of Class 2, groups A (asphyxiant), O (oxidizing) or F (flammable), substances of Class 3, flammable liquids or Class 9, miscellaneous dangerous substances belonging to packing group II or III (e.g. environmentally hazardous substances), or pesticides of Class 6.1, toxic substances belonging to packing group II or III, subject to the following conditions:

  - All openings except for pressure relief devices (when fitted) are hermetically closed.
  - Measures have been taken to prevent any leakage of contents in normal conditions of carriage, and
  - The load is fixed in cradles or crates or other handling devices or to the vehicle or container in such a way that it will not become loose or shift during normal conditions of carriage.

  This exemption does not apply to static storage vessels which have contained desensitized explosives or substances the carriage of which is prohibited by national regulations and ADR provisions.

- Carriage of gases

- Gases contained in the tanks of a vehicle performing a transport operation and destined for its propulsion or for the operation of any of its equipment (e.g., refrigerating equipment).
- Gases contained in the fuel tanks of vehicles transported. The fuel cock between gas tank and engine must be closed and the electric contact open.
- tyres carried as a load.
- Non-flammable, non-toxic gases, if the pressure of the gas in the receptacle or tank at a temperature of 20°C does not exceed 200 kPa (2 bar) and if the gas is not a liquefied or a refrigerated liquefied gas. This includes every kind of receptacle or tank (e.g. also parts of machinery and apparatus).
- Gases contained in the equipment used for the operation of the vehicle (e.g. fire extinguishers), including in spare parts (e.g., inflated pneumatic tyres), this exemption also applies to inflated pneumatic tyres carried as a load.
- Gases contained in the special equipment of vehicles and necessary for the operation of this special equipment during transport (cooling systems, fish tanks, heaters, etc.) as well as spare receptacles for such equipment or uncleaned empty exchange receptacles, transported in the same transport unit.
- Gases contained in foodstuffs (except UN 1950 aerosols), including carbonated beverages.
- Gases contained in balls intended for use in sports.
- Gases contained in light bulbs provided they are packaged so that the projectile effects of any rupture of the bulb will be contained within the package.

- Carriage of liquid fuels
  - Fuel contained in the tanks of a vehicle performing a transport operation and destined for its propulsion or for the operation of any of its equipment. The fuel may be carried in fixed fuel tanks which are directly connected to the vehicle's engine and/or auxiliary equipment and which comply with the pertinent legal provisions or may be carried in portable fuel containers (such as jerrycans'). The total capacity of the fixed tanks must not exceed 1,500 litres per transport unit and the capacity of a tank fitted to a trailer must not exceed 500 litres. A maximum of 60 litres per transport unit may be carried in portable fuel containers. These restrictions must not apply to vehicles operated by the emergency services.
  - Fuel contained in the tanks of vehicles or of other means transport (such as boats) which are carried as a load, where it is destined for their propulsion or the operation of any of their equipment. Any fuel cocks between the engine or equipment and the fuel tank

must be closed during carriage unless it is essential for the equipment to remain operational. Where appropriate, the vehicles or other means of conveyance must be loaded upright and secured against falling.

5.3 Small Load (Packages) Exemptions

The small load exemption permits you to transport up to a certain amount of dangerous goods with only a few restrictions. A DGSA may be required to verify the interpretation and computations made under this exemption.

Refer to the table in **Appendix D** for small load limit quantities of dangerous goods as assigned to transport categories 0, 1, 2, 3 or 4 for the purposes of this exemption.

- Where the quantity of dangerous goods carried on a transport unit does not exceed the values indicated in Appendix D, i.e., when individual goods or goods of the same transport category are carried together, the exemption applies.

  For example, Class 2 aerosols group F (flammable aerosols), may be carried under the exemption in quantities of up to 333 litres when no other dangerous goods are carried

- When carrying goods of different transport categories in the same transport unit, the exemption applies if the sum of goods carried does not exceed 1,000 units. However, each category must also be multiplied by the appropriate multiplying factor before adding each category together as per Table 5.1 for multiplying factors.

Transport Category	Multiplying Factor
1	50
1[a]	20
2	3
3	1
Sum of dangerous goods must not exceed 1,000	

a: For UN Nos. 0081, 0082, 0084, 0241, 0331, 0332, 0482, 1005 and 1017

Table 5-1: Transport Categories Multiplying Factor

Packaged goods may be carried under this exemption **without application** of the following provisions:

- Security provisions (see clause 4.5).
- Placarding and marking; i.e. vehicles do not require orange plates and containers do not require placards.
- Instructions in writing.
- Vehicle certification.
- Driver training certification.

Additionally, under this exemption, the following provisions are reduced:

- Packing provisions.
- Restrictions in public places.
- Requirements for vehicle crews, equipment, operation and documentation except for those listed below which still apply.
    - Transport document must be carried in the vehicle (indicating the total quantity for each transport category).
    - Vehicle must be equipped with a suitable 2 kg fire extinguisher.
    - Driver and crew must have received appropriate general training.
    - Driver and crew must not open dangerous goods packages.
    - There must be no smoking during handling in or around the vehicle.
    - Any torch carried must be non-sparking.

For application of this exemption, Appendix D can be used if you know the transport category of the substance. If the transport category is not known, it can be established by consulting Table A in of the ADR (the transport category is provided in Column 15). In order to use Table A, however, the UN number/class/packing group of the substance must be identified. Such information may be obtained from Safety Data Sheets, which should be provided with all hazardous chemicals

5.4 National Exemptions

The national regulations specify additional “national” exemptions for carriage of dangerous goods within the Emirate only. Some of these exemptions deal with certification of older vehicles and tanks which should be identified by the competent authority. These issues can be complex, so if

you are in any doubt you should seek advice from a DGSA. In addition, some of the most widely used exemptions/derogations are as follows:

- The regulations do not apply where a vehicle is being used to transfer dangerous goods between private premises and another vehicle in the immediate vicinity of those premises or between adjacent premises owned by the same person even if separated by a public road.
- Kerosene, diesel and LPG fuel deliveries to the end user need not have the customer details on the transport document.
- When carrying dangerous goods for retail distribution and subject to certain quantity limits, the inner packages of dangerous goods originally packaged in limited quantities or combination packaging may be carried on the final leg of a local distribution journey without an outer packaging.
- Regulations for transport do not apply to gases used for dispensing beverages when carried together on the same vehicle.

5.5 Limited Quantities (LQ)

Limited quantity exemptions are applicable to the carriage of dangerous goods of certain classes packed in specified small packaged quantities (e.g. 5 kg or 5 liters maximum per inner package). Each inner package must be placed in suitable outer packaging with a gross mass limit of 30 kg (inner packages and outer packaging total weight not to exceed 30 kg). Shrink-wrapped trays may also be used as outer packaging, with a package limit of 20 kg.

When the provisions of this exemption are met, although the dangerous goods are contained in individual small packages and grouped in units up to 30 kg, there is no limit to the total quantity per shipment that may be carried in this way. A 40-foot container full of limited quantity goods, for example, can benefit from this exemption. This is in contrast with the small load exemption (see Clause 5.3), which limits the total quantity per shipment.

The **packaging specified does not need to be UN approved**, but must be suitable and of good quality.

The applicable quantity limit for the inner packaging or article is specified for each substance in ADR, Table A, Column (7a). The quantity "0" has been indicated in this column for each entry **not permitted** to be carried in accordance with these provisions.

Packages containing dangerous goods in limited quantities must bear the marking shown in Figure 5.1 and 5.2 for the indicated modes of transport (mark must be 100mm x 100mm, diamond outline of at least 2mm). When transporting goods in accordance with air requirements and the air mark is applied, this mark is accepted for the other modes of transport.

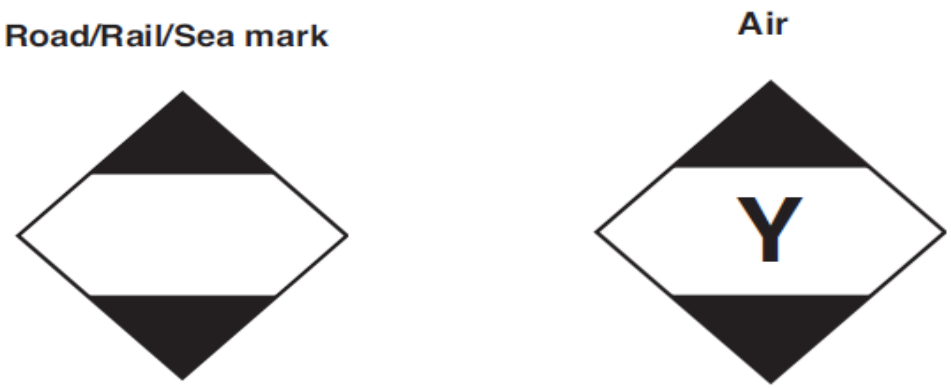


Figure 5-1: Marking of Dangerous Goods Limited Quantities in Various Transport Modes

Figure 5-2: Dangerous Goods Limited Quantities Packaging

The mark shall be readily visible, legible and able to withstand open weather exposure without a substantial reduction in effectiveness.

Once packaged and labelled for carriage in accordance with all limited quantity provisions the main exemptions are:

- No orange plates required on vehicles.
- No vehicle marking for consignments under 8 tons (over 8 tons vehicle must be marked with the same mark as for packages front and rear of vehicle (See subclause 5.5.1).
- Drivers are not required to hold a driver training certificate.
- No other hazard labels or UN number marking.
- No vehicle safety equipment or PPE.
- No fire extinguishers.
- No instructions in writing.
- No transport documents (except for sea shipment where a container packing certificate is required) (See chapter 10).

Some provisions do still apply, such as the relevant provisions concerning orientation marks, use of over-packs and vehicle/container packing certificates. Such provisions are set out in ADR 3.4.

Note also that for shipments involving sea or air transport some of the above exemptions do not apply. For example, a dangerous goods note (transport document) is still necessary for LQ shipments by sea, and so will be required for any transport operation that includes a sea crossing.

5.5.1 Vehicle Marking Carrying Limited Quantity Packages

Transport units over 12 tons (gross vehicle mass), carrying more than 8 tons of limited quantity packages must display the mark indicated in Figure 5.1 (or Figure 5.2) in the form of a placard (large label or placard dimensions should be 250mm x 250mm). In advance of carriage, consignors of dangerous goods packed in limited quantities must inform the carrier in a traceable form of the total gross mass of such goods to be consigned.

If the vehicle requires the blank orange plate marking because of other dangerous goods being carried, then the LQ placards are not required.

5.6 Excepted Quantities

The excepted quantities exemption is similar to the limited quantity exemption but is only for certain dangerous goods in very small quantities.

Once you have complied with the basic training requirements, classification procedures and packaging, labelling and quantity limitations, no other provisions apply to the transport of dangerous goods in excepted quantities.

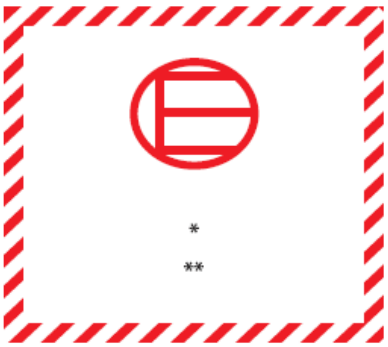
The excepted quantities for outer and inner packaging are specified by an “E code” for all dangerous goods in ADR, Table A, Column 7(b) as shown in table 5.2.

Code	Maximum net quantity per inner packaging (in grams for solids and ml for liquids and gases)	Maximum net quantity per outer packaging (in grams for solids and ml for liquids and gases or sum of grams and ml in case of mixing packing)
E0	Not permitted as excepted quantity	
E1	30	1000
E2	30	500
E3	30	300
E4	1	500
E5	1	300

Table 5-2: Dangerous Goods “E code”

Packages must consist of an inner packaging placed in an intermediate packaging, securely packed with cushioning and then placed in a suitable rigid strong outer packaging.

Figure 5.3 indicates the marking of packages containing excepted quantities, the mark being a minimum 100mm x 100mm.



Excepted quantities mark:

Hatching and symbol of the same colour, black or red, on white or suitable contrasting background

* The first or only label number indicated in Table A of Chapter 3.2 (Column 5) must be shown in this location.

** The name of the consignor or of the consignee shall be shown in this location if not shown elsewhere on the package.

Figure 5-3: Marking of Packages Containing Excepted Quantities

6 TRAINING AND TRAINING RECORDS

This chapter provides the training requirements for the drivers and crew of vehicles transporting dangerous goods as well as the dangerous goods safety advisor (DGSA) in addition to relevant documentation and keeping records for these training aspects.

6.1 General

Persons employed by the participants in transport chain referred to in Chapter 4, whose duties concern the carriage of dangerous goods, shall be aware / trained in the requirements governing the carriage of such goods appropriate to their responsibilities and duties according to the following forms:

General awareness training: Personnel shall be familiar with the general requirements of the provisions for the carriage of dangerous goods.

Function - specific training: Personnel shall be trained, commensurate directly with their duties and responsibilities in the requirements of the regulations concerning the carriage of dangerous goods. Where the carriage of dangerous goods involves a multimodal transport operation, the personnel shall be aware of the requirements concerning other transport modes.

Safety training: Commensurate with the degree of risk of injury or exposure arising from an incident involving the carriage of dangerous goods, including loading and unloading, personnel shall be trained in the hazards and dangers presented by dangerous goods. The training provided shall aim to make personnel aware of the safe handling and emergency response procedures.

Security awareness training: to include addressing the nature of security risks, recognizing security risks, methods to address and reduce such risks and actions to be taken in the event of a security breach. It must also include awareness of security plans (if appropriate) commensurate with the responsibilities and duties of individuals and their part in implementing those plans.

The training shall be periodically supplemented with refresher training to take account of changes in regulations.

Records of training shall be kept by the employer and made available to the employee or competent authority, upon request. Records shall be kept by the employer for a period established by the competent authority. Records of training shall be verified upon commencing a new employment.

Training may be conducted by the organization participates in the transport chain if it is competent to do so or provided by a third-party training provider. Details of the content of the training must be recorded and made available for inspection.

6.2 Driver Training and Examination

According to international best practice and ADR requirement, drivers of vehicles carrying dangerous goods must hold a training certificate issued by the competent authority or approved

certification body. Drivers must have participated in a training course (mandatory) and passed an examination on the particular requirements that have to be met during carriage of dangerous goods.

The training certificate shall be obtained from the competent authority (see clause 12.3) and shall be an integral part of driving license promulgation and should be annually reviewed according to the following performance criteria and their relevant knowledge & understanding:

- Prepare the DG vehicle for driving.
- Check and protect the DG vehicle and the load.
- Operate and monitor the DG vehicle systems.
- Manoeuvre the DG vehicle or tanker in restricted spaces.
- Drive the DG vehicle on public roads in efficient manner.
- Obtain information on the collection and delivery of loads carried by DG vehicle.
- Confirm the DG vehicle is loaded correctly.
- Confirm the DG vehicle is unloaded correctly.
- Couple and uncouple the DG vehicle trailer.
- Respond to incidents, hazardous conditions and emergencies in transportation of hazardous material environments.

It is worth mentioning that on 2018, the ADQCC developed the Hazardous Material Driver Occupational Terms for workers in the Transport of Hazardous Material sector in Abu Dhabi through proper coordination with relevant stakeholders which could be used as a sound guidance for training activities and components to promote qualified HazMat personnel. The Occupational Terms guidance is available in the following website link:

https://qcc.gov.ae/-/media/Project/QCC/QCC/Documents/Quality-Infrastructure-Documents/Abu-Dhabi-Specification/Abu-Dhabi-Occupational-Terms/ADOT-96---Hazardous-Material-Driver-Level-3.pdf

6.3 Vehicle Crew Training and Examination.

The participates in the transport chain must provide proper training to vehicle crew members by their certified professionals safety team or a commercial training company. Training shall be given in the form of a basic training course and, when applicable, specialization training courses to support the crew member in achieving their responsibilities addressed in subclause 4.2.3.

Subjects to be covered by the basic training course shall be, at least:

- General requirements governing the carriage of dangerous goods.

- Main types of hazard.
- Information on environmental protection in the control of the transfer of wastes.
- Preventive and safety measures appropriate to the various types of hazard.
- What to do after an accident (first aid, road safety, basic knowledge about the use of protective equipment, instructions in writing, etc.).
- Marking, labelling, placarding and orange-colored plate marking.
- What a driver should and should not do during the carriage of dangerous goods.
- Purpose and the method of operation of technical equipment on vehicles.
- Prohibitions on mixed loading in the same vehicle or container.
- Precautions to be taken during loading and unloading of dangerous goods.
- General information concerning civil liability.
- Information on multimodal transport operations.
- Handling and stowage of packages.
- Traffic restrictions in tunnels and instructions on behavior in tunnels (prevention of incidents, safety, action in the event of fire or other emergencies, etc.).
- Security awareness.

Subjects to be covered by the specialization training course for carriage in tanks shall be, at least:

- Behaviour of vehicles on the road, including movements of the load.
- Specific requirements of the vehicles.
- General theoretical knowledge of the various and different filling and discharge systems.
- Specific additional provisions applicable to the use of those vehicles (certificates of approval, approval marking, placarding and orange-colored plate marking, etc.).

6.4 DGSA Training and Examination.

According to the DGSA duties addressed in clause 4.3, the adviser shall hold a vocational training certificate, valid for transport by road. That certificate shall be issued when the candidates undergo training and pass an examination approved by the competent authority or an international certification body. The examining body shall not be a training provider.

The main objectives of the training shall be to provide candidates with enough knowledge of the risks inherent in the carriage, packing, filling, loading or unloading of dangerous goods, of the applicable laws, regulations and administrative provisions and duties. The training course and examination shall cover at least the following subjects:

- Knowledge of the types of consequences which may be caused by an accident involving dangerous goods and knowledge of the main causes of accidents.
- Requirements under national law, international conventions and agreements, regarding the following in particular:
  - Classification of dangerous goods (procedure for classifying solutions and mixtures, structure of the list of substances, classes of dangerous goods and principles for their classification, nature of dangerous goods transported, physical, chemical and toxicological properties of dangerous goods).
  - General packing provisions, provisions for tanks and tank-containers (types, code, marking, construction, initial and periodic inspection and testing).
  - Marking and labelling, placarding and orange-colored plate marking (marking and labelling of packages, placing and removal of placards and orange-colored plates).
  - Particulars in transport documents (information required).
  - Method of consignment and restrictions on dispatch (full load, carriage in bulk, carriage in intermediate bulk containers, carriage in containers, carriage in fixed or demountable tanks).
  - Transport of passengers.
  - Prohibitions and precautions relating to mixed loading.
  - Segregation of dangerous goods.
  - Limitation of the quantities carried and quantities exemptions.
  - Handling and stowage (packing, filling, loading and unloading - filling ratios -, stowage and segregation).
  - Cleaning and/or degassing before packing, filling, loading and after unloading.
  - Crews, vocational training.
  - Vehicle documents (transport documents, instructions in writing, vehicle approval certificate, driver training certificate, copies of any derogations, other documents).
  - Instructions in writing (implementation of the instructions and crew protection equipment).

- Supervision requirements (parking).
- Traffic regulations and restrictions.
- Operational discharges or accidental leaks of pollutants.
- Requirements relating to transport equipment.

N.B: The training of the drivers, vehicle crew and the DGSA should consider the requirements of the Abu Dhabi Public Health Centre for the Occupational Safety and Health in terms of training materials, protecting the health and safety of workers and emergency management and reporting which is available in the website link 1---Hazardous-Materials--Ar.pdf (adphc.gov.ae)

7 PACKAGING, MARKING AND Hazard LABELLING

This chapter provides the requirements for packaging, marking and hazard labelling of dangerous goods as well as the marking and labelling of vehicles and tanks transporting them

7.1 General

Marking and labeling are important steps when preparing a dangerous good package for transportation. Labels often communicate the hazards associated with the package, and markings ensure the shipment is handled so that spills, accidents and exposure are prevented.

The consignor is responsible for ensuring that packaging, and subsequent marking and labelling of such packaging, is appropriate and suitable for the substances, mixtures and articles consigned for carriage by road. the consignor is recommended to seek the advice of a DGSA when carrying out this task.

7.2 Packaging and Marking

Packaging of dangerous goods, be it in a box, drum, container, or when carried in road tankers or other systems of containment should be specified to provide a safeguard for people and the environment during loading, transport and unloading of dangerous goods and must therefore be appropriate for the dangerous goods concerned.

The packaging should be “UN approved” which means it has been tested and approved according to national regulation or ADR. Approved packaging will be identified with a series of marks, as indicated in the following Figures.

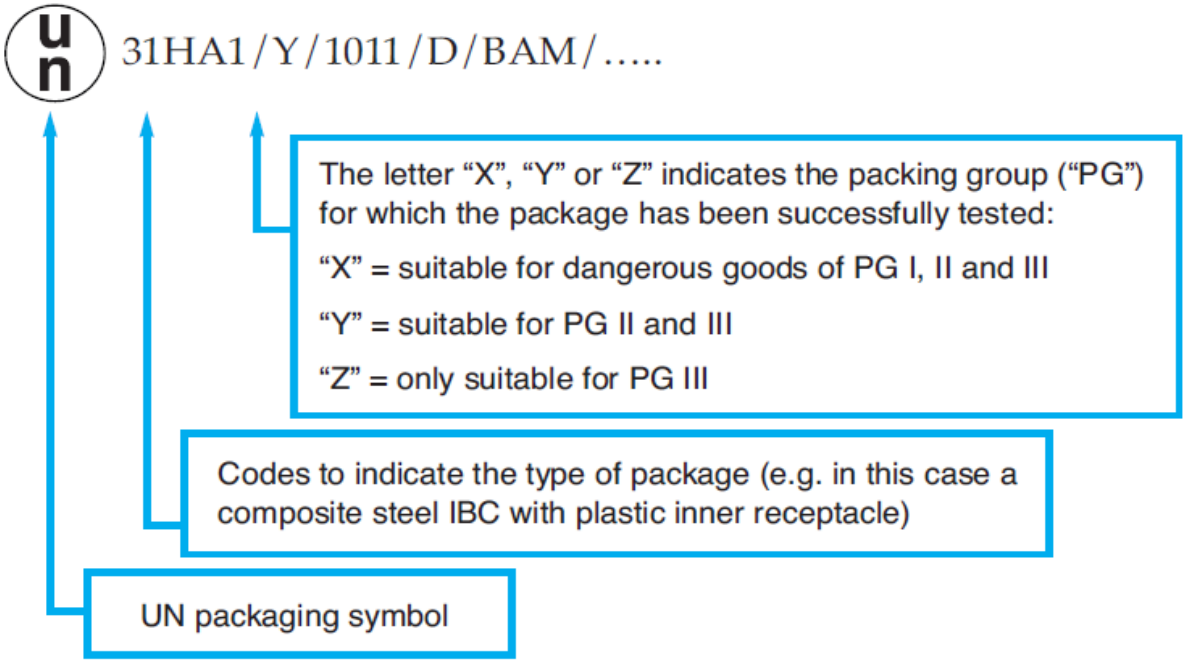


Figure 6-1: Approved Packaging Identification

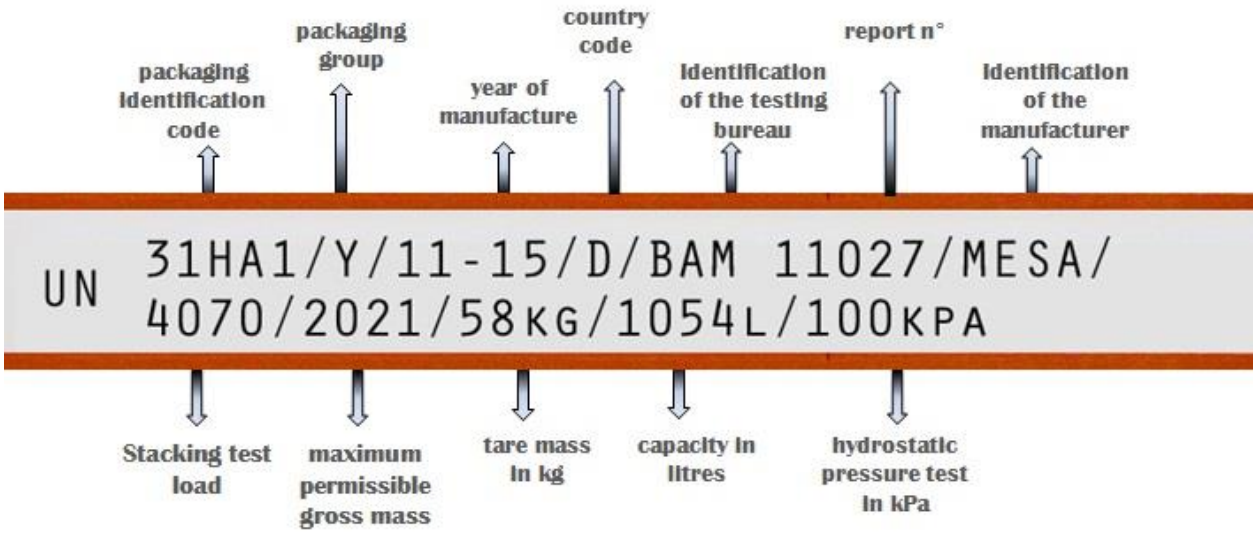


Figure 6-2: Details of Applied Marking for Composite Steel IBC with Plastic Inner Receptacle

The UN number shall be clearly and durably marked on each package with at least 12 mm high, except for packages of 30 liters capacity or less or of 30 kg maximum net mass and for cylinders of 60 liters water capacity or less, when they shall be at least 6 mm in height and except for packages of 5 liters or 5 kg or less when they shall be of an appropriate size. In the case of unpackaged articles, the mark shall be displayed on the article, on its cradle or on its handling, storage or launching device.

All package marks shall be readily visible and legible and shall be able to withstand open weather exposure without a substantial reduction in effectiveness. Intermediate bulk containers of more than 450 liters capacity and large packagings shall be marked on two opposite sides.

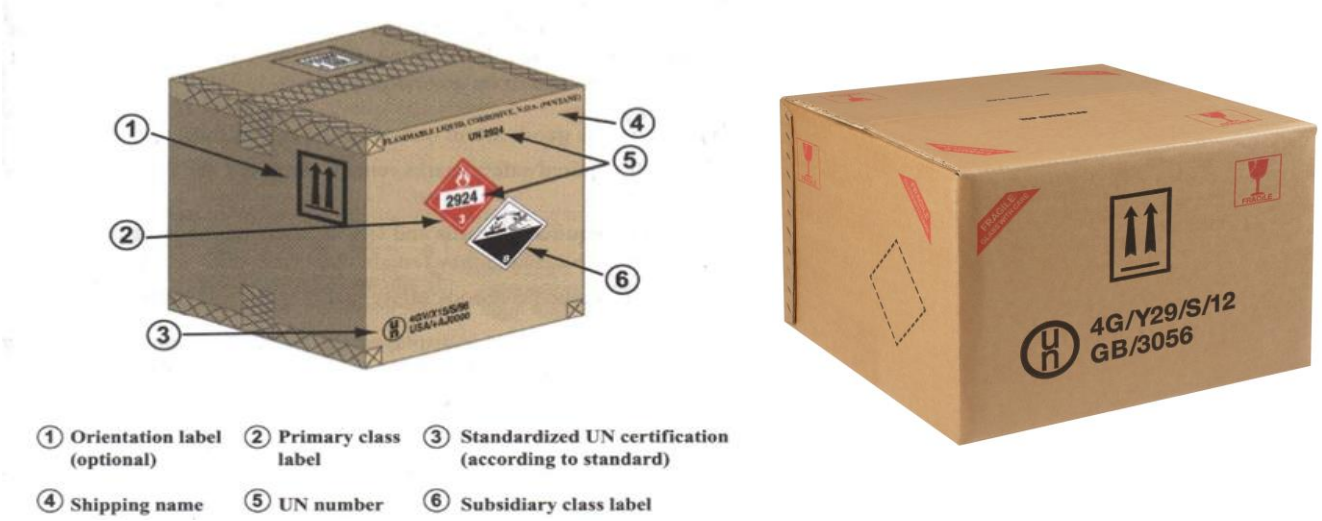
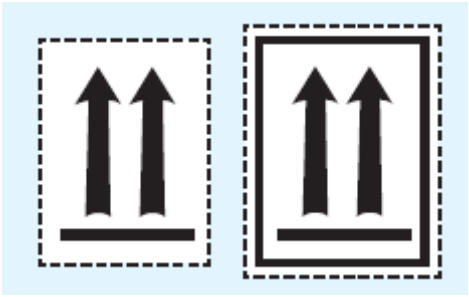


Figure 6-3: Marking to Indicate that the Packaging is UN Approved

The appropriate package type should be selected and the "packing instruction" for individual UN numbers lectured in ADR Dangerous Goods List (Table A, Column 8) should be implemented.

Examples of additional marks which may be required on packages for transport are provided in Table 7.1.

P. N	Marks	Remarks
1		Environmentally hazardous substance (EHS) mark Not required for packaging consisting of containers of less than 5 kg/5 l
2		Orientation arrows for: • Combination packaging having inner packaging containing liquids • Single packaging fitted with vents • Cryogenic receptacles intended for the carriage of refrigerated liquefied gases Apply on two opposite sides
3		Elevated temperature substances mark Applied to tanks, tank-containers etc. Mark is not for packages

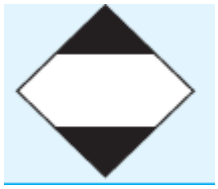
4	  **A** **B**	A) Limited quantities mark (except for air transport) B) Limited quantities mark for air transport (accepted in all modes of transport)
5		Excepted quantities mark
6		Vehicle and container coolant warning mark
7		Lithium battery mark

Table 6-1: Package Additional Marks

7.3 Hazard Labelling

Dangerous goods packages labelling is applied to provide an instant visual warning to everyone, not least those handling the goods and emergency services.

Labels for transport are the hazard/class labels as provided in Figure 3.1 (Chapter 3). Labels are placed on the outside surface of packages as shown in Figure 7.4 with design must be of a square set at an angle of 45° (diamond-shaped) with measurements of **10x10 cm, 25×25 cm or 30×30 cm** depending on the package size, the size of the vehicle or the part it is attached to.

Figure 6-4: Labels Placement on Packaging

In addition to the class label(s), the substance UN number should be applied.

Packages generally require labels, appropriate mark(s) and a UN number only once on the outer surface of the package. Ideally, if the package size allows, all labels should be displayed on one side, without overlapping or being obscured by other labelling. For IBC containers and large packages (450 litters to 3,000 litters capacity), the labels and marks are required on two opposite sides.

When different dangerous goods are packed together in the same outer packaging, the relevant UN numbers and hazard labels/marks must be shown on the outer packaging

If “overpacking” is applied (e.g. shrink-wrapping or adding another layer of packaging for transport) and the marks and labels are obscured, all such marks and labels must be re-applied along with the word “OVERPACK”, which must be placed on the outer packaging. If all marks and labels can be seen (e.g. through only one or two layers of shrink-wrap) then this provision is not required.

7.4 Vehicles Marking and Labelling

Some vehicles used to transport dangerous goods are highly specialized (e.g. vehicles used to transport explosives and road tankers) and must be certified annually for the transport of dangerous goods from the relevant authority. With the exception of those carrying explosives, vehicles carrying packaged dangerous goods may be standard vehicles (e.g. vans and curtain sided vehicles) and no annual certification is necessary.

Dangerous goods labels, which are applied onto containers and vehicles are called **placards**. They have the same diamond-shaped form as packaging labels and are mainly produced in PVC with a diameter of 25 cm per side and thus, specify the danger(s) inherent in the substance.

According to international best practice and **ADR** regulations, the vehicles with a fixed carriage or an inter-changeable one transporting dangerous goods are marked with orange plates (front and rear). The placards are not requested with exception of class 1 and class 7, placed onto two length and the back side of the vehicle. The vehicles carrying containers / the freight container must also be labelled or “placarded” with the appropriate class label on all four sides as shown in Figure 7.5.

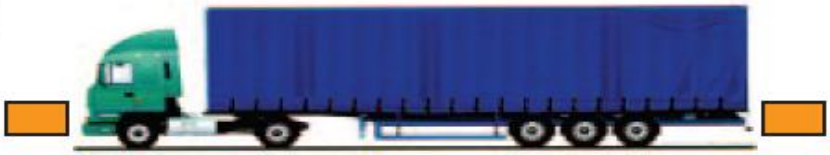
In the case of vehicles with tanks and bulk cargo containers, it is necessary to apply placards onto both sides and the back of the transport unit, independently of the goods that are being transported. Ultimately, we have a look at container-boxes, where placards are attached onto all four sides of the box.

Vans/box vans/curtain sided vehicles:

Orange plates placed front and rear of the vehicle.

No placards.

If boarding a ship the relevant placards must be applied on the sides and rear.



Freight containers:

Orange plates placed front and rear of the vehicle.

Relevant placards on both sides and each end.

Figure 6-5: Vehicles Marking and Labelling

It is the responsibility of carriers to ensure the correct vehicle is used and that appropriate marking is applied. Drivers may also share in the marking duties (e.g. their responsibilities include the removal/covering of "orange plates" when all dangerous goods are unloaded). Figure 7.6 provides an example a blank orange plate and a class hazard placard, and the minimum dimensions required for each as recommended by **ADR** regulations.

When carrying dangerous goods in bulk (unpackaged loose material) the vehicle must also be labelled or "placarded" with the appropriate class label on both sides and rear. Bulk vehicles must also identify the goods by using the numbered orange plates on both sides of the bulk container in addition to blank orange plates at the front and rear.

Note that packaged goods vehicles that normally do not require placards (e.g. vans and curtain sided vehicles) are required to have them for a sea crossing, and when marked for this purpose they are accepted for road journeys immediately before or after a sea crossing.

Blank orange plate, 400mm x 300mm, border line, black 15mm in thickness (front and rear of vehicle).

Placards when used on vehicles, containers or tanks must have minimum dimensions of 250mm x 250mm.

Figure 6-6: Blank Orange Plate and A Class Hazard Placard

7.5 Tanks Marking and Labelling

Tanks (tank-container, portable tank, fixed tank, demountable tank, battery-vehicles and MEGCs) are subject to periodic testing and certification. Examination and testing must be carried out by a competent authority for tanks used for national transport purposes and if used for international operation, testing and examination must be carried out by an appointed and accredited tank tester. These matters are the responsibility of the carrier/tank operator and must be carried out in consultation with a DGSA.

For the carriage of dangerous goods in tanks, marking of both the vehicle and tank (e.g. numbered orange plates at the front and rear of the vehicle, hazard placards and other marks as required on each side of the tank and at the rear) is required. Figure 7.7 provides an example of such side tank marking with numbered orange plate, class hazard placard and an elevated temperature mark (red triangle with thermometer) as recommended by **ADR** regulations.

When different goods are carried in a multi–compartment tank, side marking is used when marking each separate compartment.

Figure 6-7: Tank Marking and Labelling

Note that when a vehicle or container which has contained packaged dangerous goods is unloaded, some of the contents are found to have escaped, the vehicle or container shall be cleaned as soon as possible and in any case before reloading. If it is not possible to do the cleaning locally, the vehicle or container shall be carried, with due regard to adequate safety, to the nearest suitable place where cleaning can be carried out.

Vehicles or containers which have been loaded with dangerous goods in bulk shall be properly cleaned before reloading unless the new load consists of the same dangerous goods as the preceding load.

Additional examples of vehicles placarding and marking according to **ADR** regulations.are shown in following Figure 7-8.

Placarding/marking and orange-coloured plate marking by road

Vehicle carrying packages of explosive substances and articles

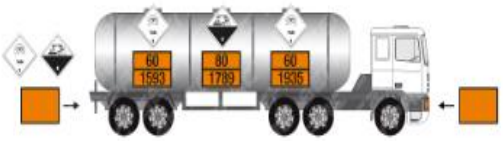
Vehicle carrying packages with radioactive materials

Vehicle carrying packages of dangerous goods
(IBCs, cylinders, bags, drums,..)

Tank carrying dangerous goods

Transport units having one tank carrying dangerous goods

Transport units having multiple tanks carrying dangerous goods



Bulk transport of dangerous goods

Transport in container - box

Tank carrying solid dangerous goods

Tank carrying liquid dangerous goods

Environmentally hazardous substance different from UN3077 / UN3082

Tank carrying dangerous goods

Tank carrying dangerous goods

Dangerous goods packed in Limited Quantities

Transport unit	Container
	
It is required only if the total gross mass of the packages containing dangerous goods packed in limited quantities carried exceed 8 tonnes per transport unit and the transport units have a maximum mass exceeding 12 tonnes.	It is required only if the total gross mass of the packages containing dangerous goods packed in limited quantities carried exceed 8 tonnes per transport unit and the transport units have a maximum mass exceeding 12 tonnes.

Legend

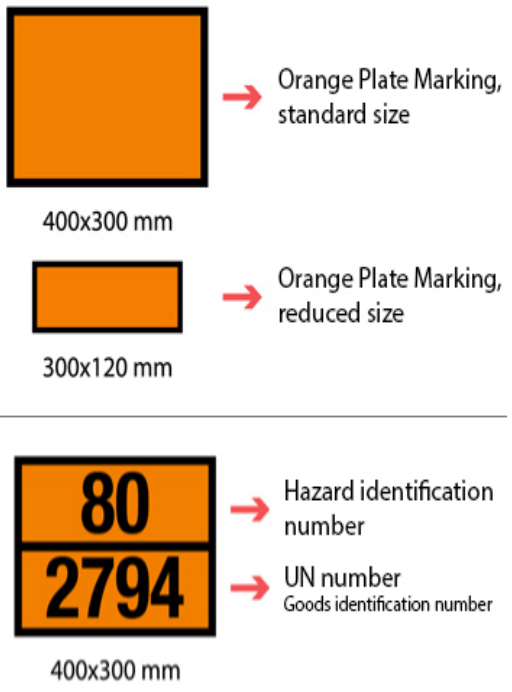
Hazard labels and placards	Neutral orange plates and with numbers
	

Figure 6-8: Additional Examples of Vehicles Placarding and Marking according to ADR Regulations

7.6 Emergency Information Panel

The emergency information panel is the combination between the dangerous goods label presented in clause 3.2 and the emergency code discussed in clause 4.7.1 which are separately illustrated on the vehicle transported dangerous goods as recommended in ADR regulations.

The emergency information panel is commonly recommended in some international practices such as Australian code which is discussed in Appendix E. Both ADR regulations and Australian code in terms of dangerous goods label and emergency code are acceptable for providing the required information about the transported dangerous goods subject to the directions / approval of the competent authority ADCDA.

8 QUANTITATIVE RISK ASSESSMENT FOR DANGEROUS GOODS TRANSPORTATION

The purpose of this chapter is to present how to conduct a quantitative risk assessment for dangerous goods transportation in terms of risk identification, analysis, estimation, evaluation and management.

8.1 General

Generally, the risk assessment is the combined effort of identifying and analyzing potential (future) events that may negatively impact individuals, assets, and/or the environment (i.e. hazard analysis); and making judgments "on the tolerability of the risk on the basis of a risk analysis" while considering influencing factors (i.e. risk evaluation).

Risk assessment is an inherent part of a broader risk management strategy to help reduce any potential risk-related consequences. The results of this process may be expressed in a quantitative or qualitative fashion. The quantitative risk assessment focuses on measurable and often pre-defined data, whereas a qualitative risk assessment is based more so on subjectivity and the knowledge of the assessor.

Practically, the quantification of risk associated with dangerous goods transport assumes a vital importance, especially in urban areas, in order to identify possible alternative routes and choose among these the route of minimum risk. In contrast, the qualitative risk assessment is applied where no alternative comparable route is available and when the basis of a qualitative comparison between the routes is sufficient to identify the appropriate route as the proposed restrictions lead to a significant improvement of safety

Commonly, the transporter will wish to use the minimum cost route and the route optimization cost-benefit analysis will not provide sufficient consideration to the impact that a possible accident could have on route surrounding area components. These impacts are associated with pollution effects on people and the environment, resulting from the release of pollutants around a vehicle involved in an accident. This polluting activity is very complex and stochastic, governed to a large extent by the meteorological conditions (mainly wind direction) prevailing at the time and site of

the accident. The affected area in this case is relatively large. Consequently, the quantification and evaluation of related costs is a difficult problem not yet satisfactorily resolved.

The chapter will concentrate on the **quantitative assessment** of risk associated with dangerous goods transport in details while general guideline for the qualitative risk assessment is discussed in appendix F.

8.2 Quantitative Risk Assessment Applications

The quantitative risk assessment must be developed for the transport of dangerous goods by road to assess the possible risks as follows:

- Where no alternative comparable route is available, the restriction or required measures should be justified according to the principle of quantitative risk assessment in reference to a tolerable risk level which is accepted in the decision phase on the basis of the decision criteria and which, in a given context, in particular embraces justifiable ideals of society
- Where alternative routes are used the risk analysis should substantiate why this routing is considered as more favourable under aspects of risk, i.e.
    - usually on the basis of a qualitative comparison between the routes is not obviously illustrated that the proposed restrictions lead to a significant improvement of safety.
    - in other cases, a quantitative comparison of the risks inherent in the alternative routes.

Upon the competent authority request, the quantitative risk assessment shall be carried out by quantitative risk assessment expert has the relevant knowledge, proper experience in conducting a comprehensive quantitative risk assessment model (QRSM). Using computer calculations is an indispensable tool in order to rationally evaluate the risks, and the capability skills in using the international statistical data. The main objective of the risk assessment is identifying the route economically feasible for the stakeholders directly involved in the transport activities and pursue safe transport by minimizing risk throughout the whole transportation process.

8.3 Risk Indicators

The commonly used risk indicators in performing quantitative risk assessments (QRA) are individual risk and Societal risk which are of interest to the transportation of dangerous goods and routes comparison.

- **Individual risk**

Individual risk represents the risk at a given point. It corresponds to an annual likelihood for a person, who is assumed to be present, without protection, of dying due to the occurrence of an accidental phenomenon occurring in an installation or along a route which results in the release of a dangerous substance.

- **Societal risk**

Societal risk corresponds to an annual probability that at least N persons are simultaneously killed because of their presence within the impact area of an accidental phenomena within an installation or along a route which results in the release of a dangerous substance.

Societal risk can be represented as a frequency / severity curve (F/N curve). The frequency is the frequency of having accidents causing N dead or more. N is the number of dead and F the cumulative frequency of accidents with N or more deaths.

8.4 Quantitative risk assessment processes:

The risk assessment processes include three major steps namely Risk analysis, Risk estimation and Risk evaluation as shown in Figure 8.1. The risk analysis is required for the quantification of a certain risk related to the fields of application which has to be as objective and precise as reasonably achievable. The risk estimation is conducted to value the individual or societal risks which are assigned to all potential accident scenarios on the basis of specific data for dangerous goods transport capacity and route use. This "scientific" part is followed by an evaluation of the calculated risk level. If the risk level is below the tolerable risk level, the risk management process requires no further action. Otherwise the decision-making process and the risk treatment must be implemented.

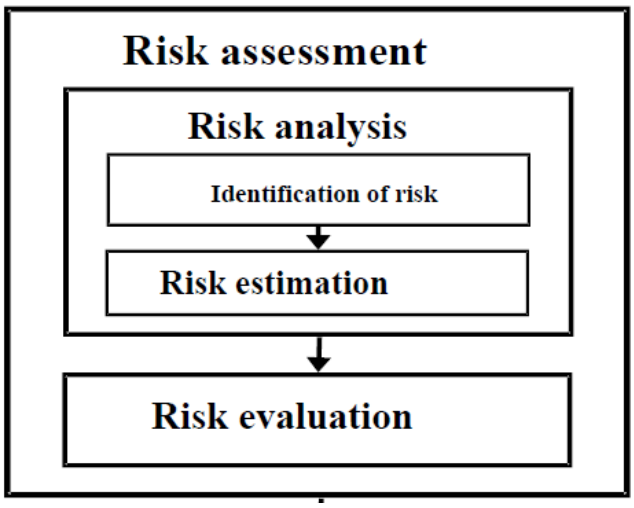


Figure 6-9: Risk Assessment Processes

8.5 Risk Analysis

8.5.1 Identification of Risk Parameters

The following parameters shall be considered to assess the individual risks as the probability of lethality at a given point:

- Frequency of occurrence of a dangerous incident (meaning prevention barriers failure), which depends on: loss of containment frequency, failure probability of the safety barriers

used to prevent/mitigate the dangerous incident, ignition probability in the case of release of flammable substances, weather conditions such as wind speed, and faction of combustion energy dissipated in the form of thermal energy (e.g. in case of BLEVE), etc.

- Specific effect probability (thermal, toxic, overpressure...),
- Probability of exposure to an effect. This parameter depends on the effect area, which is linked to weather conditions, environmental conditions (temperature, solar radiation), wind directions, probability of immediate/delayed ignition, fraction of combustion energy dissipated as thermal energy, etc.
- Probability of impact on health (lethal injury). The probability of getting killed by exposure to a dangerous phenomenon are related to the received dose (depending on the distance from the source). Lethality percentages are related to the distance from the source. In QRA studies, lethality probabilities are evaluated between the source and a maximum distance corresponding to a lethality threshold (often 1%).
- Presence of the individual which depends on presence distribution (day or night) and intermittent occupancy (festival, camping site, stadiums, etc.).

The following parameters shall be also considered to assess the societal risks

- Frequency of an accident which is related to a given dangerous phenomenon and to a given effect is the product of the frequency of occurrence of the dangerous phenomenon by the probability of an effect
- Severity evaluation to assess the severity of each accident (i.e. fatalities number). The fatalities number is calculated for each scenario, at each point of the effect area, with the number of exposed persons, the lethality probability and the presence probability if necessary.

8.5.2 Risk Analysis Implementation

Risk analysis is always connected with uncertainties of different origin. In comparing the risks posed by two alternative routes the main objective is to estimate whether there is significant advantage in using one or other of the routes, rather than to determine an absolute value of the level of risk. In this case, the risk estimation tool may contain only those elements of estimation which have a low level of uncertainty and which are relevant for estimating the risks of the routes concerned. The outcome of the risk analysis is information on the individual or societal risk of the transport situation under consideration. The risk analysis has to derive probabilities of accident scenarios and potential consequences connected with these accident scenarios.

8.5.3 Scenario Definition

The structure which is best suited for the classification of accident scenarios and also for the risk calculation itself is the **event tree concept** which is developed on the basis of a causal tree which

specifies the frequency of primary events in a systematic dimension which comprises the elements basic event, place of discharge, quantity discharged etc. Such a structure simplifies the calculation because of the clear overview and indicates the gradual process in the quantitative composition of the calculation. Figure 8.2 shows an example of an event tree.

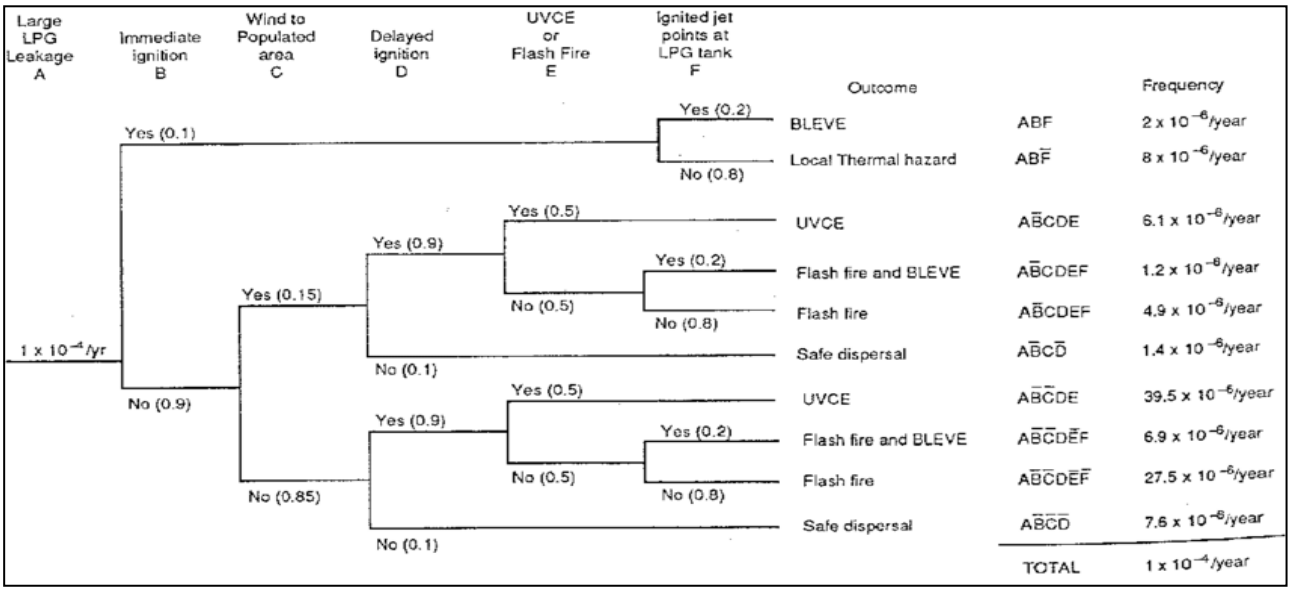


Figure 6-10: Example of an event tree for a road Large LPG Leakage

The following aspects have to be considered in event tree analyses for the carriage of dangerous goods (either for the definition of scenarios or for the risk analysis itself):

- **Vehicles and traffic:**

Data about the goods and the vehicles must be collected in order to obtain information about potential branching in the event tree and about the likelihood of events and scenarios.

- Types of goods transported
- Vehicle and tank types
- Specific safety measures and transport time (day/night)

- **Road network**:

The infrastructure must be considered in a risk analysis comprises the entire “system road network “including junctions with other modes of transport (railway crossings, tunnels, bridges, safety installations, pipelines etc.). Therefore, it is recommended to incorporate an examination of the infrastructure and to indicate the contributions to the risk. The required information also includes:

- Type of road (open-area, level section, road gradient, population density of residential areas, bridge, one-way traffic, oncoming traffic etc.),
- Speed limits,
- Safety installations (e.g. crash barriers, traffic lights, overpasses),
- Tunnel passages,
- Railway crossings.

➢ **Primary event**:

According to international best practice and ADR, the risk assessment considers only major accidents (and incidents with the potential to become major accidents). Relevant scenarios are:

- Collision,
- Rear-end collision,
- Overturning,
- Collision with other objects (railway crossings),
- Fire (similarly to an explosion or toxic release, a fire is also to be considered as a subsequent potential effect of other primary events)
- Sudden tank failure.

➢ **Scenario for discharge of substances**:

Since it is not conceivable to foresee all the cases of discharge of substances for every specific accident situation, it is possible in practice to lay down representative and agreed scenarios considering the difference between continuous and spontaneous discharge. In this case, the scenarios thus determined are taken into consideration as test scenarios which make a simplified assessment of consequences.

8.5.4 Statistical Data

As the domestic number of dangerous goods transport accidents is fairly low which limits the statistical significance of accident frequencies and of conditional probabilities within event tree branches, it is therefore highly recommended when deriving statistical data for risk analysis purposes to consider the following data:

- Information from international accident databases and
- Accident data of general goods transport.

The applicability of these statistics to the national individual dangerous goods transport scenario must be checked and the assumptions made for using them must be substantiated. Systematic differences between national accident statistics due to differences regarding roads, vehicles, freight quantity, minimum thresholds for the definition of accidents and other parameters should be considered.

8.5.5 Modelling Accident Consequences

Assume the event tree contained in Figure 8.2 ends with the discharge and, if applicable, the burning of the main substance LPG. For the derivation of harm (e.g. fatalities and injuries) further tracking of potential branching of event tree is necessary. Factors which affect the conditional probability of a certain sequence of events following a discharge of hazardous substances depend on the accident location and its surroundings.

Relevant information includes

- Population density in the area around the transport route (depending on time of day)
- Traffic density and probability of congestion (depending on seasons and times of the day),
- Nature and the use of the surrounding buildings and other infrastructures,
- Accessibility of the infrastructure for emergency services
- Atmospheric conditions (wind and temperature statistics) and
- Topography

Some parameters are only relevant for certain scenarios (e.g., wind statistics for discharge of gaseous toxic substances) whereas others are needed in all cases. Two geographical (topological) elements are crucial: Firstly, the distance to the built-up areas, secondly the population densities in all parts of the near surroundings in a grid appropriate for the area with significant impact (e.g., resolution 25 x 25 m to 100 x 100 m). Inventories of the types of buildings, including information about their usage, are helpful for calculating the presence of human beings (residential/industrial/ commercial areas, schools, hospitals, etc.).

The number of exposed people can be calculated as follows:

- In case of homogeneous population density in a zone the number of exposed persons is the product of this effects area by the density.
- If the density is not homogeneous, the effect area is divided into homogeneous meshes and the number of exposed persons is calculated for each mesh. It is important to count everyone. The impacted persons number cannot be divided by the number of meshes.
- In case of punctual targets, they are counted separately.

Relevant scenarios of impact on people and the environment are

- Explosion
- Fire (flash or pool)
- Atmospheric dispersion of toxic substances and
- Contamination of water and soil

In order to derive accident consequences for every scenario, **numerical or analytical models** have to be used to estimate the physical effects of each scenario (radiation, pressure, concentration of toxic substances, debris impact). Models used for risk estimation should be previously verified and compared with real scenarios or model benchmarks. In general, four types of harm or damage should be examined:

- People killed during or shortly after the accident
- People injured
- Damage to important buildings and structures
- Environmental pollution linked to the cargo discharged.

Concerning fatalities and injuries the damage to persons has to be estimated with the help of statistical and physiological models based on the estimated physical effects. There is still an unsatisfactory level of uncertainty in some of these models depending on the type of the consequences. Hence, a considerable part of the level of uncertainty in risk analysis has its origin in estimation of harm.

8.6 Risk Estimation

The risk estimation process includes the application of the event tree as well as physical and physiological models for the location under consideration. Calculated/estimated values of individual or societal risks are assigned to all potential accident scenarios based on specific data for dangerous goods transport capacity and route use.

For systematic risk estimation the transport route under consideration must be divided into different sections with a standard length in order to make risk values comparable to risk criteria. A typical reference length for the derivation of risk (per year) is 100 m to 1 km. When alternative routes are under consideration the total societal risk of every route is assessed for comparison. In this case, the risk of a route in relation to a reference length provides no additional information that can be used.

Individual risk is typically depicted by means of ISO-risk contours (e.g. fatalities per year and route length) on a map of the area under consideration to give information about the spatial distribution of risk irrespective of the real actual population density distribution as shown in Figure 8.3.

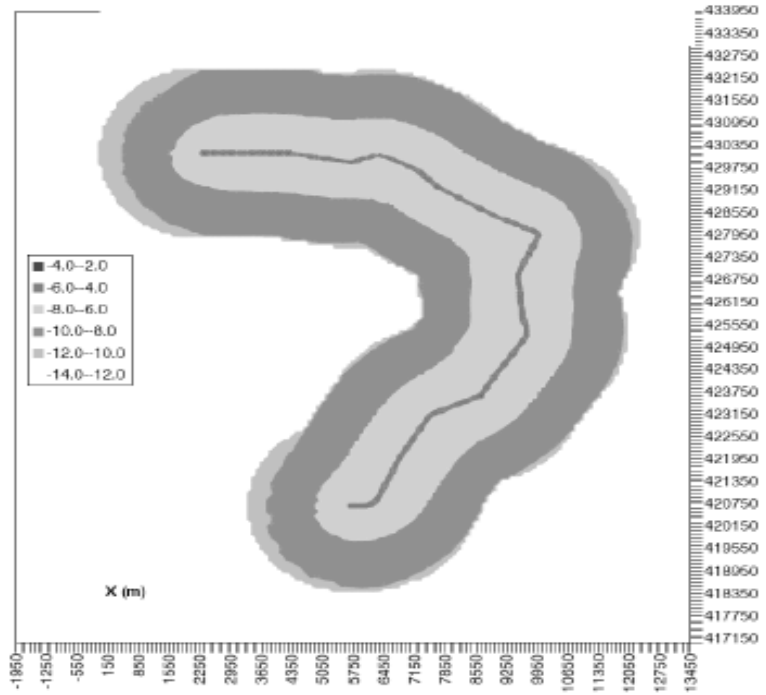


Figure 6-11: Example of ISO Risk Graphs of the Spatial Distribution of the Individual Risk

Societal risk is shown in form of a graph showing the relationship of harm (e.g. N people killed) to frequency F (often called F-N curve). In this case the population density distribution has to be considered. To plot F/N curves corresponding to a route, it is necessary to aggregate all the accidents along the route (occurring at different points x and leading to Nx deaths for each effect). The effects distances (circles for instance) for each dangerous phenomenon have to be moved along the route to cumulate the accidents. Figure 8.4 represents F/N curves of different scenarios that can occur on the same route.

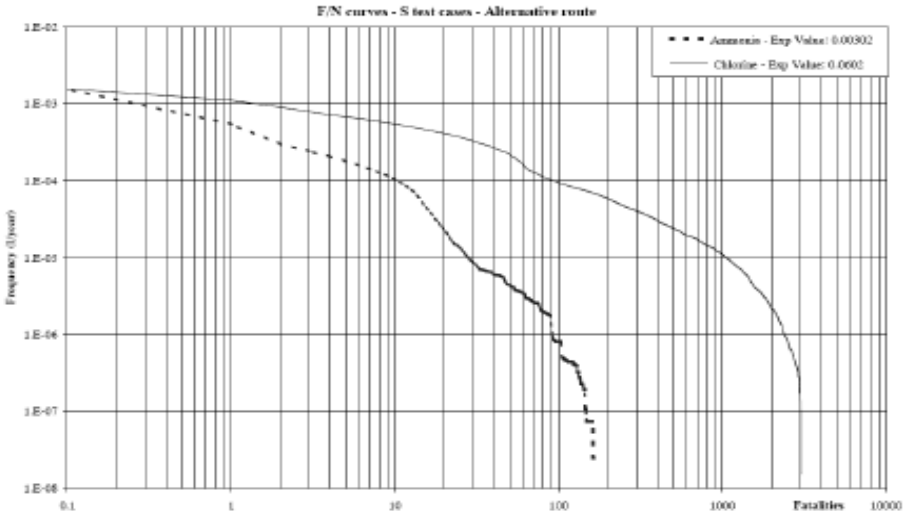


Figure 6-12: Example of an FN Graph for Societal Risk

Different routes can be compared to each other using F/N curves. When the F/N curves of the routes are represented on the same graph, if one of the curves is clearly "below" the other without crossing with any other curve, then the corresponding route presents the lowest societal risk.

In any other special case, a global indicator may be useful to choose the least risky route, in addition to socio-economic considerations.

8.7 Risk Evaluation

There are commonly used different approaches to risk evaluation at the national level due to specific parameters. These differences concern

- type of evaluated risk (individual, societal, environmental)
- level and shape of acceptance and tolerability limits
- areas/categories of acceptance and tolerability.

Each type of risk needs a risk criterion to evaluate whether a risk is tolerable. These risk criteria should be measured against risk criteria for comparable types of risk.

The as low as reasonably practicable (ALARP) principle in some countries such as UK, defines an area of unacceptable risk which implicates the need for risk treatment when risk analysis results fall into this area. The adjacent tolerability area with lower risk values leads to measures according to this principle whereas the acceptable area with even lower insignificant (residual) risk does not require any action by the competent authority.

In derogation from this the approach to risk evaluation in other countries such as Netherlands, does not contain an ALARP or transition area between tolerable and non-acceptable risks, but for societal risk it considers an additional differentiated risk aversion due to the different risk perception in an event with low probability and great damage and an event with high probability and small damage. It is also possible to restrict the risk evaluation to major damage and an additional disregard of accidents with a very low probability as shown in Figure 8.5.

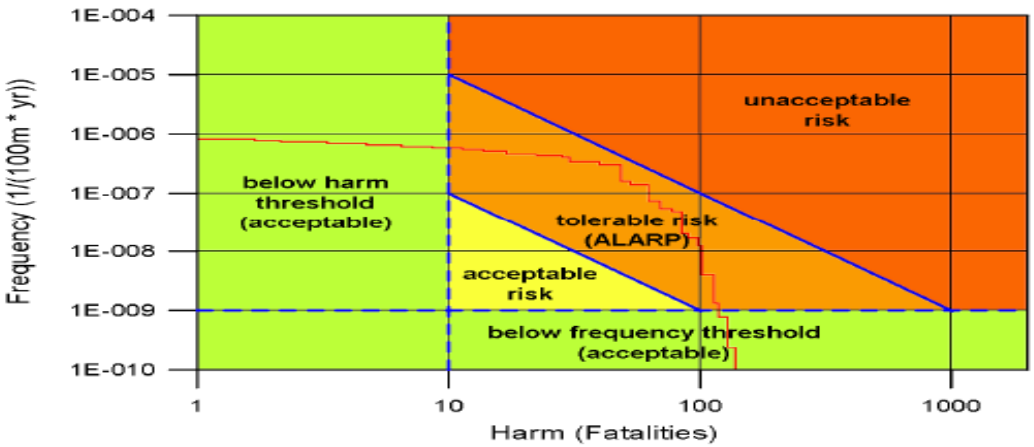


Figure 6-13: Example of an FN Graph for Societal Risk with Possible Areas for Risk Evaluation

For a useful risk evaluation based on fixed risk criteria it is crucial to aim at minimizing uncertainty. Particularly when restrictive measures are envisaged, transparent analysis and discussion of uncertainty within the evaluation process is advisable for the understanding and acceptance of the measures.

8.8 Risk Management

The risk evaluation provides information on whether an analysed situation corresponds to a tolerable risk or not. This evaluation takes place independently of the risk analysis phase. Nevertheless, the documentation should also contain information about the selection of measures and particularly about the definition of decision criteria outside the risk estimation itself.

It is straightforward to use the same methods and models as for the risk estimation for the comparison of the effectiveness of different potential measures. The effectiveness of measures includes aspects such as the potential for risk reduction and the cost to stakeholders.

A proper justification of measures increases the chance of their broad acceptance. It is advisable to check the risk management process periodically in order to consider changes in context or process.

9 GENERAL TRANSPORT PROVISIONS

The purpose of this chapter is to present general provisions for dangerous goods transportation in terms of loading and unloading, mixed packing and load as well as explosive and radioactive materials transport requirements, tunnel and parking restrictions and supervision of vehicles and the international transport restrictions.

9.1 General

The various requirements for transport, not least requirements for vehicles, packages, tanks, in bulk and containers should be set out. Generally, each item of equipment or packaging will be specified for the dangerous goods to be carried. For the specific provisions that apply to a certain business the services of a DGSA may be required.

9.2 Loading, Load Restraint and Uploading

Loading, unloading and handling operations apply to all packages and dangerous goods in bulk, including the placing (and subsequent removal from) of any container, bulk container, tank container or portable tank onto a vehicle. Operators involved in the transport of relatively small quantities of packaged dangerous Goods may take advantage of the various transport exemptions outlined in chapter 5.

➢ **Loading**

Checks prior to loading and transportation of dangerous goods must be carried out in all circumstances and if any of the following do not comply with the regulatory provisions, loading should not commence:

- Documentation.
- Vehicle and its load (from visual inspection of the vehicle itself), packaging, container, tank containers, bulk container, portable tank, etc.
- Driver (training certificate).
- Transport and safety equipment carried on the vehicle, including PPE.
- Loading equipment such as forklift, telehandler, liftgate, conveyor belt, hand pallet, etc. in good conditions.

➢ **Load Restraint**

Check the following:

- Orientation arrows on packages are pointing in the right direction.
- As far as possible liquids are loaded below dry goods.
- Load distribution – ensure weight is as evenly distributed as possible.

- Goods are protected while stacking and no over stacking.

All dangerous goods are secured to the vehicle: unsecured packaged goods must not be loaded on or in a vehicle or container. Packages can be secured to prevent movement by filling voids with dunnage, by use of strapping and/or by blocking and bracing. Goods should not move in any direction during normal transport conditions. When using straps take care not to damage or deform the package.

Figure 6-14: Secure Dangerous Goods to the Vehicle

Note: curtains on curtain-sided vehicles do not act as a means of load security unless specifically designed for that purpose.

➢ **Uploading**

Unloading must not be carried out if an inspection of the vehicle, driver, load, transport or safety equipment reveals deficiencies that might affect the safety or security of the unloading. Such deficiencies must be remedied before the commencement of unloading. In general, the operator must:

- Verify which goods are to be unloaded.
- Check security of load and for damage to packaging;
- Ensure that the uploading equipment such as forklift, telehandler, liftgate, conveyor belt, hand pallet, etc. are in good conditions
- Rescue dangerous goods not unloaded.

9.3 Mixed Packing Restrictions

Generally, different dangerous goods or dangerous goods and other non-dangerous goods may be packed together in combination packagings (together in the same package, i.e. inner packages contained within an outer package), provided that they do not react dangerously with one another.

Restrictions may apply to certain dangerous goods in relation to limitation on quantities. Decisions made in relation to mixed packaging should therefore always be verified by a DGSA.

ADR provides Mixed Packing (MP) provisions assigned to specific dangerous goods. According to the substance and which MP code(s) it is assigned to, the shipment of other non-dangerous goods within the same package as specific dangerous goods may be prohibited. For example, UN 1504, Sodium Peroxide, is assigned in the ADR Dangerous Goods List – Table A in column 9b with the code “MP2”. The meaning of these codes is explained as “Shall not be packed together with other goods”. This therefore prohibits any other goods in the package – including going so far as to prohibit even the inclusion of a paper instruction leaflet.

In case the column 9b does not contain a code starting with letters “MP” only the general packing requirements shall be applied.

There is in all the modes a general requirement that forbids any non-dangerous goods to be included in a package if those non-dangerous goods might react dangerously with the dangerous goods and cause:

- Combustion and/or evolution of considerable heat.
- Evolution of flammable, toxic or asphyxiant gases.
- The formation of corrosive substances.
- The formation of unstable substances.

So, for example, a receptacle of water should not be packaged in the same package as a receptacle of a Class 4.3 “Dangerous when Wet” substance, such as UN14043, Calcium Hydride, as such goods will give off flammable gases if wetted.

9.4 Mixed Load Restrictions

Mixed loading restrictions apply to certain dangerous goods. This means that packages of certain goods may not be loaded on to the same vehicle/container. This only affects Class 1 (explosive substances), and both Class 4.1 (flammable solids) and Class 5.2 (organic peroxides) if they have a secondary explosive hazard, i.e. Class 4.1(1) and Class 5.2(1). Such substances may not be loaded on to the same vehicle with other dangerous goods, and substances within these classes and in different compatibility groups may additionally not be permitted together in the same vehicle.

Because of the classes of goods involved, this restriction is likely to affect relatively few dangerous goods shipments. All other dangerous goods may be carried in one vehicle (e.g. gas cylinders with corrosive liquids and flammable solids, or any other combination falling outside the restriction).

Restrictions also apply to loads containing foodstuffs when toxic (Class 6.1) or infectious (Class 6.2) substances are carried. A DGSA should be consulted in relation to all load restrictions.

Technically, incompatible dangerous goods should not be transported together to avoid possible reactions between the dangerous goods or reduce the hazards of any accidental leakage or spillage. For incompatible materials, shared transportation may still be allowed if the materials are separated from each other by a minimum distance. The following dangerous goods segregation Table 9.1 provides the general values of segregation, and how to get necessary information to determine whether you should transport a hazardous material together with other hazardous materials.

Class or Division	1.3	1.4	1.5	1.6	2.1	2.2	2.3 Zone A	2.3 Zone B	3	4.1	4.2	4.3	5.1	5.2	6.1 PGI Zone A	7	8 Liquids
Explosives - 1.3	*	*	*	*	X		X	X	X		X	X	X	X	X		X
Explosives - 1.4	*	*	*	*	O		O	O	O		O				O		O
Very Insensitive Explosives - 1.5	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Extremely Insensitive Explosives - 1.6	*	*	*	*													
Flammable Gases - 2.1	X	O	X				X	O							O	O	

Non-Toxic, Non-Flammable gases - 2.2			X														
Toxic Gas Zone A - 2.3	X	O	X		X				X	X	X	X	X	X			X
Toxic Gas Zone B - 2.3	X	O	X		O				O	O	O	O	O	O			O
Flammable Liquids - 3	X	O	X				X	O					O		X		
Flammable Solids - 4.1			X				X	O							X		O
Spontaneously Combustible Materials - 4.2	X	O	X				X	O							X		X
Substances which, in contact with water, emit flammable gases - 4.3	X		X				X	O							X		O
Oxidizers - 5.1	X		X				X	O	O						X		O
Organic Peroxides - 5.2	X		X				X	O							X		O
Toxic Liquids PGI Zone A - 6.1	X	O	X		O				X	X	X	X	X	X			X
Radioactive Materials - 7			X		O												
Corrosive Liquids - 8	X	O	X				X	O		O	X	O	O	O	X		

Table 6-2: Dangerous Good Segregation

FOOTNOTES:

(X): These materials may not be loaded, transported, or stored together in the same transport vehicle or storage facility during the course of transportation. The hazard risks should be considered.

(O): These materials may not be loaded, transported, or stored together in the same transport vehicle or storage facility during the course of transportation **unless separated** from each other (Usually **>=3 meters**). However, Class 8 (corrosive)liquids may not be loaded above or adjacent to Class 4 (flammable) or Class 5 (oxidizing) materials except that the mixture of contents would not cause a fire or a dangerous evolution of heat or gas;

(*) Segregation among different Class 1 (explosive) materials is governed by the compatibility table. Exception: ammonium nitrate (UN 1942) and ammonium nitrate fertilizer may be loaded or stored with Division 1.1 (Class A explosive) or Division 1.5 (blasting agents) materials.

(Blank): The absence of any hazard class or division or a blank space in the table indicates that no restrictions apply.

The followings are general principles of dangerous goods segregation:

- Hazardous materials of the same class usually may be stowed/transport together (except incompatible subsidiary risks or dangerous chemical reactions).
- Strong acids are usually deemed as incompatible with strong alkali.
- Class 4.3 materials should be separated from all containers of aqueous (water containing) solutions even if the solutions are not dangerous goods.
- Class 5.2 organic peroxides and highly pyrophoric class 4.2 goods are highly reactive. They are recommended to be transported separately
- Class 6.1 toxic substances shall be separated from all foods or feeds.
- Some explosives (unstable,1.1 and 1.2), infectious substance (class 6.2) and radioactive materials (class 7) are usually deemed incompatible with all other dangerous goods.
- Class 9 dangerous goods are usually deemed compatible with all other dangerous goods.

9.5 Dangerous Goods Transport Requirements

The dangerous goods transport in Abu Dhabi Emirate must follow the GCC recommendations on preventative requirements for hazardous materials - Part 4 which is available in the website link **https://cdservices.moi.gov.ae/Protective_Precautions.pdf** in addition to the further requirements of the competent authority according to the dangerous goods classes as shown in Table 9.2:

Dangerous Goods Type	Class	Competent Authority
Explosive material and fireworks	1	Abu Dhabi Police General Command – Explosives Division
Radioactive material	7	Federal Authority for Nuclear Regulation (FANR)

Other Dangerous Goods	2,3,4,5,6,8 and 9	Abu Dhabi Civil Defense Authority
Hazardous Wastes	See chapter 11	Tadweer

Table 6-3: Dangerous Good Competent Authority

The following clauses present the transport requirements of each dangerous goods class as selective clauses from the GCC recommendations – Part 4 as well as the additional requirements of the competent authority.

9.5.1 Explosive Material and Fireworks Transport Requirements

The explosive material and fireworks transport must follow the followings:

1. Abu Dhabi Police General Command **–** Explosives Division requirements.

- The transport permits for the explosive materials and fireworks dangerous goods including the military escort for transport vehicles should be obtained from Abu Dhabi Police.
- The Abu Dhabi Police, represented by the Traffic and Patrol Directorate, is responsible for the preventive role of monitoring roads and enforcing the traffic federal law of 1995 and its executive regulations, including the editing of the violation of the transport of dangerous goods without a permit. Table 13.2 presents examples of common dangerous goods transport violations. The penalties fees addressing violation shall be stipulated in the national regulations by the relevant competent authorities in future to support the members of Traffic and Patrol Directorate to activate the role.
- It is strictly prohibited to transport explosives material and fireworks at bad weather periods (rainfall, fog, etc.).

2. GCC recommendations on preventative requirements for hazardous materials - Part 4 (Chapter 1 – Section 6 – Explosive Materials) as describe in the subsequent items A and B and could be obtained from the website link: **https://cdservices.moi.gov.ae/Protective_Precautions.pdf**.

A. Explosive Transport Vehicle Requirements

The following requirements are addressed in the GCC recommendations on preventative requirements for hazardous materials - Part 4 (Chapter 1 – Section 6 – Clause 5).

- A contingency plan for transporting explosives must be prepared in coordination with the competent authorities before carrying out the transfer process.
- The vehicle for transporting explosives must be licensed for the purpose by the Abu Dhabi Civil Defense Authority (Firefighting Section).
- Explosives must be transported in transport vehicles with a closed box of non-flammable and moisture-proof materials.

- All explosive transport vehicles must have a tight floor and all exposed metal parts inside the box must be clad with non-sparking materials.
- The explosives transport vehicle must be strong and able to transport the cargo easily, be in good mechanical condition and operate properly and properly, with the following checks being carried out on the vehicle's engine before loading
- All parts of the vehicle must be clean of any stuck oils or grease.
- The vehicle's fuel tank and the pipes connected to it must be intact and free of any deposits.
    - Vehicle brakes, lights, horns and front wipers must be in good condition.
    - All vehicle tires must be sound and filled with air.
    - All vehicle electrical wiring must be well fixed inside plastic tubes
- The vehicle must be equipped with two dry powder extinguishers with a capacity of 6 kg if the vehicle's load is less than 635 kg, and with a capacity of 9 kg when the vehicle's load is 635 kg and more.
- The fire extinguishers of explosives transport vehicles must be checked periodically by an authority approved by the Abu Dhabi Civil Defense Authority (Fire Department).
- The load of explosives transport vehicles must not exceed 75% of their prescribed carrying capacity.
- The vehicle must be clearly distinguished by the approved international signs and symbols system and HazChem Accidents Management System.
- It is strictly forbidden to transport explosives on any of the vehicles not designated for transporting explosives.
- The loading and unloading of explosives must be completed under the supervision of specialized experts and the preparation of personnel and equipment for emergency situations.
- Care must be taken while driving the vehicle, as well as during loading or unloading.
- It is prohibited to smoke, carry matches, any igniters, firearms, oxidizing or corrosive materials near the explosive’s vehicle.
- It is prohibited to transport explosives at night without prior approval by the competent authorities in this regard.
- The itinerary of the explosives transport vehicle must be determined in advance, in coordination with the competent authorities.

- It is prohibited to transport electric batteries, flammable materials, oxidizing materials or chemical solutions - and all the like - inside explosive vehicles.
- It is prohibited to transfer explosives from a broken vehicle to another within the boundaries of any region except after informing the competent authorities, provided that the transfer takes place under the supervision of explosives experts in such cases.
- It is forbidden to transport all types of detonating capsules (detonators) in the same vehicle for transporting explosives, and they must be transported in another vehicle with the same specifications approved for explosives transport vehicles.
- The explosives vehicle must be accompanied by two police cars, one in the front and the other in the back, at a distance of 50 meters from the vehicle.
- It is prohibited in all cases to stop the explosives vehicle in any public street near residential units, buildings, workplaces or gatherings before reaching the unloading site - except in emergency cases with notification of that.
- It is prohibited to leave the vehicle - without the presence and supervision of its driver or another assigned by the officials - in an area surrounded by a fence or wall where all its gates and entrances are closed, even if waiting in it is permitted.
- Explosives must be delivered to authorized persons in warehouses or approved temporary storage areas.
- The explosives transport vehicle must be equipped with warning lights in the front, rear and sides, with the need to operate it while transporting explosives.
- The driver of the explosives transport vehicle must be familiar with the following:
    - The dangers of transported explosives and ways of dealing with their accidents and facing their risks.
    - Primary firefighting methods.
    - Roads leading to the place to be reached.
    - How to contact officials and competent authorities in case of emergency.

B. Fireworks Transportation Requirements

The following requirements are addressed in the GCC recommendations on preventative requirements for hazardous materials - Part 4 (Chapter 1 – Section 6 – Clause 5).

- All fireworks transport operations must be subject to the requirements of the Abu Dhabi Civil Defense Authority (Firefighting Section).

- The safety and durability requirements must be available in the fireworks transport vehicle in accordance with the requirements of the Abu Dhabi Civil Defense Authority (Firefighting Section) - as stated in the requirements for transporting explosives (clause 9.5.1) and the requirements of the Technical Inspection Department of the Traffic Department.
- The driver of the vehicle must be professionally trained and familiar with the work assigned to him in order to be:
  - Aware of the danger of transported explosives and the threats associated with transport operations.
  - Familiar with the roads leading to the place to be reached.
  - Familiar with the primary methods of fighting fire.
  - Aware of how to contact officials in case of emergency and holds a general driving license.
  - Able to read and write and be at least 21 years old.
  - Familiar with traffic rules, passed the medical examination, sound in body and free from diseases and birth defects.
- The driver of the vehicle must be well acquainted and well trained in all technical matters related to the operation of the tanker, and he should have the power to move the tanker in emergency cases.
- The vehicle must be clearly distinguished by the international signs and symbols system approved by the Abu Dhabi Civil Defense Authority (firefighting) and the HazardChem Accidents Management System.
- The driver of the vehicle must avoid traffic jams and crowded places and adhere to the paths specified by the Traffic Department, and then deliver them directly to the concerned authority or persons.
- It is prohibited to stop the vehicle during the process of transporting fireworks in a place other than the intended destination, except in emergency cases.
- It is prohibited to transport any metallic or non-metallic tools that generate electrical charges, batteries or flammable materials within the transported fireworks sets

9.5.2 Radioactive Material Transport Requirements

In accordance with Federal Law by Decree No 6 of 2009, concerning the Peaceful Uses of Nuclear Energy, a licence is required to carry out activities involving ionizing radiation. Any business or governmental organization including entities operating in free zones, which possess, use,

manufacture, handle, store, import or export, transport and dispose of radioactive materials, X-ray generators or other sources of ionizing radiation must apply for a FANR licence".

The radioactive material transport must follow the followings:

1. The Federal Law, Decree No.6 of 2009 concerning the Peaceful Uses of Nuclear Energy
2. Basic safety standards for facilities and activities containing ionizing radiation other than those of nuclear facilities (FANR-REG-24).
3. Regulation of safe transport of radioactive materials (FANR-REG-13).
4. Regulation of radioactive sources security (FANR-REG-23).
5. Radiation Security Guidelines (FANR-RG-007).
6. Transport safety guidelines (FANR-RG-006).
7. GCC recommendations on preventative requirements for hazardous materials - Part 4 (Chapter 1 – Section 5 – Radioactive Materials) which could be obtained from the website link **https://cdservices.moi.gov.ae/Protective_Precautions.pdf**
8. Special / Additional Requirements from competent authority (FANR)

9.5.3 Other dangerous Goods Transport Requirements

The considered other dangerous goods are the followings:

- Flammable / Combustible Liquid.
- Liquefied Natural Gas (LNG).
- Liquefied Petroleum Gas (LPG).
- Compressed Gases.

These dangerous goods transport must follow the followings

1. GCC recommendations on preventative requirements for hazardous materials - Part 4 as follows:
   - Flammable / Combustible Liquid – Chapter 1, Clause 4.
   - Liquefied Natural Gas (LNG) - Chapter 2, Clauses 5 and 6.
   - Liquefied Petroleum Gas (LPG) - Chapter 3, Clauses 1 and 5.
   - Compressed Gases - Chapter 4, Clauses 1, 4 and 5.

   The considered clauses are presented in Appendix G.
2. The following laws, decisions and resolutions which could be obtained from the website link **https://cdservices.moi.gov.ae/Protective_Precautions.pdf**

- Federal Law No. 23 of 2006 regarding Civil Defense.
- Ministerial Decision No. 24 of 2012 regarding fees and fines.
- Ministerial Resolution 505 of 2012 regarding the executive regulations regulating civil defense services in the country.
- Ministerial Resolution 213 of 2017 regarding the organization of civil defense services.

3. Abu Dhabi Civil Defense Authority further requirements.

9.6 Tunnel Restrictions

The competent authority (DMT-ITC) shall assign the road tunnel to one of the tunnel categories defined in clause 9.6.1, when applying restrictions to the passage of vehicles carrying dangerous goods through tunnels. Account should be taken of the tunnel characteristics, risk assessment including availability and suitability of alternative routes and modes and traffic management considerations. The same tunnel may be assigned to more than one tunnel category, e.g. depending on the hours of the day, or the day of the week etc.

9.6.1 Tunnel Categorization

According to the international best practices, Tunnels are categorized using the letters A to E. This categorization assumes that there are three major dangers in tunnels which may cause numerous victims or serious damage to the tunnel structure:

- Explosions.
- Release of toxic gas or volatile toxic liquid.
- Fires.

The five tunnel categories are the following:

➢ **Tunnel category A:**

No restrictions for the carriage of dangerous goods.

➢ **Tunnel category B:**

Restriction for the carriage of dangerous goods which may lead to a very large explosion;

The following dangerous goods are considered based on the intrinsic dangerous properties of the goods, the type of containment and the quantity carried.

Class 1: Compatibility groups A and L.
Class 3: Classification code D (UN Nos. 1204, 2059, 3064, 3343, 3357 and 3379).

Class 4.1: Classification codes D and DT; and Self-reactive substances, type B (UN Nos. 3221, 3222, 3231 and 3232). Class 5.2: Organic peroxides, type B (UN Nos. 3101, 3102, 3111 and 3112).
When the total net explosive mass per transport unit is greater than 1000 kg: Class 1: Divisions 1.1, 1.2 and 1.5 (except compatibility groups A and L).
When carried in tanks: Class 2: Classification codes F, TF and TFC. Class 4.2: Packing group I. Class 4.3: Packing group I. Class 5.1: Packing group I. Class 6.1: UN No. 1510.

- **Tunnel category C:**

Restriction for the carriage of dangerous goods which may lead to a very large explosion, a large explosion or a large toxic release.

The following dangerous goods are considered based on the intrinsic dangerous properties of the goods, the type of containment and the quantity carried:

- The dangerous goods restricted in tunnel category B, and
- The following dangerous goods:

Class 1: Divisions 1.1, 1.2 and 1.5 (except compatibility groups A and L), and Division 1.3 (compatibility groups H and J). Class 7: UN Nos. 2977 and 2978.
When the net explosive mass per transport unit is greater than 5000 kg: Class 1: Division 1.3 (compatibility groups C and G).
When carried in tanks: Class 2: Classification codes 2A, 2O, 3A and 3O, and classification codes containing the letter T only or letter groups TC, TO and TOC. Class 3: Packing group I for classification codes FC, FT1, FT2 and FTC. Class 6.1: Packing group I, except UN No. 1510. Class 8: Packing group I for classification codes CT1, CFT and COT.

➢ **Tunnel category D:**

Restriction for the carriage of dangerous goods which may lead to a very large explosion, to a large explosion, to a large toxic release or to a large fire; The following dangerous goods are considered based on the intrinsic dangerous properties of the goods, the type of containment and the quantity carried :

- The dangerous goods restricted in tunnel category C, and
- The following dangerous goods:

Class 1: Division 1.3 (compatibility groups C and G). Class 2: Classification codes F, FC, T, TF, TC, TO, TFC and TOC. Class 4.1: Self-reactive substances, types C, D, E and F; and UN Nos. 2956, 3241, 3242, 3251, 3531, 3532, 3533 and 3534. Class 5.2: Organic peroxides, types C, D, E and F. Class 6.1: Packing group I for classification codes TF1, TFC and TFW and UN No.3507; and Toxic by inhalation entries for which special provision 354 is assigned in column (6) of Table A and toxic by inhalation entries of UN Nos. 3381 to 3390. Class 8: Packing group I for classification codes CT1, CFT and COT. Class 9: Classification codes M9 and M10.
Class 1: Division 1.3 (compatibility groups C and G). Class 2: Classification codes F, FC, T, TF, TC, TO, TFC and TOC. Class 4.1: Self-reactive substances, types C, D, E and F, and UN Nos. 2956, 3241, 3242, 3251, 3531, 3532, 3533 and 3534. Class 5.2: Organic peroxides, types C, D, E and F. Class 6.1: Packing group I for classification codes TF1, TFC and TFW and UN No.3507 as well as Toxic by inhalation entries for which special provision 354 is assigned in column (6) of Table A and toxic by inhalation entries of UN Nos. 3381 to 3390. Class 8: Packing group I for classification codes CT1, CFT and COT. Class 9: Classification codes M9 and M10.

➢ **Tunnel category E:**

Restriction for the carriage of all dangerous goods other than those for which '(-)' is marked in

Column (15) of Table A and for all dangerous goods in accordance with the provisions of clause 5.5 if the quantities carried exceed 8 tones total gross mass per transport unit.

9.6.2 Determine the Tunnel Category

A comprehensive study should be conducted by the competent authorities to determine the categories of national tunnels and suitability for dangerous goods transport and to provide the relevant signage on the approach to a tunnel accordingly. The following aspects should be considered along with the study stages:

- Road tunnel standard, i.e. vertical and horizontal alignment, reference speed, bidirectional, number of traffic lanes, reversible lanes, etc.
- The tunnel length including covered road outside the tunnel.
- The traffic flow as designed annual average daily traffic per tunnel. The traffic flow shall be increased according to the amount of heavy trucks flow through specific formulas.
- The traffic situation/possible traffic jams (daily or seasonal).
- The rescue capacity including evacuation strategies, resource availability, time of arrival, equipment availability, and tactical knowledge and preparation (including training) to respond to emergencies.
- The potential consequences of an accident (i.e. the tunnel is not situated just next to other densely populated areas or next to important societal services, e.g. a central power line).
- Implement suitable precautions regarding the protection of load bearing structures in case of a fire, separating components explosion load absorption capacity, installation of a fixed extinguishing system and declaration all vehicles transporting dangerous goods before entering the tunnel.

The quantitative risk assessment model (QRAM) and the decision support model (DSM) are commonly used in the implementation of extensive tunnel risk analysis as follows:

➢ **The quantitative risk assessment model (QRAM)**

A comprehensive quantitative risk assessment model (QRSM) is used to deal with both tunnels and the open road using computer calculations as an indispensable tool in order to rationally evaluate the risks. The model facilitates the implementation of proper assessment of the risks considering all kinds of dangerous materials, all possible meteorological conditions, all possible incidents, sizes of breaches, vehicles capacity (fully or partially loaded), and many other variables. Since all circumstances are impossible to consider, simplifications must be made.

The roles of quantitative risk assessment is briefly discussed in chapter 8.

➢ **The decision support model (DSM)**

The decision process is a complex procedure and a decision support model (DSM) using computerized tools is therefore required to ease and assist rational decision making. The attributes that could be evaluated and weighted by the DSM include:

- Injury and fatality risks to road users and the local population using the indicators from the QRAM. The DSM helps the decision maker to weight his concerns (for example, a risk-adverse decision maker considers one incident with 100 fatalities less acceptable than 100 incidents with one fatality in each).
- Material damage due to possible incidents in tunnels or detour routes.
- Environmental impact due to an incident in a tunnel or detour route. The environmental output from the QRAM is limited, giving only approximate indicators for environmental risk. The DSM can be expanded to accept more detailed environmental information.
- Direct expenses (investment and operational cost of tunnel risk reduction measures as well as possible additional costs in the transport of dangerous goods).
- Inconvenience to road users due to a possible incident (time lost during repair works after an incident in the tunnel).
- Nuisance to local population (environmental impact of dangerous goods traffic, with the exclusion of possible incident consequences, but possibly including psychological impact).

Any other attributes found relevant by the decision maker can also be included in the decision problem. In order to decide, the decision maker must determine all attributes that are relevant and how these attributes should be weighed against each other. These choices must reflect the preferences of the decision maker.

9.6.3 Provisions for Road Signs and Notification of Restrictions

The tunnel category, assigned by the competent authority to a given road tunnel for the purpose of restricting the passage of transport units carrying dangerous goods, is indicated by means of road signs. Table 9.3 indicates the categories and the corresponding letter which appears on the approach to a tunnel. Figure 9.2 gives an example of a sign (in this case a category C, which appears, for example, on the approach to a certain Tunnel).

Tunnel Category	A	B	C	D	E
Letter on Approach	No Sign, No Restrictions	B	C	D	E

Table 6-4: Road Signs for Restricting the Passage of Transport Units Carrying Dangerous Goods in Tunnels

Figure 6-15: Example of Road Sign for Restricting the Passage of Transport Units Carrying Dangerous Goods in Tunnels

All dangerous goods have a corresponding restriction code B, C, D, E, or a hyphen, indicated as '(-)'. When a hyphen is indicated instead of one of the restriction codes, the dangerous goods are not subject to any tunnel restriction (except for UN Nos. 2919 and 3331 – radioactive material).

Table 9.4 shows the dangerous goods restriction codes and thus identifies the tunnels that cannot be entered (when two letters are indicated, the first applies to carriage in tanks and the second applies to packaged goods). When carrying several different substances, **the dangerous goods with the most restrictive code dictate the restriction for the whole load** (e.g. for a mixed load of dangerous goods with tunnel restriction codes of B, C and D, the full load will have a restriction code B).

The tunnel category, assigned by the competent authority to a given road tunnel for the purpose of restricting the passage of transport units carrying dangerous goods, is indicated by means of road signs. Table 9.2 indicates the categories and the corresponding letter which appears on the approach to a tunnel. Figure 9.2 gives an example of a sign (in this case a category C, which appears, for example, on the approach to a certain Tunnel).

Restriction Code of the Whole Load*	**Restriction**
_	Passage allowed through all tunnels
B	Passage forbidden through B, C, D and E
C	Passage forbidden through C, D and E
D	Passage forbidden through D and E
E	Passage forbidden through E
B / D	Tank carriage: Passage forbidden through tunnels of category B, C, D and E

	Other carriage (e.g. packages): Passage forbidden through tunnels of category D and E
B / E	Tank carriage: Passage forbidden through tunnels of category B, C, D and E Other carriage (e.g. packages): Passage forbidden through tunnels of category E
C / D	Tank carriage: Passage forbidden through tunnels of category C, D and E Other carriage (e.g. packages): Passage forbidden through tunnels of category D and E
C / E	Tank carriage: Passage forbidden through tunnels of category C, D and E Other carriage (e.g. packages): Passage forbidden through tunnels of category E
D / E	Bulk or tank carriage: Passage forbidden through tunnels of category D and E Other carriage (e.g. packages): Passage forbidden through tunnels of category E

* Dangerous Goods with a tunnel restriction code '(-)' means no restrictions (except for UN Nos. 2919 and 3331).

Table 6-5: Dangerous Goods Restriction Codes for Tunnels

9.7 Parking Restrictions and Supervision of Vehicles

The vehicles with certain quantities of particular classes of dangerous goods must be:

- Supervised at all times, or
- If unsupervised, parked in a secure depot.

When parking restrictions are required and when the above provision cannot be met, then the following provisions will apply in order of preference after the vehicle has been properly secured:

- A vehicle park supervised by an attendant who must be notified.
- A public or private park in a safe position.
- A suitable open space away from traffic, houses and people.

As the parking provisions only apply to certain dangerous goods and in certain quantities, column 19 of Table A of ADR shall be consulted as well as the DGSA clarifications.

For example:

The restriction above applies to petrol in packages (e.g. drums or IBCs) of ≥ 10,000 kg, or in tanks when ≥ 3,000 litres is carried. However, in accordance with ADR, these restrictions do not apply to any quantity of diesel or kerosene.

It should be noted that general health and safety legislation and security provisions should always be taken into consideration when leaving vehicles containing any dangerous goods unattended and appropriate procedures employed.

9.8 International Transport Restrictions

The carrier owned dangerous goods vehicles engaged in the international carriage of dangerous goods by road must obtain the additional provisions by the competent authorities in other emirates or countries, provided that those provisions do not conflict with the national regulations. The carrier must ensure that these provisions are properly presented in the transport and may be in instruction in writing documents as well as proper awareness of driver, vehicle crew and DGSA. The followings are examples of additional provisions:

- Additional safety requirements or restrictions concerning vehicles using certain structures such as bridges or tunnels, vehicles using combined transport modes such as ferries or trains, or vehicles entering or leaving ports or other transport terminals.
- Requirements for vehicles to follow prescribed routes to avoid commercial or residential areas, environmentally sensitive areas, industrial zones containing hazardous installations or roads presenting severe physical hazards.
- Emergency requirements regarding routing or parking of vehicles carrying dangerous goods resulting from extreme weather conditions, accident, industrial action, civil disorder or military hostilities.
- Restrictions on movement of dangerous goods traffic on certain days of the week or year.

10 DOCUMENTATION

The chapter provides general documentation requirements in the dangerous goods transportation including the transport document list, large container or vehicle packing certificate, instructions in writing and record keeping.

10.1 General

Documentation is an important aspect of the transport of dangerous goods. Vital information on the dangerous goods carried, verification of driver qualifications and emergency information is central to the documentation which must be in place during transport operations.

The use of electronic data processing (EDP) or electronic data interchange (EDI) techniques as an aid to or instead of paper documentation could be permitted, subject to the competent authorities' approval, provided that the procedures used for the capture, storage and processing of electronics data meet the legal requirements as regards the evidential value and availability of data during transport in a manner at least equivalent to that of paper documentation.

When the dangerous goods transport information is given to the carrier by EDP or EDI techniques, the consignor shall be able to give the information to the carrier as a paper document, with the information in the sequence required.

10.2 Documentation List

The following documents must be carried on the transport unit:

- The transport document detailing all the dangerous goods carried.
- The large container or vehicle packing certificate; when appropriate.
- The instructions in writing.
- Means of identification, which include a photograph, for each member of the vehicle crew.
- The following documents shall be carried out on the transport unit upon the request of relevant authority:
    - The annual vehicle certificate of approval.
    - The driver's training certificate.
    - A copy of any exemptions, approvals or Multilateral Agreements (MLAs), as appropriate.

The DGSA consultation is requested if the requirement for particular documentation, or of the information to be provided in such documentation are uncertain.

10.3 Transport Document

The transport document must be provided by the consignor, and must set out the following information for each dangerous substance, material or article carried:

a) The safety data sheets for the carried load.

b) The UN number preceded by the letters "UN".

c) The proper shipping name (PSN) supplemented, when applicable, with the technical name in brackets.

d) The hazard label model numbers given in Column (5) of Table A in ADR Chapter 3.2 or, when multiple hazard label model numbers are given, the numbers following the first one must be given in brackets.

e) Where assigned, the packing group for the substance, which may be preceded by the letters "PG" (e.g. "PG II").

f) The number and a description of the packages when applicable. UN packaging codes may only be used to supplement the description of the kind of package (e.g. one box (4G)).

NOTE: It is not required to indicate the number, type and capacity of each inner package in a combination packaging.

g) The total quantity of each item of dangerous goods bearing a different UN number, proper shipping name or, when applicable, packing group (as a volume or as a gross mass, or as a net mass as appropriate).

NOTE 1: In the case of intended application of “small load” exemptions (see clause 5.3), the total quantity of dangerous goods for each transport category must be indicated on the transport document.

NOTE 2: For specified dangerous goods in machinery or equipment, the quantity indicated must be the total quantity of dangerous goods contained therein in kilograms or litres as appropriate.

h) The name and address of the consignor.

i) The name and address of the consignee(s). With the agreement of the competent authorities of the countries concerned with the carriage, when dangerous goods are carried to be delivered to multiple consignees who cannot be identified at the start of the carriage, the words "Delivery Sale" may be given instead (See clause 5.4).

j) A declaration as required by the terms of any special agreement.

k) Where assigned, the tunnel restriction code given in Column (15) of Table A of ADR, in capitals within parenthesis. The tunnel restriction code need not be added in the transport document where the carriage is known beforehand not to pass through a tunnel with restrictions for carriage of dangerous goods (See clause 9.7).

The location and order in which the elements of information required appear in the transport document is left optional, except that (a), (b), (c), (d) and (j) must be shown in the order listed above (i.e. (a), (b), (c), (d), (j)) with no information interspersed. The information required on a transport document shall be legible.

Examples of such permitted dangerous goods descriptions are:

"UN 1098 ALLYL ALCOHOL, 6.1 (3), I, (C/D)" or

"UN 1098, ALLYL ALCOHOL, 6.1 (3), PG I, (C/D)"

Table 10.1 provides an example of how such transport documents are laid out.

(Competent Authority Name) transport document **Consignor: Company XYZ** **Address: A Road, Town, County** **Date: dd/mm/yy**		
Dangerous goods description:	**No. of packages/type**	**Total quantity**
UN1134, chlorobenzene, 3, PG III, (D/E)	20 x 200-liter plastic drums (1H2)	4,000 liters
UN1760, corrosive liquid, N.O.S. (contains sodium hydroxide), 8, PG III, (E)	10 X 10-liter plastic drums (1H1)	100 liters
Consignee(s): Company ABC Address: A Road, Town, County		

Table 10-1: Example of Dangerous Goods Transport Document

Note 1: When availing of the small load exemption, Section 5.3, the **total quantity of each transport category** must be indicated.

Note 2: It is recommended as good practice to include, where relevant, the **packaging material,** (e.g. steel, aluminum, plastics, plywood, fiberboard, etc.).

10.3.1 Special Provisions

- ***For Wastes:***

If waste containing dangerous goods (other than radioactive wastes) is being carried, the proper shipping name shall be preceded by the word "WASTE", unless this term is part of the proper shipping name, e.g.:

"UN 1230 WASTE METHANOL, 3 (6.1), II, (D/E)", or

"UN 1230 WASTE METHANOL, 3 (6.1), PG II, (D/E)".

- ***For Salvage Packagings and Salvage Pressure receptacles:***

When dangerous goods are carried in a salvage packaging or salvage pressure receptacle, the words "SALVAGE PACKAGING" or "SALVAGE PRESSURE RECEPTACLE" shall be added after the description of the goods in the transport document.

- ***For Empty means of Containment, Uncleaned:***

  - For empty means of containment, uncleaned, which contain the residue of dangerous goods of classes other than Class 7, the words "EMPTY, UNCLEANED" or "RESIDUE, LAST CONTAINED" shall be indicated before or after the dangerous goods description.

  - For empty packagings, uncleaned, which contain the residue of dangerous goods of classes other than Class 7, including empty uncleaned receptacles for gases with a capacity of not more than 1 000 liters, the particulars are replaced with "EMPTY PACKAGING", "EMPTY RECEPTACLE", "EMPTY IBC" or "EMPTY LARGE PACKAGING", as follows: "EMPTY PACKAGING, 6.1 (3)".

  - For empty packagings, uncleaned, having contained goods of Class 3 carried together with empty packagings, uncleaned, having contained goods of Class 8 with a Class 6.1 subsidiary risk may be referred to in the transport document as:

    "EMPTY PACKAGINGS, WITH RESIDUES OF 3, 6.1, 8".

  - For empty means of containment other than packagings, uncleaned, which contain the residue of dangerous goods of classes other than Class 7 and for empty uncleaned receptacles for gases with a capacity of more than 1 000 liters, the particulars are preceded by "EMPTY TANK-VEHICLE", "EMPTY DEMOUNTABLE TANK", "EMPTY TANKCONTAINER", "EMPTY PORTABLE TANK", "EMPTY BATTERY-VEHICLE", "EMPTY MEGC", "EMPTY MEMU", "EMPTY VEHICLE", "EMPTY CONTAINER" or "EMPTY RECEPTACLE", as appropriate, followed by the words "LAST LOAD:" as follows

    "EMPTY TANK-VEHICLE, LAST LOAD: UN 1098 ALLYL ALCOHOL, 6.1 (3), I, (C/D)" or

    "EMPTY TANK-VEHICLE, LAST LOAD: UN 1098 ALLYL ALCOHOL, 6.1 (3), PG I, (C/D)".

  - When empty means of containment, uncleaned, which contain the residue of dangerous goods of classes other than Class 7, are returned to the consignor, the transport documents prepared for the full-capacity carriage of these goods may also be used. In such cases, the indication of the quantity is to be eliminated (by effacing it, striking it out or any other means) and replaced by the words "EMPTY, UNCLEANED RETURN".

10.4 Large Container or Vehicle Packing Certificate

If the carriage of dangerous goods in a large container precedes a voyage by sea, a container packing certificate conforming to Section 5.4.2 of the IMDG Code must be provided with the transport document. The functions of the transport document and of the container packing certificate may be incorporated into a single document. If not, these documents must be attached

one to the other. If these functions are incorporated into a single document, the inclusion in the transport document of a statement that the loading of the container has been carried out in accordance with the applicable mode regulations together with the identification of the person responsible for the container packing certificate will be sufficient.

NOTE: *The container packing certificate is not required for portable tanks, tank containers and MEGCs.*

Table 10.2 provides an example for the declaration in a multi-mode transport document:

CONTAINER/VEHICLE PACKING CERTIFICATE I hereby declare that the goods described above have been packed/loaded into the container/vehicle identified above in accordance with the applicable provisions of ADR/IMDG Code 5.4.2
MUST BE COMPLETED AND SIGNED FOR ALL CONTAINER/VEHICLE LOADS BY PERSON RESPONSIBLE FOR PACKING/LOADING
Name of company
Name/status of declarant
Place and date
Signature of declarant

Table 10-2: Example for Declaration in a multi-mode Transport Document

10.5 Instruction in Writing

A copy of the instructions in writing must be supplied by the carrier to the vehicle crew in a language understood by the driver and crew. This document is commonly referred to as the TREM card (transport emergency card) and must be kept readily available in the cab of the vehicle.

These instructions state the dangerous goods hazard characteristics, set out emergency actions to be performed by the driver/crew, , provides additional guidance and list the general and personal equipment to be carried on a vehicle.

Before the start of the journey, the members of the vehicle crew must inform themselves of the dangerous goods loaded and consult the instructions in writing for details on actions to be taken in the event of an emergency.

The followings are set of instructions in writing concerning the actions to be taken by the vehicle crew in the event of an accident or emergency that may occur during carriage:

- Apply the braking system, stop the engine and isolate the battery by activating the master switch where available.
- Avoid sources of ignition. In particular, do not smoke, or use electronic cigarettes or similar devices or switch on any electrical equipment.
- Inform the appropriate emergency services, giving as much information about the incident or accident and substances involved as possible.
- Put on the warning vest and place the self-standing warning signs as appropriate.
- Keep the transport documents readily available for responders on arrival.
- Do not walk into or touch spilled substances and avoid inhalation of fumes, smoke, dusts and vapours by staying up wind.
- Where appropriate and safe to do so, use the fire extinguishers to put out small/initial fires in tyres, brakes and engine compartments.
- Fires in load compartments shall not be tackled by members of the vehicle crew.
- Where appropriate and safe to do so, use on-board equipment to contain spillage and to prevent leakages into the aquatic environment or the sewage system.
- Move away from the vicinity of the accident or emergency, advise other persons to move away and follow the advice of the emergency services;
- Remove any contaminated clothing and used contaminated protective equipment and dispose of it safely.

Additional guidance to the vehicle crew on the hazard characteristics of dangerous goods by class and on actions subject to prevailing circumstances is shown in Appendix B.

Additional guidance to the vehicle crew on the hazard characteristics of dangerous goods, indicated by class / marks and on actions subject to prevailing circumstances is shown in Appendix B.

Equipment for personal and general protection to carry out general actions and hazard specific emergency actions to be carried on board the transport unit are shown in clause 4.4.1

10.6 Transport Equipment Inspection Certification

All transport equipment including vehicles, tanks, tank-containers, portable tanks, demountable tanks, tank swap bodies, tube trailers, bulk containers, intermediate bulk containers, containers, packaging, packages, receptacles and aerosols, and any other item, used in the carriage of dangerous goods by road should be subjected to regular general inspections (e.g. visual inspection prior to filling, packing, loading and vehicle safety equipment checks etc.). Certain transport

equipment may require certification and may also be subject to periodic inspection as requested by competent authorities. All inspection and certification regimes must be in accordance with national legislation. Inspection may only be carried out by competent persons and in some instances this work may only be performed by accredited inspection bodies.Table 10.3 provides some typical examples of certification and mandatory inspection requirements.

Transport equipment	Certification	Periodic inspection
Packaged goods vehicles, vans/trucks	None (except for vehicles carrying explosives)	None (except for vehicles carrying explosives)
Certain trucks and trailers (transporting tanks)	Initial type approval	Annual vehicle approval certification
Packaging (boxes/drums etc)	Test report from manufacturer/supplier	None (note: plastic containers have a limited shelf life, typically 5 years)
IBCs	Test report from manufacturer/supplier	Inspection every 2.5–5 years (metal/rigid plastics and composite)
Bulk containers	In accordance with national regulations or ADR	In accordance with national regulations or ADR
Tanks	Type approval from manufacturer/supplier	Inspection every 2.5–3 and 5 6years as appropriate

Table 10-3: Example of Certification and Mandatory Inspection Requirements

Certain vehicles (trucks and trailers) are required to undergo an annual technical inspection, which is in addition to the annual roadworthiness test and must be conducted at centres approved by competent authorities There are two types of certificates issued: “National” for vehicles used exclusively in the Emirate and “International” for vehicles used for international transport, i.e. travelling in other GCC Member countries.

10.7 Record Keeping

Records and documentation are part of business, but some must be kept as requested by competent authorities. Table 10.4 gives examples of documents which must be retained by businesses involved with the carriage of dangerous goods.

Document	Participant responsible	Retention period
Transport documents	Consignor and carrier	Three months
Training records	All employers	Duration of employment plus one year
Annual report (DGSA)	Consignor and carrier	Five years
Vehicle certification	Carrier/operator	Period of use
Tanks certification	Operator	Period of use
Packaging certification (available on request from packaging manufacturer)	Consignor	Period of use
Packaging test reports	Consignor	Until the next test report is issued

Table 10-4: Example of Retained Documents in Carriage of Dangerous Goods.

11 HAZARDOUS WASTE HANDLING AND TRANSPORT

The purpose of this chapter is to present the hazardous wastes handling and transport requirements in terms Consignor and Carrier responsibilities, collection and packing of hazardous wastes, general conditions and labelling of vehicle transporting hazardous wastes, hazardous waste management and the application for hazardous wastes disposal.

11.1 General

Hazardous waste is defined as a waste or a combination of wastes which because of its quantity, concentration, physical, or chemical characteristics may pose a substantial or potential threat to human health or the environment when improperly treated, stored, disposed, transported, or otherwise managed.

Some important types of hazardous wastes are nuclear waste, industrial waste, medical waste, universal waste, and construction waste. Such wastes can be solids, liquids, sludge, or gases. Hazardous wastes are often by-products of chemical production, manufacturing and other industrial processes such as oil-based paints, surface treatment, fluorescent light bulbs and ballasts, lead-acid vehicle batteries, and even discarded commercial products like cleaning fluids or pesticides. Improper and inadequate storage, transportation, treatment, or disposal operations can result in contaminating surface and groundwater supplies.

These wastes are classified based on their biological, chemical, and physical properties and generate materials that are either toxic, reactive, ignitable, corrosive, infectious, or radioactive and can be treated by chemical, thermal, biological, and physical methods.

Historically, hazardous wastes that were disposed of in regular landfills led to the leachate contamination of the ground and entering natural hydrologic systems. Many landfills now require countermeasures against groundwater contamination.

Currently, hazardous wastes must often be treated, stabilized and solidified before the final disposal in a landfill. Most flammable materials can be recycled, e.g., into industrial fuel. Many hazardous wastes can be recycled to new products e.g., lead acid batteries or electronic circuit boards.

Import of hazardous waste to Abu Dhabi Emirate from other emirates for the purpose of disposal is **prohibited**. Import of hazardous wastes to the Emirate of Abu Dhabi for the purpose of reuse, recycling or treatment require a permit from Abu Dhabi Centre of Waste management (WMC). Export of hazardous waste to other emirates for reasons other than disposal must have a prior written approval from the competent authorities of the other emirates

11.2 Consignor and Carrier Responsibilities

The hazardous waste generator (Consignor) is responsible for

- Issue the E-manifest through BOLISATY system as per WMC requirement.

- Implement the E-manifest through BOLISATY system as per WMC requirement.
- Obtaining permit for disposal of hazardous waste from the competent authorities. The original documents must be handed to the Supervisor at the disposal site/ waste treatment facility upon delivery of the waste loads.
- Ensuring that the waste materials are properly packed and marked.
- Providing the appropriate documents to the hazardous waste carriers.
- Ensuring that the risk of untoward incident which can arise during transport shall be minimized and shall not cause any form of pollution or environmental damage.

The hazardous waste transporter (carrier) is responsible for:

- Obtaining a “Waste management Permit” from the competent authorities and add the relevant hazardous waste transport activity (ies) as per the type (s) of hazardous waste (s) to be transported, and complying with all applicable regulations,
- Obtaining the annual permit for each vehicle intended for use in transporting hazardous waste,
- Providing all vehicles used for transportation of hazardous waste with an electronic system to track vehicles route (see clause 12.6),
- Ensuring that the drivers and the vehicle crew are trained to handle/transport hazardous waste
- Selecting the routes avoiding dense residential areas, and to arrange supervision during parking.
- Ensuring that the driver of a vehicle has all necessary documents for the load,
- Ensuring that the drivers and the vehicle crew are provided with personal protective equipment (PPE) and emergency response kits in case of spillage and leakage of hazardous waste, and
- Ensuring that safety measures are considered during loading of the wastes, transportation, and unloading at the end-point, including the cleaning of the vehicle afterwards.

11.3 Labelling of Vehicle and Package

All vehicles transporting hazardous waste shall be labelled with placards on both sides and rear. The placard must be marked with relevant hazard symbol and word identifying the load (see chapter 4). During the transportation of hazardous wastes such as chemicals, the appropriate warning labels should be on every single package. Only one danger class label should normally be fixed on a package. However, if the substance or article presents more than one significant risk,

such as fire and poisoning, the package should bear labels indicating the primary and the other secondary risks.

11.4 Collection, Handling and Transport of Hazardous Waste

There is always a risk of spillage and leakage during the transport of hazardous waste. When incompatible substances mix with each other there is a possibility of a chemical reaction, which can produce enough heat and vapours to cause fire or explosion and can release dangerous gases.

To prevent spillage and leakage of hazardous waste, the following conditions should be followed:

- Hazardous waste should be properly packaged.
- Handling (loading, unloading, etc.) should be done with prior reference to the labelling of the contents. Handlers should use appropriate personal protection equipment (PPE).
- Careful verification of the condition of load to prevent any reaction during handling and transport.
- Careful verification of valves and connections to prevent any leakage.

To prevent of risk of any accident, following conditions should be followed:

- Vehicles carrying hazardous wastes should not be left to stand unattended.
- The connection of the vehicle and container should be connected or secured properly so that it does not run loose,
- Any previous spillage in the vehicles or containers should be cleaned prior to putting new load of hazardous waste.
- Only experienced and trained drivers shall responsible to transport and drive any hazardous waste vehicles.

11.5 General Conditions of Transport of Hazardous Waste

- Hazardous waste must be transported in a secured and safe manner. The vehicle and waste containers must be sealed completely so that no leakage would occur during transportation.
- Two or more kinds of incompatible wastes shall not be loaded together in a single vehicle. Incompatible wastes are those materials that when mixed there would be a risk of violent reaction or fire, generate a harmful gas, or render the materials more dangerous to deal with.
- Hazardous waste shall be disposed only in an approved site or facility as specified in the waste disposal approval.
- In case of a road accident, the driver or operator must notify the competent authorities immediately within few (2) hours stating the location and nature of the accident.

- Vehicles used for transportation of hazardous waste must have specific requirement as per different waste categories which are discussed in chapter 12.

- At all time, all waste transport vehicles must carry emergency response equipment and safety provisions to manage any accidents or spills involving hazardous waste. The equipment shall include but not limited to the following: safety gloves, boots, cover-all attire, scooping tools or spade, absorbent materials, rigid plastic or metal containers with lid, spare sacks of appropriate material and appropriate fire extinguishers.

11.5.1 List of Specific Handling Requirements of Different Categories of Wastes

According to the Federal Law (No.) 24 of 1999 and modified by Federal Law (No.) 11 for 2006 regarding Protection & Development of the Environment as well as the Executive Order of Federal Law No. 24 of 1999 for Regulation of Handling Hazardous Materials, Hazardous Wastes and Medical Wastes, issued by Cabinet Decree No. 37 of 2001, the **Waste Management Department in Dubai** provided the following List of specific handling requirements of different categories of wastes in the Technical Guideline No.11

- **Category A: Acid, Alkali or Corrosive Waste**

These substances can attack and corrode many materials, for example, cloth, paper and several metals. Decomposition often produces heat and gases, and in some cases extremely flammable hydrogen gas. The choice of a packing material and loading should be carefully planned, because it can be some time before the consequences of corrosive effects are visible. The choice of durable packing material is important in preventing accidental spillage.

Accidental mixing of different corrosive materials can lead to violent reactions, which may give off large amounts of gases. Therefore, each package of such chemicals must be separately labelled by the waste generator and the SDS of the chemicals should be available with the vehicle's driver.

- ***Category F: Flammable wastes***

Flammable Wastes pose a significant risk of fire and explosion. Many flammable liquids can be charged with static electricity. Containers should have an earthing connection to avoid static charge builds up. Some flammable wastes have more than one hazardous property. It can be both flammable and toxic or can be both flammable and corrosive as well as oxidizing.

Package containers of flammable liquids should be well ventilated to reduce vapor concentrations, free of any ignition sources and such flammable wastes should be stored in temperature controlled and dry place. Carriers (Transporters) should be aware of all the hazards (fire/explosion, health, chemical reactivity) of the materials. Safety Data Sheets (SDS) of the chemicals should be available with the vehicle's driver.

- ***Category G: Reactive waste***

Transportation of such waste involves high amount of risk. Therefore, the transportation of reactive waste is must handled and transported by competent authorities only.

➢ ***Category H -1: Clinical waste***

Clinical or health-care waste contains potentially harmful microorganisms which can infect human. These wastes pose high health risks through the release of pathogens and toxicity characteristic of these wastes. The collection, handling and transport require special procedures to prevent these hazards. For transportation of clinical waste, waste transporters must ensure the followings:

- The medical waste must be packed securely in yellow bag, strictly following the specifications as per UN No. 3291.
- All staff handling bags of medical waste should be well trained on handling procedures which includes but not limited to the followings.
    - Understanding the special problems related to handling of all types of medical wastes including used sharps.
    - Checking of bags if securely sealed.
    - Handling bags by neck only.
    - Identification of waste by bag colour and ensure that the origin of the waste is clearly marked on the bag.
    - Checking the integrity of the seal of the bags when movement is complete.
    - Knowing the procedure in the case of accidental spillage and to report promptly such incidents.
    - Be aware that such wastes should not be re-bagged, except under supervision by a Senior Medical Staff, in the event of a bag failure.
    - The carrier (transporter) shall ensure that concerned staffs are aware of the proper colour (YELLOW) coding for medical waste specified in the Code and shall not remove or handle waste which is improperly bagged.
- Staff handling medical waste should be provided with heavy-duty gloves, industrial apron or leg protectors and industrial “Wellington” boots or equivalent type. Emergency personal protective (PPE) outfits must be available at all times in the transport vehicle for emergency spill response. These (PPE) outfits must include suitable overalls, masks, disposable gloves and eye protectors googles.
- Medical waste in bags must be transported in closed containers and air-cooled vehicles.
- A full course of anti-tetanus, Hepa-B, serum and feces carried disease immunization must be considered for all staff carrying out the medical waste handling operations.

- Transporters handling medical waste must have a contingency plan to deal with any spillage and in cases when the container of waste is damaged or ruptured.
- Carriers (Transporters) must ensure that sharps wastes shall only be handled if they are contained in a sharp container/special box (UN No. 3291), which meets the following criteria:
  - Made of strong, rigid, puncture-proof materials.
  - Impermeable and able to be permanently sealed once it is full or ready for disposal (or at intervals of not more than one week).
  - Fitted with non-removable lid with an aperture that prevents removal of sharps waste once dropped in the box.
  - Preferably yellow in colour and marked with the biohazard symbol and the words “DANGER -USED SHARPS” on the exterior.
  - Should be of size suitable for handling and fitted with a safe handle for that purpose.
  - Provision for the generator to clearly mark the sharp box with the name of the institution from which it arises.
  - Provision should be made for ability to mark and label any trolleys or containers with the name of the institution from which it was collected. The transporters must ensure that proper labelling and marking is done.
- Containers used for transport and handling of medical waste to the Medical Waste Treatment Facility should have the following specifications:
  - Containers can be 240-liter waste bins in the case of smaller generators up to 1.5 m3 trolleys with dimensions not exceeding 1.2m L x 0.725m W x 1.6m B
  - The trolley should have a removable front panel.
  - Containers must be dedicated to the collection of medical wastes only and should not be used for moving other items, (to avoid cross contamination).
  - Containers must be cleaned and disinfected (e.g., steam sterilization system, chemicals, etc.) that will be used in the medical waste treatment facility for the cleaning of the containers prior to their re-collection and re-use.
  - Other specifications may be approved by the competent authorities if they are functional, safe and suitable for the disposal facility.

11.6 Application for the Hazardous Waste Disposal

- Only companies who generate hazardous waste should submit their waste disposal request online to Abu Dhabi Waste Management Centre (TADWEER) system. Relevant documents shall be attached in the application.

- Total amounts of waste to be declared in the disposal request shall be in metric tons estimated for the wastes already accumulated plus waste to be generated for next three (3) months. Once permit is approved, it will be valid for a month only. There is no possibility of validity extension in case the paid permit remained unused or partially used after the permit expiry.

- Exact address of the facility where wastes are generated and stored shall be specified in the waste location details in the application.

12 DANGEROUS GOODS TRANSPORTATION PERMITS

The chapter presents the required dangerous goods transportation permits in the Emirate including

Economic licensing, vehicle ownership, company activity permit, vehicle licensing, vehicle driver's license, vehicle licensing for transporting dangerous goods, and vehicle route permit.

12.1 General

Dangerous goods should be transported under certain circumstances according to specific regulations to prevent their hazardous impacts on people, property and the environment. The road transport operators and drivers must comply with existing and anticipated regulations, and also is required to be familiar with the latest technologies and standards that address the regulations' key issues. This chapter is tailored to the practical needs of road transport companies and their drivers, preparing them for ever-demanding market and regulatory conditions in accordance with national and ADR regulations.

- Economic License
- Vehicle Ownership
- Safety certification for dangerous goods transport vehicles and tanks
- Company activity permit for transporting dangerous goods / wastes
- Vehicle driver's license
- Vehicle licensing for transporting hazardous materials
- Route permit for dangerous goods transport vehicle.

12.2 Economic License

The company shall follow the following steps to obtain an economic license for the transportation of dangerous goods:

- Apply for an economic license addressing the economic activity to the website of the Abu Dhabi Department of Economic Development https://added.gov.ae/ with the required documents and information.
- Pay the fees on request and obtain an economic license.

Based on the economic license, the company can purchase vehicles with the required local specifications in accordance with the classification of dangerous goods / wastes to be transported in addition to recruit the drivers and necessary employment according to the expected volume of activity.

12.3 Vehicle Ownership

The company shall follow the following steps to obtain ownership of the vehicle dedicated to the transport of dangerous goods / waste:

- The company shall submit the application to Abu Dhabi Police General Command as

  described on their website https://www.moi.gov.ae/en/eservices/eservice.179.aspx to approve hazardous materials vehicles/tanks and gas cylinders with all required documents and documents.

- Abu Dhabi Police General Command receives, studies and examines the application to ensure that the required documents and documents are met and then refer the application to **the competent authority as shown in table 9.2** for technical inspection and approval of the vehicle.

- The company must prove that the following requirements are available in the vehicle before inspecting the vehicle from the competent authority:

  - Vehicle has capacity to carry its load safety without any risk of spillage.
  - Compartment or skip is adequate to prevent leakage.
  - Vehicle displays placard showing the classification and its corresponding UN code for the physical/chemical composition of the transported dangerous goods / waste.
  - The name, address and contact details of the transporter company are clearly marked on the vehicle.
  - Equipping the car with all the safety equipment needed for emergencies such as
    - Personal protective equipment (PPE),
    - spill kits, absorbents, plastic/metal containers with cover),
    - Fire extinguishers/other firefighting tools
  - The first aid kit is provided with full medical necessities.
  - Information on the sample provided (liquids/waste transporter)
  - Requirements (by type of materials/waste) are met for vehicles

- The competent authority receives the request and technically inspects the vehicle to ensure that all its requirements are met and then approves the vehicle and issues a certificate of vehicle technical inspection (To Whom It May Concern Certificate or No Objection Certificate) or requests modifications by the company until obtaining the certificate. Figure I.1 in Appendix I shows a guiding sample for the contents of the vehicle certificate according to ADR

- The company submits the application (with the certificate) to Abu Dhabi Police General Command
- Abu Dhabi Police General Command receives the application and technical inspection certificate and then approves and issues the vehicle ownership to transport dangerous goods/waste or requests modifications by the company until ownership of the vehicle is obtained.

  N.B: The classification of dangerous goods to be transported by the vehicle, particularly explosives, fireworks, or radioactive materials, should be clarified on the vehicle ownership documents.

12.4 Company Activity Permit

The company shall apply for a company activity permit to engage in the transport of dangerous goods/wastes activity to the ITC-DMT website www.itc.gov.ae - Freight Section and attaching the following:

- A copy of valid Abu Dhabi economic license addressing the license activity.
- Documents and information required in the executive regulations for the transport of goods as well as the registration in ASATEEL system.
- Request for electronic system certificate to track vehicle transporting hazardous materials / wastes (Section 12.7.1).
- Pay the relevant fees on request:
- Get the permit and electronic system certificate after payment

The company must provide the following information when requested by ITC to ensure that the company is administratively able to safely transport dangerous goods/waste:

- The company organizational structure with a copy of valid training certificates for the driver, safety advisor and operator from the competent authority for the safely trading and transport of dangerous goods/waste and emergency response procedures in the case of spills and accidents that may arise during the transport of these goods/waste.
- Communication protocol between the DGSA and the drivers of dangerous goods vehicles.
- Documenting the transport of dangerous goods and keeping records.
- Procedures for selecting the route of vehicles transporting dangerous goods.

12.5 Vehicle driver's license

The following steps must be followed by the person holding a valid driving license to obtain a permit to drive vehicles transporting dangerous goods/waste:

- The person must be familiar with the national requirement for driving of vehicle transporting dangerous goods/wastes (see clause 6.2).
- The person must get training courses, pass the examination and then obtain the official training certificate from the competent authority.

12.6 Vehicle Licensing for Transporting Gas Cylinders or Dangerous Goods

In accordance with Ministerial Decision No. 213 of 2017 to amend the regulations of Cabinet Resolution 24 of 2012 regarding the regulation of civil defense services in the country issued by Ministerial Resolution 505 of 2012 - Article 72, the following documents must be provided to Abu Dhabi Civil Defense Authority for the licensing of vehicles and tankers transporting gas cylinders or dangerous goods

- Photo of valid vehicle ownership or the technical inspection certificate.
- Photo of valid economic license.
- Photo of the permit card for driving tanker or vehicle transporting dangerous goods.
- Photo of driver's license
- Certificate of electronic tracking system from ITC.
- Initial approval letter for registration in the case of new vehicles / tanks or class change.

12.7 Vehicle Route Approval

12.7.1 Electronic System to Track Vehicles Transporting Hazardous Materials

The Integrated Transport Center (ITC) announced the launch of an electronic system to track vehicles transporting hazardous materials, which aims to enhance road safety and security through continuous monitoring, control and tracking of the movement of vehicles transporting hazardous materials and waste. The system provides a feature to:

- Identify the nature and quantity of transported materials and ensure rapid coordination with the competent authority (ADCDA) in accidents or emergency situations, through tracking devices installed on the vehicles and connected with the central database and programs in the system which supports the center and the relevant strategic partners in tracking the movement of vehicles and optimal handling of these materials.

- Locate the vehicles in real time and monitoring both fleet operators and drivers' compliance with traffic rules.
- Automatically update the vehicle's status and it enables to count the total number of vehicles in a specific area or one location, and track the vehicle's history with determining speed, location and status.

The Center called on companies and agencies related to the transport of hazardous materials and waste, to the necessity of installing and operating the necessary electronic tracking devices in vehicles and linking them to the electronic system to track the transport of hazardous materials, explaining that any company or entity working in this field needs a license from the Abu Dhabi Civil Defense Authority, and this license is conditional on obtaining a certificate for the installation of electronic tracking devices from the center, provided that these devices, their operation and maintenance are in accordance with the approved technical requirements. The center also confirmed that all the procedures for this service and the approved companies supplied are available in detail on the center's website www.itc.gov.ae - Freight Section.

The main objectives of electronic system are as follows:

- Real time monitoring and tracking of vehicle transporting hazardous materials / wastes;
- To eliminate illegal dumping.
- To prevent illegal activities related to waste transportation to unauthorized facilities; and
- To prevent mixing of incompatible hazardous materials/ wastes from different sources.

12.7.2 Assessment of Potential Route

The assessment of potential routes shall include the followings:

A. Road and Traffic Factors

The assessment of the potential routes for suitability on road and traffic grounds will require the collection of the following information to establish the capability and level of service of the road system as measured by its physical characteristics, the volume of traffic and its composition, and congestion levels of existing and potential routes.

- Inventory of routes including the length, road width, number of lanes, traffic control and parking restrictions.
- Road structural condition.
- Present road usage, traffic volumes and composition, including the number of trucks carrying hazardous materials and the quantity and type of the materials, load size and frequency of transport. This is obtained from physical counts.

- Traffic movements at critical intersections along the routes.
- Travel time along the alternative routes.
- Origin and destination of trucks carrying hazardous materials, if the study area includes major developments generating significant hazardous materials traffic movements.

The following factors consider the route ability to handle the traffic effectively and safely.

➢ **Structural and Geometric Adequacy of Roads**

Routes with good geometry (e.g., wide carriageway with minimum horizontal and vertical curves) and capable of carrying heavy vehicles should be selected in preference to routes of lesser quality.

➢ **Carriageway Levels of Service**

The desirable standard is to achieve at least a level of service of C and not less than D. Therefore, a level of service D is suggested as the minimum level for a road section.

➢ **Level of Service of Critical Intersections**

The intersections controlled by signals or roundabout, and intersections without signals should be evaluated according to the national criteria. Intersections with poor levels of service usually reflect congestions and delays.

➢ **Travel Speed**

Travel speeds at or near 25km/hr. indicate a road section experiencing congestion and delays (Level of Service E), while those under this speed reflect a congested situation (Level of Service F). The number of traffic signals can be used as a measure of delay along a route section. A route with a smaller number of signals is most likely be preferred as it would have the potential for fewer delays.

N.B: Generally, the road level of services are as follows:

A: Free-flow conditions with unimpeded manoeuvrability. Stopped delay at signalized intersection is minimal.

B: Reasonably unimpeded operations with slightly restricted manoeuvrability. Stopped delays are not bothersome.

C: Stable operations with somewhat more restrictions in making mid-block lane changes than LOS B. Motorists will experience appreciable tension while driving.

D: Approaching unstable operations where small increases in volume produce substantial increases in delay and decreases in speed.

E: Operations with significant intersection approach delays and low average speeds.

F: Operations with extremely low speeds caused by intersection congestion, high delay, and adverse signal progression.

- **Accident Rates**

The safety record of each route can be expressed as a crash rate (i.e. total vehicle and truck crashes per million kilometers of travel). These rates are derived from an analysis of reported crashes along the different sections of the route. Ideally, the crash rate should not exceed 0.7 crashes per million vehicle kilometers.

- **Availability of Alternative Emergency Routes**

In case of an emergency which would require the short-term closure of a route used for the transport of hazardous materials, an alternative route should be available.

B. Environmental and Land Use Safety Considerations Approach

The routes which are found to be satisfactory on road and traffic grounds should be subjected to a risk assessment using the "Qualitative" method summarized in Appendix F. Upon request of the competent authority, a detailed quantitative risk assessment should be undertaken If the differences between the routes are small and further differentiation is still needed (see chapter 8)

The quantitative risk assessment requires information of heavy vehicle movements, roads used, traffic composition, land use frontage, accident statistics and quantities and types of hazardous materials being carried. This information is then used to evaluate:

- **Risk Levels:** Accident rates**,** potential population exposed to effects**,** identification of land use pattern, especially sensitive land use and future land use in the area
- **Safety Management:** Emergency response capability**,** operational guidelines used**,** operational and organizational safeguards, including safety management systems, documentation on past incidents (spills as well as traffic related accidents)

12.7.3 Route Permit

Vehicles shall not transport any dangerous goods for which a placard is required on a highway unless a permit authorizing the transportation of the dangerous goods has been issued by Abu Dhabi Police General Command. The company shall request the route permit for a dangerous goods /wastes transport vehicle from ADP providing the following

- Name and business address of carrier, operator, or owner.
- Company permits for transport dangerous goods / wastes
- Vehicle and driver licenses

- Copy of electronic system certificate to track vehicle transporting hazardous materials / wastes.
- In addition, the study proposal for route selection in the following sequences could be submitted upon the request of Abu Dhabi Police General Command:
    - Identification of potential routes using the road hierarchy, eliminating roads unsuitable for heavy vehicles, then
    - Applying the mandatory and subjective factors.
    - Aassessment of the potential routes, comparing them based on road and traffic factors, environmental and land use safety, and transport economics (see clause 12.7.2)
    - Selection of a preferred route or routes after reviewing all the factors; and
    - Implementation of the route(s), including making any necessary road or traffic management improvements.
    - The emergency response capability of each route.
- Pay related fees as requested:
- Obtain the approval of Abu Dhabi Police General Command according to class of dangerous goods on the selected preferred route.

N.B: For repeated vehicle trips between identified and recured destination points the carrier company could establish a protocol with Abu Dhabi Police General Command to collectively obtain the route permits as the vehicle shall respect these routes which are monitored by DMT- ITC via the Electronic System to Track Vehicles Transporting Hazardous Materials as discussed in clause 12.7.1.

13 ENFORCEMENT

The chapter includes the enforcement processes for the transport of dangerous goods in terms of inspection as well as offences and penalties

13.1 General

Enforcement of the regulations governing the carriage of dangerous goods by road is primarily undertaken by inspectors of the competent authorities as addressed in clause 9.5.

13.2 Inspection

Compliance with the legislation is monitored and enforced by inspection. Inspections are carried out on vehicles at the roadside and at the premises of businesses involved in consignment, carriage, loading, packing, filling and unloading of dangerous goods.

Roadside vehicle inspections follow an inspection regime set down in the regulations, which means that inspections are uniform throughout the Emirate. Inspections are conducted competent authorities. Table 13.1 illustrates examples of vehicle inspection checklist according to international best practices and ADR regulations.

Vehicle inspection checklist

1. Place of Check	2. Date:	3. Time:

4. Vehicle Nationality Mark and Registration Number			
5. Trailer/Semi-Trailer Nationality Mark and Registration Number			
6. Undertaking Carrying Out Transport/Address			
7. Driver / Driver's Assistant			
8. Consignor, Address, Place of Loading (1) (2)			
9. Consignee, Address, Place of Unloading (1) (2)			
10. Total Quantity of Dangerous Goods per Transport Unit			
11. Quantity Limit Exceeded	Yes		No
12. Mode of Transport	In Bulk	Package	Tank

Documents on Board	Inspected	Infringement	Not Applicable
13. Transport Document			
14. Instructions in Writing			
15. Bilateral/Multilateral Agreement/National Authorization			

16. Certificate of Approval for Vehicles			
17. Drivers Training Certificate			

Transport Operation	Inspected	Infringement	Not Applicable
18. Goods authorized for Transport			
19. Vehicles authorized For Goods Carried			
20. Provisions Related to The Mode of Transport (Bulk, Package, Tank)			
21. Mixed Loading Prohibition			
22. Loading, Securing of The Load and Handling (3)			
23. Leakage of Goods or Damage to Packages (3)			
24. Un Packaging Marking /Tank Marking (2) (3)			
25. Package Marking (e.g. UN No.) and Labelling (2)			
26. Tank /Vehicle Placarding			
27. Vehicle / Transport Unit Marking (Orange Plate, Elev. Temp.)			

Equipment on Board	Inspected	Infringement	Not Applicable		
28. General Purpose Safety Equipment Specified In the regulations					
29. Equipment According to The Goods Carried					
30. Other Equipment Specified in the Instructions in Writing					
31. Fire Extinguisher(s)					
32. The Most Serious Risk Category of established infringements, if any	Category I		Category II	Category III	
33. Remarks:					
34. Authority/ Officer having carried out the Inspection:					

(1) To Be Filled Only if Relevant for an Infringement
(2) To be Stated under “Remarks” for Groupage Transport Operations
(3) Check of Visible Violations

Table 13-1: Example of Inspection Checklist used in Dangerous Goods Transport

Premises inspections are generally unannounced and provide inspectors with the opportunity to look more closely at the full range of a business’ activities concerning dangerous goods transport. Such inspections also provide an opportunity for businesses to seek advice from the competent authorities. Where enforcement action is necessary this may take the form of a written notice/report of inspection, directions for an improvement plan and/or a contravention or prohibition notice.

13.3 Violations and Penalties

Violations and penalties are set out in national legislation. A violation is committed if a person contravenes a provision of national regulations and includes a contravention of any of the general participant duties which are covered in chapter 4 of this guidance. Table 13.2 presents examples of common dangerous goods transport violations. The penalties fees addressing violation shall be stipulated in the national regulations by the relevant competent authorities in future.

P. N	Violation Type
1	**VEHICLE DOCUMENTAION**
1.1	Failure to provide Certificate of Approval for the Vehicle
1.2	Failure to provide Certificate for Vehicle Route Approval
1.3	Failure to provide transport and instructions in writing documents
1.4	Failure to provide Bilateral/Multilateral Agreement/National Authorization whenever required.
1.5	Failure to provide Vehicle / Transport Unit Marking (Orange Plate, Elev. Temp.)
1.6	Not respect the Mixed Loading Prohibition
2	**SAFETY MEASURES**
2.1	Failure to provide Personal Protective Equipment (PPE)
2.2	Failure to provide the mandatory safety Equipment According to The Goods Carried
2.3	Failure to provide the emergency action code and relevant Protective Clothing
2.4	Failure to provide the required Fire extinguishers /other firefighting tools
2.5	Failure to provide First Aid Kit with complete medical necessities.

3	**HAZMAT IDENTIFICATION**
3.1	Offering for transportation a dangerous good without shipping papers, package markings, labels, and placards (where required):
3.2	Offering for transportation a dangerous good that is misclassified on the shipping paper, markings, labels, and placards (including improper treatment as consumer commodity).
4	**TRAINING**
4.1	Failure to provide initial training to employees (general awareness, function-specific, safety, and security awareness training).
4.2	Failure to create and maintain employees training records.
4.3	Failure to provide recurrent training to employees (general awareness, function-specific, safety, and security awareness training.
4.4	Failure to provide valid official training certificate to DGSA and vehicle drivers
4.5	Failure to provide Hazmat Driver Level 3 licence
5	**PACKAGE MARKING/LABELING**
5.1	Failure to mark the identification number on a package
5.2	Marking a package with an incorrect shipping name and identification number
5.3	Failure to mark the proper shipping name and identification number on a package
5.4	Placing an improper size label on a package
5.5	Placing a label on a package that does not meet color specification requirements
5.6	Failure to apply limited quantity marking or “RQ” marking on a non-bulk package containing a hazardous substance
5.7	Failure to place a Cargo Aircraft Only label on a package intended for air transportation, when required
5.8	Failure to mark a package containing liquid hazardous materials with required orientation markings
6	**MARKING/PLACARDING**
6.1	Failure to properly mark a bulk container
6.2	Failure to placard a freight container or vehicle containing hazardous materials (no placard at all)
6.3	Improperly placarding a freight container or vehicle containing hazardous materials
7	**SHIPPING PAPERS**
7.1	Failure to include a proper shipping name in the shipping description or using an incorrect

	proper shipping name:
7.2	Failure to include a hazard class/division number in the shipping description
7.3	Failure to include an identification number in the shipping description:
7.4	Using an incorrect hazard class
7.5	Using an incorrect identification number
7.6	Failure to include the Packing Group or using an incorrect Packing Group:
7.7	Failure to provide a shipping paper for a shipment of hazardous materials or accepting hazardous materials for transportation without a shipping paper:
8	**PACKAGING MISUSE**
8.1	Failure to close a UN standard packaging in accordance with the closure instructions
8.2	Overfilling or underfilling a package so that the effectiveness is substantially reduced
8.3	Offering a hazardous material for transportation in a packaging that has been successfully tested to an applicable UN standard but is not marked with the required UN marking (including missing specification plates)
8.4	Offering a hazardous material for transportation in a self-certified packaging that has not been subjected to design qualification testing
8.5	Offering a hazardous material for transportation in an unauthorized non-UN standard or non-specification packaging (includes failure to comply with the terms of a special permit authorizing use of a non-standard or non-specification packaging):
8.6	Offering a hazardous material for transportation in an improper package:

(1) To Be Determined by Relevant Competent Authorities

Table 13-2: Examples of Common Dangerous Goods Transport Violations

APPENDIXES

APPENDIX A: LIST OF DANGEROUS GOODS

The appendix gives summary about list of dangerous goods – Table A addressed in the ADR Volume 1, Part 3, chapter 3.2 in the following link.

ADR – Volume 1:https://unece.org/sites/default/files/2021-01/ADR2021_Vol1e_0.pdf

UN No.	Name and description	Class	Classification code	Packing group	Labels	Special provisions	Limited and excepted quantities		Packaging			Portable tanks and bulk containers	
									Packing instructions	Special packing provisions	Mixed packing provisions	Instructions	Special provisions
	3.1.2	2.2	2.2	2.1.1.3	5.2.2	3.3	3.4	3.5.1.2	4.1.4	4.1.4	4.1.10	4.2.5.2	4.2.5.3
(1)	(2)	(3a)	(3b)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9a)	(9b)	(10)	(11)
1202	GAS OIL or DIESEL FUEL or HEATING OIL, LIGHT (flash-point more than 60 °C and not more than 100 °C)	3	F1	III	3	363 640M 664	5 L	E1	P001 IBC03 LP01 R001		MP19	T2	TP1
1203	MOTOR SPIRIT or GASOLINE or PETROL	3	F1	II	3	243 534 363 664	1 L	E2	P001 IBC02 R001	BB2	MP19	T4	TP1

ADR tank		Vehicle for tank carriage	Transport category (Tunnel restriction code)	Special provisions for carriage				Hazard identification No.	UN No.	Name and description
Tank code	Special provisions			Packages	Bulk	Loading, unloading and handling	Operation			
4.3	4.3.5, 6.8.4	9.1.1.2	1.1.3.6	7.2.4	7.3.3	7.5.11	8.5	5.3.2.3		3.1.2
(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(1)	(2)
LGBV		AT	3 (D/E)	V12				30	1202	GAS OIL or DIESEL FUEL or HEATING OIL, LIGHT (flash-point more than 60 °C and not more than 100 °C)
LGBF	TU9	FL	2 (D/E)				S2 S20	33	1203	MOTOR SPIRIT or GASOLINE or PETROL

Figure A-1: List of Dangerous Goods Sample – Table A

A.1 Table Description

Each row of Table A deals with the substance(s) or article(s) covered by a specific UN number. However, when substances or articles belonging to the same UN number have different chemical properties, physical properties and/or carriage conditions, several consecutive rows may be used for that UN number.

Each column of Table A is dedicated to a specific subject as indicated in the explanatory notes below the table. The intersection of columns and rows (cell) contains information concerning the subject treated in that column, for the substance(s) or article(s) of that row:

- The first four cells identify the substance(s) or article(s) belonging to that row (additional information in that respect may be given by the special provisions referred to in Column (6);
- The following cells give the applicable special provisions, either in the form of complete information or in coded form. The codes cross-refer to detailed information that is to be found in the Part, Chapter, Section and/or Sub-section indicated in the explanatory notes below. An empty cell means either that there is no special provision and that only the general requirements apply, or that the carriage restriction indicated in the explanatory notes is in force. When used in this table, an alphanumeric code starting with the letter's "SP" designates a special provision of Chapter 3.3, Part 1, Volume 1 of ADR.

The applicable general requirements are not referred to in the corresponding cells. The explanatory notes below indicate for every column the Part(s), Chapter(s), Section(s) and/or Sub-section(s) where these are to be found in ADR.

A.2 Explanatory Notes for Each Column

The following is the brief of the explanatory notes for each column in table A. For more details refer to ADR Volume 1, Part 3, chapter 3.2 in the aforementioned link.

Column 1: "UN No." - Contains the UN number:

Column 2: "Name and description"

Column 3a: "Class"

Column 3b: "Classification code"

Column 4: "Packing group"

Column 5: "Labels"

Column 6: "Special provisions"

Column 7a: "Limited Quantities"

Column 7b: "Excepted Quantities"

Column 8: "Packing instructions"

Column 9a: "Special packing provisions"

Column 9b: "Mixed packing provisions"

Column 10: "Portable tank and bulk container instructions"

Column 11: "Portable tank and bulk container special provisions"

Column 12: "Tank codes for ADR tanks"

Column 13: "Special provisions for ADR tanks"

Column 14: "Vehicle for tank carriage"

Column 15: "Transport category / (Tunnel restriction code)"

Column 16: "Special provisions for carriage - Packages"

Column 17: "Special provisions for carriage - Bulk"

Column 18: "Special provisions for carriage – Loading, unloading and handling"

Column 19: "Special provisions for carriage - Operation"

Column 20: "Hazard identification number"

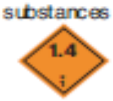
APPENDIX B: INSTRUCTIONS IN WRITING ACCORDING TO ADR

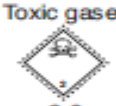
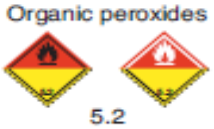
B.1 Actions in the Event of an Accident or Emergency

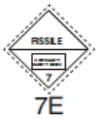
In the event of an accident or emergency that may occur or arise during carriage, the members of the vehicle crew shall take the following actions where safe and practicable to do so:

- Apply the braking system, stop the engine and isolate the battery by activating the master switch where available;
- Avoid sources of ignition, in particular, do not smoke, use electronic cigarettes or similar devices or switch on any electrical equipment;
- Inform the appropriate emergency services, giving as much information about the incident or accident and substances involved as possible;
- Put on the warning vest and place the self-standing warning signs as appropriate;
- Keep the transport documents readily available for responders on arrival;
- Do not walk into or touch spilled substances and avoid inhalation of fumes, smoke, dusts and vapours by staying up wind;
- Where appropriate and safe to do so, use the fire extinguishers to put out small/initial fires in tyres, brakes and engine compartments;
- Fires in load compartments shall not be tackled by members of the vehicle crew;
- Where appropriate and safe to do so, use on-board equipment to prevent leakages into the aquatic environment or the sewage system and to contain spillages;
- Move away from the vicinity of the accident or emergency, advise other persons to move away and follow the advice of the emergency services;
- Remove any contaminated clothing and used contaminated protective equipment and dispose of it safely.

B.2 Additional guidance to members of the vehicle crew on the hazard characteristics of dangerous goods by class and on actions subject to prevailing circumstances

Danger labels and placards	Hazard characteristics	Additional guidance
(1)	(2)	(3)
Explosive substances and articles  1 1.5 1.6	May have a range of properties and effects such as mass detonation; projection of fragments; intense fire/heat flux; formation of bright light, loud noise or smoke. Sensitive to shocks and/or impacts and/or heat.	Take cover but stay away from windows.
Explosive substances and articles  1.4	Slight risk of explosion and fire.	Take cover.

Flammable gases  2.1	Risk of fire. Risk of explosion. May be under pressure. Risk of asphyxiation. May cause burns and/or frostbite. Containments may explode when heated.	Take cover. Keep out of low areas.
Non-flammable, non-toxic gases  2.2	Risk of asphyxiation. May be under pressure. May cause frostbite. Containments may explode when heated.	Take cover. Keep out of low areas.
Toxic gases  2.3	Risk of intoxication. May be under pressure. May cause burns and/or frostbite. Containments may explode when heated.	Use emergency escape mask. Take cover. Keep out of low areas.
Flammable liquids  3	Risk of fire. Risk of explosion. Containments may explode when heated.	Take cover. Keep out of low areas.
Flammable solids, self-reactive substances, polymerizing substances and solid desensitized explosives 	Risk of fire. Flammable or combustible, may be ignited by heat, sparks or flames. May contain self-reactive substances that are liable to exothermic decomposition in the case of heat supply, contact with other substances (such as acids, heavy-metal compounds or amines), friction or shock. This may result in the evolution of harmful and	
Substances liable to spontaneous combustion  4.2	Risk of fire by spontaneous combustion if packages are damaged or contents are spilled. May react vigorously with water	
Substances which, in contact with water, emit flammable gases  4.3	Risk of fire and explosion in contact with water.	Spilled substances should be kept dry by covering the spillages.
Oxidizing substances  5.1	Risk of vigorous reaction, ignition and explosion in contact with combustible or flammable substances.	Avoid mixing with flammable or combustible substances (e.g. sawdust).
Organic peroxides  5.2	Risk of exothermic decomposition at elevated temperatures, contact with other substances (such as acids, heavy-metal compounds or amines), friction or shock. This may result in the evolution of harmful and flammable gases or vapours or self-ignition.	Avoid mixing with flammable or combustible substances (e.g. sawdust).

Toxic substances  6.1	Risk of intoxication by inhalation, skin contact or ingestion. Risk to the aquatic environment or the sewerage system.	Use emergency escape mask.
Infectious substances  6.2	Risk of infection. May cause serious disease in humans or animals. Risk to the aquatic environment or the sewerage system.	
Radioactive material  7A  7B  7C  7D	Risk of intake and external radiation.	Limit time of exposure.
Fissile material  7E	Risk of nuclear chain reaction.	
Corrosive substances  8	Risk of burns by corrosion. May react vigorously with each other, with water and with other substances. Spilled substance may evolve corrosive vapours. Risk to the aquatic environment or the sewerage system.	
Miscellaneous dangerous substances and articles  9  9a	Risk of burns. Risk of fire. Risk of explosion. Risk to the aquatic environment or the sewerage system.	

NOTE 1: For dangerous goods with multiple risks and for mixed loads, each applicable entry shall be observed.

NOTE 2: Additional guidance shown in column (3) of the table may be adapted to reflect the classes of dangerous goods to be carried and their means of transport.

B.3 Additional guidance to members of the vehicle crew on the hazard characteristics of dangerous goods by Marks and on actions subject to prevailing circumstances

Mark	Hazard characteristics	Additional guidance
(1)	(2)	(3)
 Environmentally hazardous substances	Risk to the aquatic environment or the sewerage system	
 Elevated temperature substances	Risk of burns by heat.	Avoid contact with hot parts of the transport unit and the spilled substance.

Equipment for personal and general protection to carry out general actions and hazard specific emergency actions to be carried on board the transport unit in accordance with ADR

The following equipment shall be carried on board the transport unit:

- or each vehicle, a wheel chock of a size suited to the maximum mass of the
- vehicle and to the diameter of the wheel;
- two self-standing warning signs;
- eye rinsing liquid [a] and

for each member of the vehicle crew

- a warning vest (e.g. as described in the EN 471 standard);
- portable lighting apparatus;
- a pair of protective gloves; and
- eye protection

Additional equipment required for certain classes:

- an emergency escape mask for each member of the vehicle crew shall be carried on board the transport unit for danger label numbers 2.3 or 6.1;
- a shovel [b]
- a drain seal [b]
- a collecting container [b]

a: Not required for danger label numbers 1, 1.4, 1.5, 1.6, 2.1, 2.2 and 2.3.

b: Only required for solids and liquids with danger label numbers 3, 4.1, 4.3, 8 or 9.

APPENDIX C: MODEL FOR REPORT ON OCCURRENCES DURING THE CARRIAGE OF DANGEROUS GOODS

Carrier infrastructure operator:

.....
…….

Address:

.....
……

Contact name: ..... **Telephone:** .....**Fax:** ……..

(The competent authority shall remove this cover sheet before forwarding the report)

1. Mode
• Road Vehicle registration (optional) …….. ……..
2. Date and location of occurrence
Year: …… Month: ……. Day: ……. Time: ……..
• Built-up area • Loading/unloading/transhipment site • Open road • Location / Country……
3. Topography
• Gradient/incline • Tunnel • Bridge/Underpass • Crossing
4. Particular Weather Conditions
• Rain • Fog • Thunderstorm • Storm • Temperature: ..... °C
5. Description of occurrence
• Derailment/Leaving the road • Collision • Overturning/Rolling over

- Fire
- Explosion
- Loss
- Technical fault

Additional Description of occurrence

……
……
……

6. Dangerous goods involved

UN Number (1)	Class	Packing Group	Estimated quantity of loss of products (kg or *l*) (2)	Means of containment (3)	Means of containment material	Type of failure of means of containment (4)

(1) For dangerous goods assigned to collective entries to which special provision 274 applies, also the technical name shall be indicated.

(2) For Class 7, indicate values according to the criteria above.

(3) Indicate the appropriate number
1. Packaging
2. IBC
3. Large packaging
4. Small container
5. Wagon
6. Vehicle
7. Tank-wagon
8. Tank-vehicle
9. Battery-wagon
10. Battery-vehicle
11. Wagon with demountable tanks
12. Demountable tank
13. Large container
14. Tank-container
15. MEGC
16. Portable tank

(4) Indicate the appropriate number
1. Loss
2. Fire
3. Explosion
4. Structural failure

7. Cause of occurrence (if clearly known)

- Technical fault
- Faulty load securing
- Operational cause (rail operation)
- Other:

……
……

8. Consequences of occurrence

Personal injury in connection with the dangerous goods involved:

- Deaths (number: .....)
- Injured (number: .....)

Imminent risk of loss of product

- Estimated level of damage ≤ 50,000 Euros
- Estimated level of damage > 50,000 Euros

- Evacuation of persons for a duration of at least three hours caused by the dangerous goods involved

- Closure of public traffic routes for a duration of at least three hours caused by the dangerous goods involved

- Loss of product:

- Material/Environmental damage:

- Involvement of authorities:

APPENDIX D: DANGEROUS GOODS TRANSPORT CATEGORY

Where the dangerous goods carried in the transport unit belong to the same category, the maximum total quantity per transport unit is indicated in column (3) of the table below.

Transport category (1)	Substances or articles packing group or classification code/group or UN No. (2)	Maximum total quantity per transport unit (3)
0	Class 1: 1.1A/1.1L/1.2L/1.3L and UN No. 0190 Class 3: UN No. 3343 Class 4.2: Substances belonging to packing group I Class 4.3: UN Nos. 1183, 1242, 1295, 1340, 1390, 1403, 1928, 2813, 2965, 2968, 2988, 3129, 3130, 3131, 3134, 3148, 3396, 3398 and 3399 Class 5.1: UN No. 2426 Class 6.1: UN Nos. 1051, 1600, 1613, 1614, 2312, 3250 and 3294 Class 6.2: UN Nos. 2814 and 2900 Class 7: UN Nos. 2912 to 2919, 2977, 2978 and 3321 to 3333 Class 8: UN No. 2215 (MALEIC ANHYDRIDE, MOLTEN) N Nos. 2315, 3151, 3152 and 3432 and articles containing such substances or mixtures and empty uncleaned packagings, except those classified under UN No. 2908, having contained substances classified in this transport category.	**0**
1	Substances and articles belonging to packing group I and not classified in transport category 0 and substances and articles of the following classes: Class 1: 1.1B to 1.1J [a] /1.2B to 1.2J/1.3C/1.3G/1.3H/1.3J/1.5D [a] Class 2: groups T, TC [a], TO, TF, TOC [a] and TFC aerosols: groups C, CO, FC, T, TF, TC, TO, TFC and TOC chemicals under pressure: UN Nos. 3502, 3503, 3504 and 3505 Class 4.1: UN Nos. 3221 to 3224, 3231 to 3240, 3533 and 3534 Class 5.2: UN Nos. 3101 to 3104 and 3111 to 3120	**20**

2	Substances belonging to packing group II and not classified in transport categories 0, 1 or 4 and substances and articles of the following classes: Class 1: 1.4B to 1.4G and 1.6N Class 2: group F aerosols: group F chemicals under pressure: UN No. 3501 Class 4.1: UN Nos. 3225 to 3230, 3531 and 3532 Class 4.3: UN Nos. 3292 Class 5.1: UN Nos. 3356 Class 5.2: UN Nos. 3105 to 3110 Class 6.1: UN Nos. 1700, 2016 and 2017 and substances belonging to packing group III Class 9: UN No. 3090, 3091, 3245, 3480 and 3481	**333**
3	Substances belonging to packing group III and not classified in transport categories 0, 2 or 4 and substances and articles of the following classes: Class 2: groups A and O aerosols: groups A and O chemicals under pressure: UN No. 3500 Class 3: UN No. 3473 Class 4.3: UN No. 3476 Class 8: UN Nos. 2794, 2795, 2800, 3028, 3477 and 3506 Class 9: UN Nos. 2990 and 3072	**1 000**
4	Class 1: 1.4S Class 4.1: UN Nos. 1331, 1345, 1944, 1945, 2254 and 2623 Class 4.2: UN Nos. 1361 and 1362 packing group III Class 7: UN Nos. 2908 to 2911 Class 9: UN Nos. 3268, 3499, 3508 and 3509 and empty, uncleaned packagings having contained dangerous goods, except for those classified in transport category 0	**unlimited**

a: For UN Nos. 0081, 0082, 0084, 0241, 0331, 0332, 0482, 1005 and 1017, the total maximum quantity per transport unit shall be 50 kg.

In the above table, "maximum total quantity per transport unit" means:

- For articles, gross mass in kilograms (for articles of Class 1, net mass in kilograms of the explosive substance; for dangerous goods in machinery and equipment specified in the table.
- the total quantity of dangerous goods contained therein in kilograms or liters as appropriate);

- For solids, liquefied gases, refrigerated liquefied gases and dissolved gases, net mass in kilograms;
- For liquids, the total quantity of dangerous goods contained in liters;
- For compressed gases, adsorbed gases and chemicals under pressure, the water capacity of the receptacle in liters.

APPENDIX E: PLACARDING ROAD VEHICLES

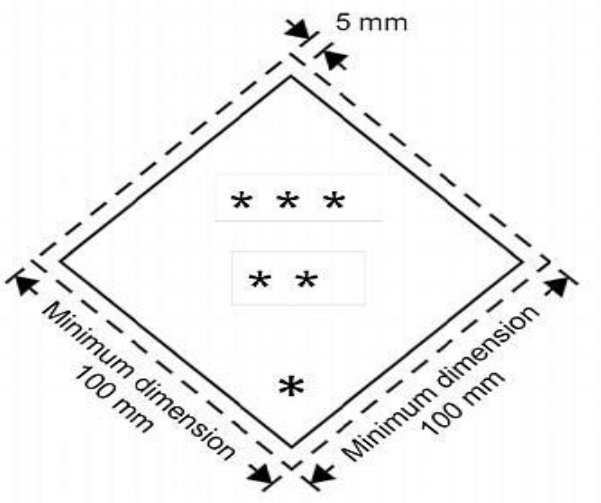
The purpose of this appendix is to present the placarding methods and completed emergency panels as discussed in the Australian code as an optional practice for ADR regulations in terms of dangerous goods labels and emergency code to be combinational presented on the vehicles and tanks.

E.1 All Placard Loads

All road vehicles transporting a placard load of dangerous goods must be placarded on the front and rear with placards indicating what dangerous goods are being carried.

E.1.1 Placarding Methods

- If a cargo transport unit, bulk container or placardable unit must be placarded, the placard must be displayed in a substantially vertical plane and:
  - securely fixed to the unit; or
  - stencilled onto or printed on the unit; or
  - placed securely in a frame that is securely fixed to the unit.
- The placard must:
  - be durable and weather resistant; and
  - have letters and numerals that are legible; and
  - not be obscured.
- The part of the unit immediately behind the placard must be of a contrasting colour to the colour of the placard unless:
  - the border of the placard is of a contrasting colour and design; or
  - the placard is a label having a dotted or solid outer boundary line in accordance with the Labels which must be configured as shown in Figure E.1



* The class or, for divisions 5.1 and 5.2, the Division number must be shown in thebottom corner.
** Additional text/numbers/symbol/letters must (if mandatory) or may (if optional) be shown in this bottom half.
*** The class or division symbol or, for divisions 1.4, 1.5 and 1.6, the division number and for Model No 7E the word “FISSILE” must be shown in the top half.

Figure E.1: Class / Division Label

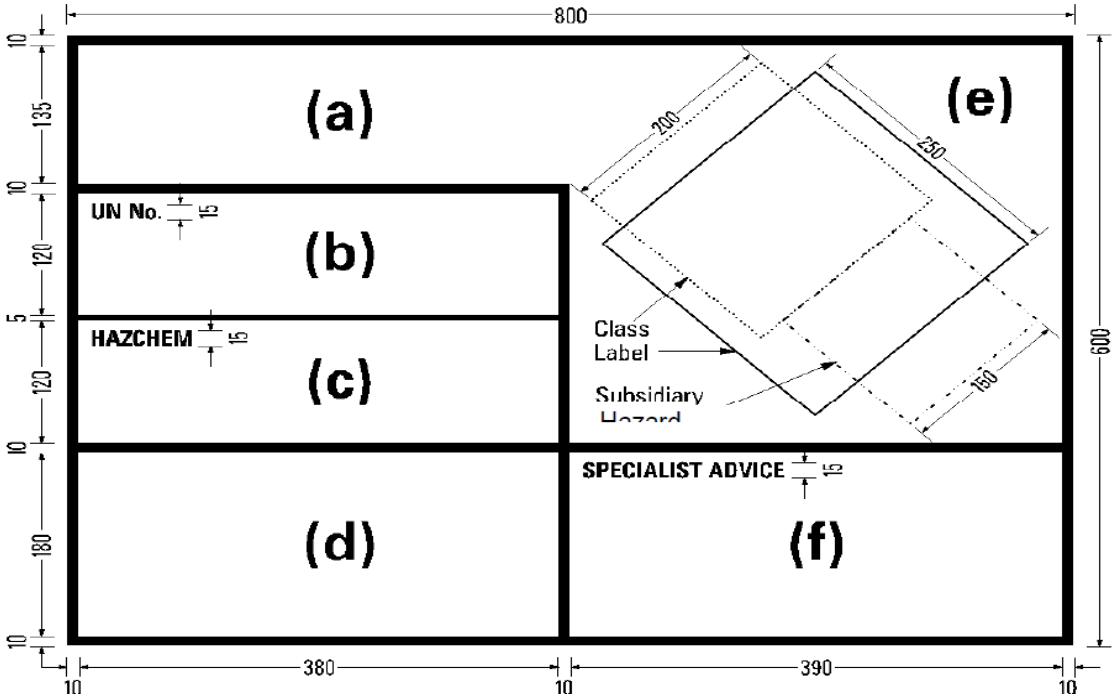


Figure E.2a: Format and colour of Emergency Information Panel

Background: White, Lines and Text : Black All measurements in mm

In addition, the following figures show the format and colour of emergency information panel

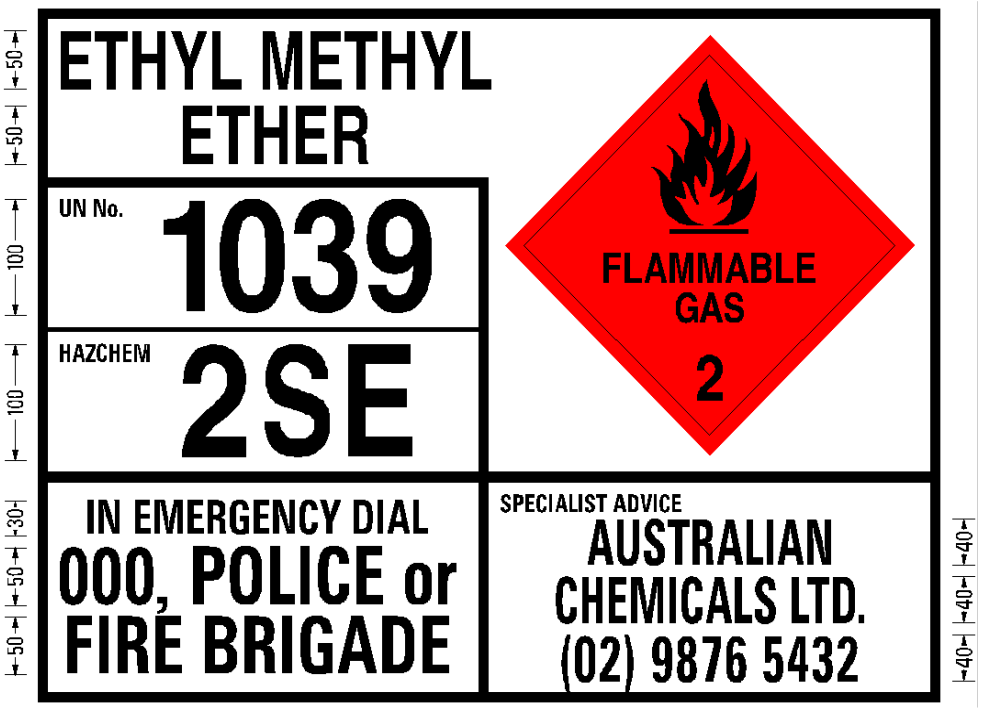


Figure E.2c: Examples of Completed Emergency Information Panel –

(i) Single Sub-Hazard

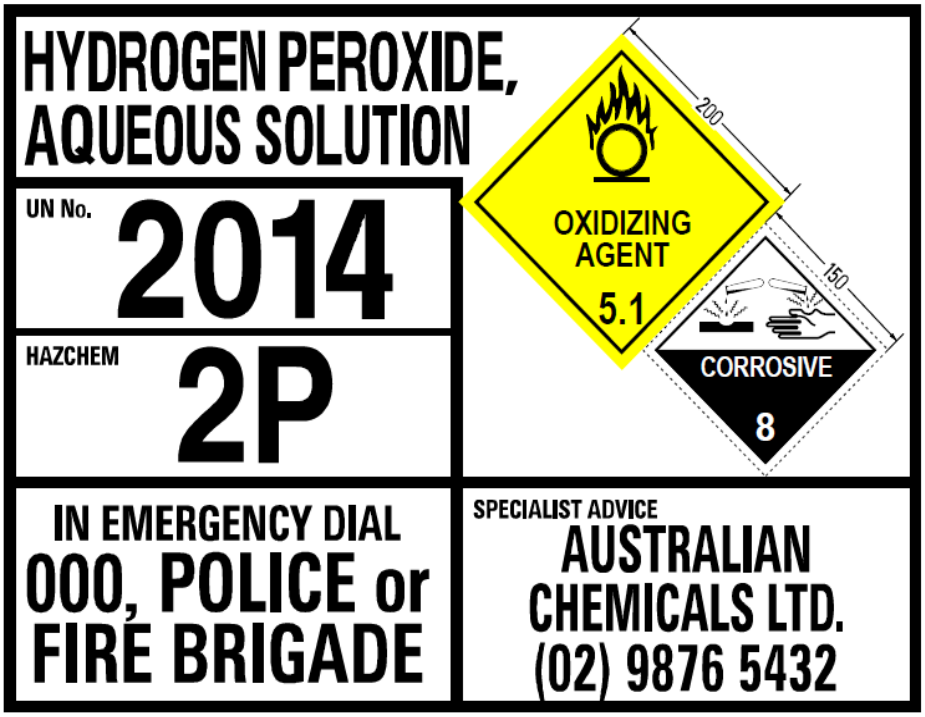


Figure E.2c: Examples of Completed Emergency Information Panel –

(ii) Two Sub-Hazard – Permissible alternative

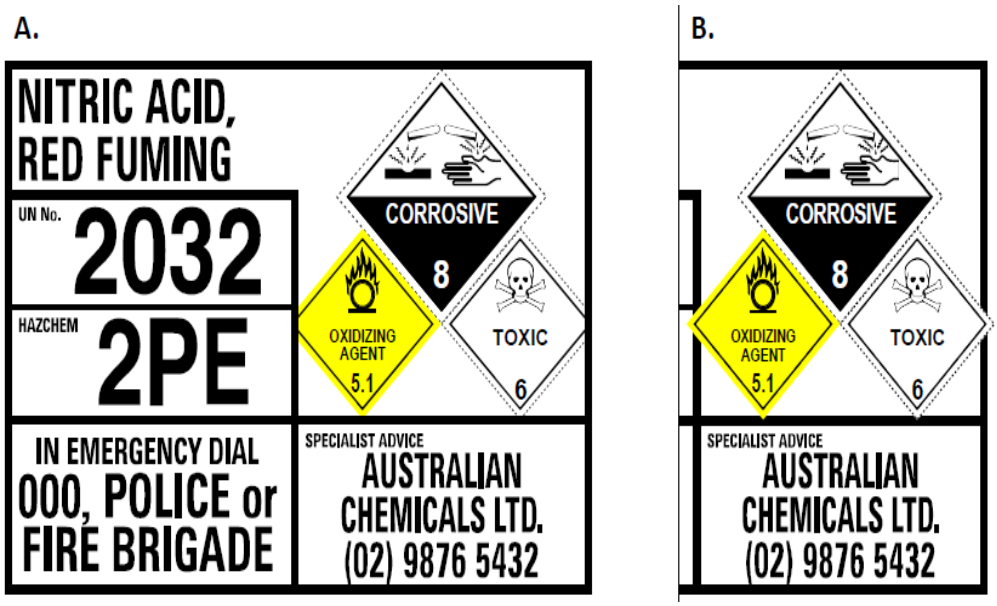


Figure E.2c: Examples of Completed Emergency Information Panel –

(iii) Three Sub-Hazard – Permissible alternative

200 mm square Primary Hazard Label, 150 mm square Sub-Hazard Label

A: Trimmed to fit **B**: Permitted to overlap borders

- Where all of the dangerous goods are of a single class or division, the placards required are:
  - the class or division label; and
  - any subsidiary hazard labels applicable to the goods
- Where there is more than one class of dangerous goods on the vehicle during the journey, the placards required are either or both of the following:
  - mixed class labels (model No. 10) as shown in Figure E.3.
- If the vehicle is a combination road vehicle, additional placards must be fitted when required.

Background: orange 4 x horizontal stripes: black Text: white or orange (also referred to as a Mixed Class Placard)	 **(Model No. 10)**

Figure E.3: Mixed Class Label

E.2 Combination Road Vehicle

- Sub-section E.2 applies to a combination road vehicle where the aggregate quantity of dangerous goods carried on all units of the combination comprises a placard load.
- The placards that must be fitted in accordance with clause E.1 to the front and rear of a combination vehicle must be determined based on the aggregate load carried on all units of the combination vehicle.
- In addition, placards must be fitted to both sides of each trailer or rigid vehicle that forms part of the combination and is individually carrying a placard load, indicating the dangerous goods that are carried on the individual unit.
- Placards fitted to the sides of a unit must include:
  - class, division and/or mixed class labels
  - emergency information panels if any of the dangerous goods on the unit are carried in bulk containers, tanks or placardable units.

E.3 Dangerous Good in Bulk Containers, Tanks or Placardable Units

- In addition to placards required by clause E.2 a road vehicle on which any dangerous goods are carried in bulk containers, tanks or placardable units must be placarded with emergency information panels

- **Placement of Emergency Information Panels**
  - emergency information panels, selected in accordance with EIP Selection discussed below must be fitted:
    (a) on the rear of a vehicle or vehicle combination on any part of which dangerous goods are carried in one or more bulk containers, tanks or placardable units; and
    (b) on the sides of each trailer or rigid vehicle on which dangerous goods are carried in bulk containers, tanks or placardable units.

  - Emergency information panels must be placed on the vehicle:
    (a) in a substantially vertical plane; and
    (b) with the lower edge at least 450 millimetres1 above the ground; and
    (c) when fitted to the sides of the vehicle, as close as practicable to the front of the loading area of the vehicle; and

  - **EIP Selection**
    (a) A road vehicle transporting only one type of dangerous goods in bulk containers, tanks or placardable units must be placarded with emergency information panels describing those dangerous goods be placarded with:

(i) if the dangerous goods constitute a mixed load of refined petroleum products:
- mixed load (refined petroleum product) emergency information panels or

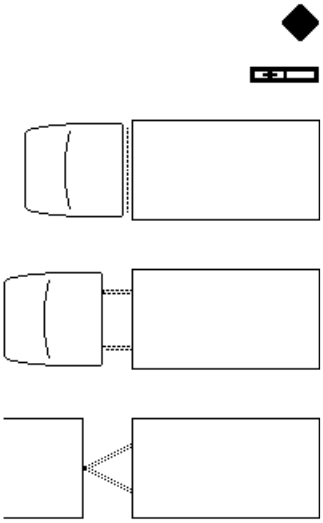
(ii) if the goods are not a mixed load of refined petroleum products:
- multi-load emergency information or

(iii) in lieu of either (i) or (ii):
- individual emergency information panels describing each of the dangerous goods displayed in such a way that it is clear which goods are in what units; and

(b) have at each outlet point of each tank or compartment of a multi-compartmented tank, a mark identifying the dangerous goods contained in that tank or compartment.

The placarding road vehicle configurations are shown in the following Figure E.4:

Key to symbols used in these illustrations



= Class, Division or Mixed Class Label

= Emergency Information Panel (EIP)

= Rigid Truck

= Prime Mover / Semi Trailer

= Trailer, in combination with rigid truck or semi-trailer

N.B: These illustrations are included for guidance only. They do not apply to all combinations of loads. To ascertain the placarding requirements for any particular load, refer to the text.

Figure E. 4a: Illustrations of Placarding Typical Road Vehicle Configurations

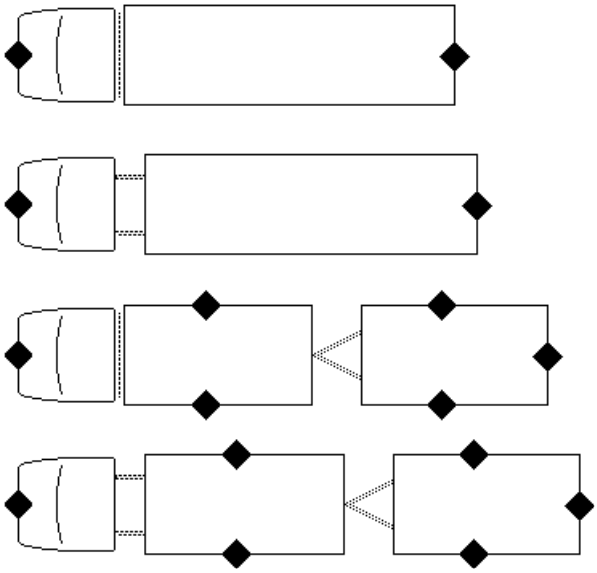


Figure 4. Eb: Road vehicles and combination road vehicles transporting dangerous goods in:

(i) Cylinders, packages, large packages, over packs; or (ii) Pressure drums, tubes or IBCs each ≤ 500 kg(L).

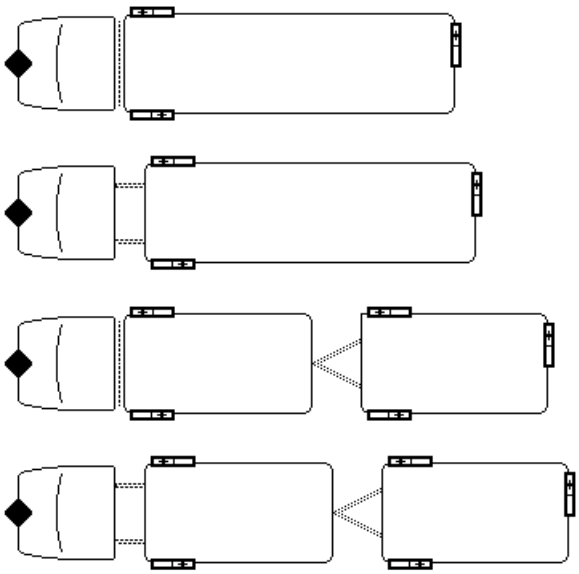


Figure 4. Ec: Road tank vehicles and combination road tank vehicles

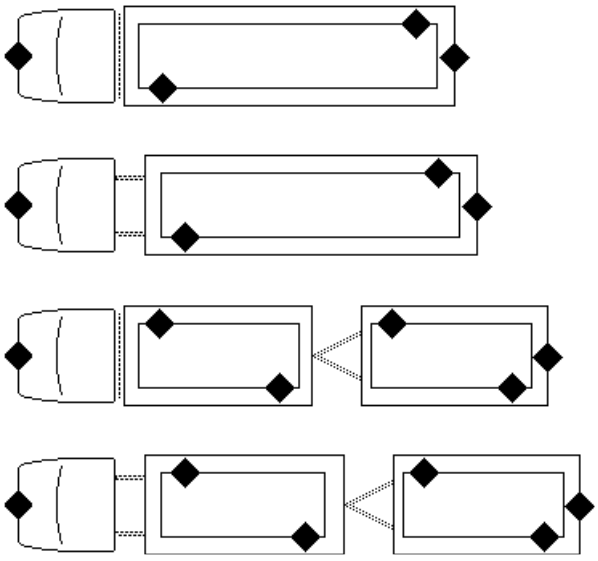


Figure 4. Ed: Road vehicles and combination road vehicles transporting dangerous goods in freight containers (not containing placard able units).

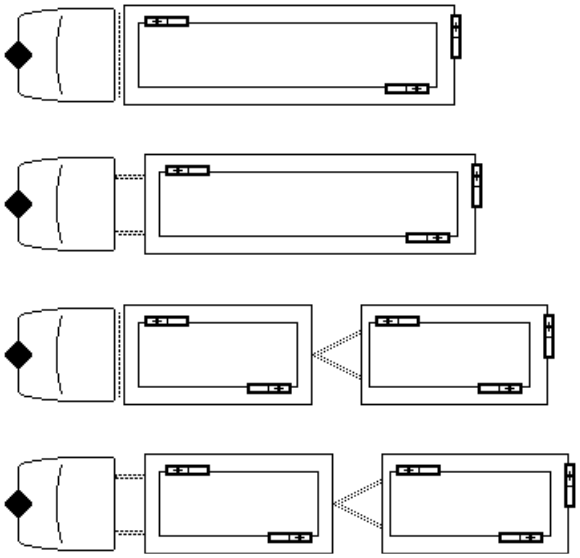
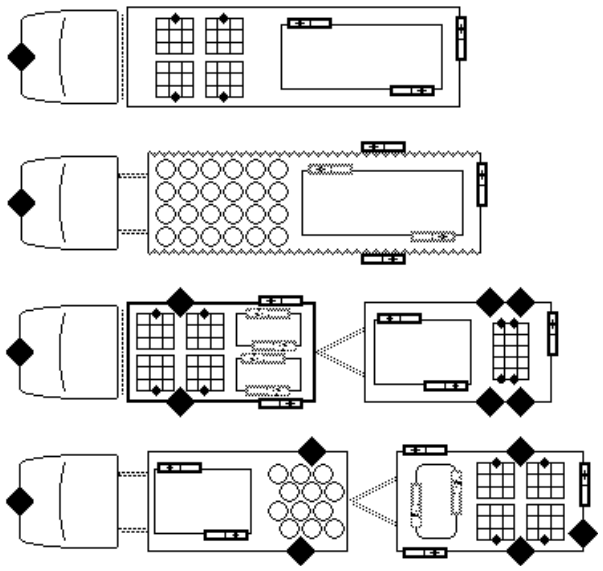


Figure 4. Ee: Road vehicles and combination road vehicles transporting portable tanks, bulk containers or placard able units displaying EIPs, or freight containers loaded with placardable units.



Gated vehicle
-Same class goods in packages and placardable units
-EIPs on placardable units visible from side

Curtain sided vehicle
-Same class goods in packages and placardable units
-EIPs on placardable units obscured

Rigid truck - fully enclosed, with packages and placardable units of different classes, and Gated trailer - packaged goods have a sub hazard and are different class to placardable unit
- Multi-load EIP on rear,
- Mixed Class label on front

Gated combination vehicle - Placardable units of one class, different materials, Packages all one (different) class,
- EIPs on trailer sides as placardable unit obscured
- Multi-load, one class EIP plus Class Label on rear
- Mixed Class on front, Class Label on all sides

Figure 4. Ef: Road vehicles transporting dangerous goods both in packages etc. as in (a), and in placard able units.

APPENDIX F: QUALITATIVE RISK ASSESSMENT FOR DANGEROUS GOODS TRANSPORTATION

The purpose of this appendix is to briefly present how to make a qualitative risk assessment based on the Fishbone Diagram from risk factors of dangerous goods road Transport, then to make a risk matrix diagram. Finally, some recommendations and measures will be suggested for dangerous goods road transport enterprises to strengthen their risk control and improve the safety of operation.

F.1 General

The qualitative risk assessment is based on subjectivity and the knowledge of the assessor and the qualitative risk analysis should generally be performed on all risks

The qualitative assessment of risk associated with dangerous goods transport is commonly applied where no alternative comparable route is available and when the basis of a qualitative comparison between the routes is obvious that the proposed restrictions lead to a significant improvement of safety.

F.2 Risk Identification

Identification of risk factors is the basis of risk control, only in the correct identification of the risks can be targeted to quickly use the appropriate method to control the risk. Risk factors can be identified from several aspects, any small factor can cause an accident. In order to avoid risks, the cause of these accidents should be analysed, and the relevant risk control and safety management should be developed. The method of Fishbone Diagram is commonly considered to identify the influencing factors of the specific road transport of dangerous goods and analyses them.

F.2.1 Identify the Risk Factors with Fishbone Diagram

Fishbone Diagram, also called Cause & Effect Diagram, is a very simple and practical way to explore the bottom cause of the problem. In the production, we should draw a trunk bone first and write the subject on the head of the fishbone, then protrude several large bones on the trunk bone and list the possible causes of the problem, finally, protruding small bones, separately into the causes and marked. In this way, the entire process of risk identification is simply detained.

Combined with some typical dangerous goods road transportation accident cases, gathering and analysing the illegal investigation of dangerous goods in some regions, ultimately making the dangerous goods road transportation risk factors Fishbone. Figure F.1 shows an example of dangerous goods road transportation risk factors fishbone diagram.

F.2.2 Major Risk Factors

The following is specific analysis of the major five risk factors:

- **Driver**

Each driver's personality characteristics are different, and their professional qualities of the transport of dangerous goods are also different. According to the relevant international examples of dangerous goods transportation accidents, about 80% of the accidents are caused by traffic accidents, and personnel factors is the main cause of the traffic accidents. If there is no good driving skills and adequate safe driving consciousness, the vehicle equipment and enterprise management system, no matter how good and perfect, are only furnishings. Therefore, enterprises must conduct safety training for drivers, improve their safe driving consciousness and resolutely put an end to speeding, drunken driving, fatigue driving, illegal parking, not according to the specified route and other common drivers' illegal operations.

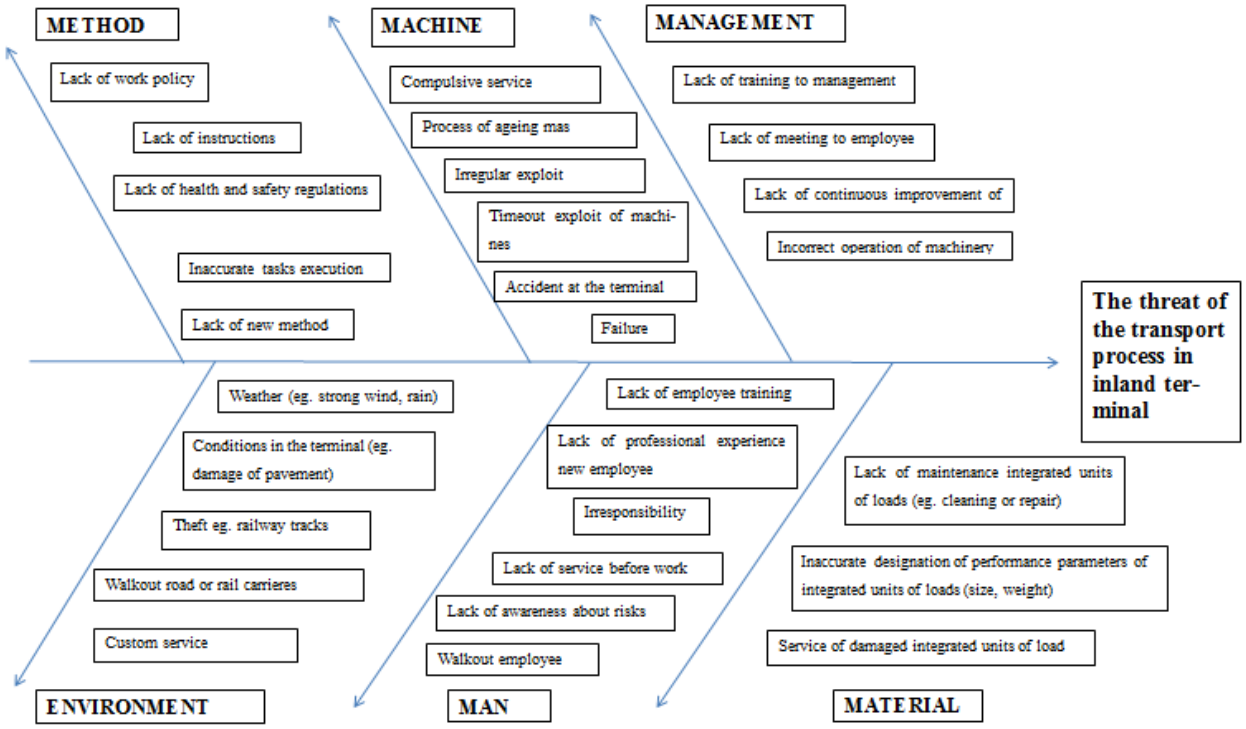


Figure F.1: Example of Dangerous Goods Road Transportation Risk Factors Fishbone Diagram.

- **Transport Vehicle**

The mechanical equipment mainly involved is the transport vehicle and the technical status of the vehicle equipment is a great influencing factor in the course of the transportation, and whether the safety status and performance of the vehicle are qualified is vital. The most influential part is the car steering and braking system. In a nutshell, it is the steering wheel, deceleration and stop problems. It is advised that all the dangerous goods transport vehicles must be installed with GPS system and emergency cut-off device subject to the traffic police approvals and checks. In addition, the vehicles conveyed dangerous goods must be inspected on time, and the overdue vehicles should be scrapped in time.

- **Classification of Dangerous Goods**

The material here is equivalent to the transported object in the road transport of dangerous goods, that is, the hazard characteristics of the goods itself may be the risk of the transport process, and inflammable and explosive goods in nine categories of dangerous goods are the main source that caused the accidents in their road transport. For example, a truck fully loaded with fireworks and firecrackers exploded in the process of driving, causing fatalities and serious injure as Fireworks and firecrackers are inflammable and explosive goods. Accordingly, the risk of the material itself will greatly increase the risks it brings to enterprises

- **Management Method**

The method here refers to the management of the enterprises. As long as there is someone, there is no guarantee of "Zero" mistake. So only through the enterprises' layers of management and supervision and strengthening the training to enhance people's safety awareness, the failure could be minimized. However, in most cases, the company's business direction is mainly concentrated in reducing costs and improving customer service, so many companies ignore the risk management of transportation safety.

- **Environment**

The location and traffic conditions of the accidents will affect the arrival and emergency rescue time of the fire and traffic police departments, while uncertain whether factors and the geographical conditions of transportation routes will also affect the probability of such accidents, and there is a great possibility of increasing the severity of the consequences of the accidents. Therefore, in the transportation of dangerous goods, the environment is also a great influential risk factor. Commonly, the environmental factors that affect the road-transportation safety of dangerous goods mainly refers to the weather and geographical conditions.

F.3 Risk Assessment based on Risk Matrix

The risk matrix is mainly used to identify the risks in the management of dangerous goods road transport, to assess the potential risk factors and the probability of risks, to determine the risk level by pre-evaluation criteria, and then to consider risk control to reduce risk. Therefore, the use of the risk matrix to explore the road transportation of dangerous goods can be clearer and more intuitive to understand the risk level division, in order for the follow research on Risk Control of Transportation Enterprises.

F.3.1 Explanation of Risk Matrix

The risk matrix is a qualitative risk assessment method that can estimate the magnitude of risk by synthetically assessing the probability of risk and the dimension of injury. It is a tool for risk visualized that is used primarily for risk assessment according to the following orders:

1. Hazard Identification: lists the dangerous goods that need to be assessed;

2. Hazard Determination: Select a hazard level for each dangerous good according to the ruled definition;

3. Damage Estimation: Estimates the likelihood of occurrence for each identified hazard goods;

4. Risk Assessment: According to the results of steps 2 and 3, find the corresponding intersection on the matrix, and draw the risk conclusion.

F.3.2 Establish Risk Consequence Levels and Frequency of Events

In the risk evaluation, the risk consequences are commonly divided into four categories of personal injury, property damage, environmental impact and reputation effects, each category is divided into six levels by the severity of the consequences, according to the accident frequency range the risk possibility from low to high as five grades. According to the international best practice, the potential impacts of dangerous goods road transport from the personnel, property, environment and reputation are divided into six levels, and the six levels are assigned with 0,1,2,3,4,5 and use the potential impact of these four aspects to make Table F-1 for the subsequent production of Risk Matrix.

Consequence Severity Assignment	Risk consequences			
	personnel	property	surroundings	reputation
0	No harm	No loss	No effect	No effect
1	Mild injury	Slight loss	Slight impact	Slight impact
2	Severe injury	Moderate loss	Moderate impact	Limited impact
3	1 People die	Local loss	Local influence	Local influence
4	2-3 People die	Huge loss	Tremendous influence	Domestic impact
5	〉 3 People die	Great loss	Great influence	International influence

N.B: The qualitative risk assessment is based on subjectivity and the knowledge of the assessor. The risk consequences definitions and boundaries shall be specified by the assessor through deep coordination with relevant entities in the Emirate subject to the approval of the competent authority.

Table F-1: Establish Risk Consequence Levels and Frequency of Events

The consequences of dangerous goods road transport accidents are divided into five levels in accordance with the target event frequency, each level was made the following definition: A - Rarely (once every ten years), B - Occasionally (every five years), C - Possible (every three years to five years), D - Sometimes (every year to three years) and E - Often (more than once a year). For the convenience of calculation, simply assign A, B, C, D, E these five levels assigned to 1, 2,3,4,5, produced as shown in Table G-2:

Assignment	1	2	3	4	5
Frequency	rarely	occasionally	possible	sometimes	often

Table F-2: Accident Frequency and Assignment

F.3.3 Risk Matrix Model

After setting the risk consequences and the risk frequency, using the seriousness of the risk consequences as table columns and the severity of the risk as table rows to made into a table. Then, the risk is calculated according to the following formula:

Accidents Risk Factors = consequence severity level × frequency of occurrence

The calculated values are filled into the intersection of the ranks, all the values constitute a matrix and finally the value of the risk classification according to the results shown in Table G- 3.

Risk matrix	General risk		Significant risk			Assignment	Risk consequences			
							Personnel	Property	Surroundings	reputation
General risk	5	10	15	20	25	5	More than 3 people died	Great loss	great influence	International influence
	4	8	12	16	20	4	2-3 people died	huge loss	Tremendous influence	Domestic impact
	3	6	9	12	15	3	1 person died	Local loss	Local influence	Local influence
low risk	2	4	6	8	10	2	Severe injury	Moderate loss	Moderate impact	Limited impact
	1	2	3	4	5	1	Mild injury	Slight loss	Slight impact	Slight impact
	0	0	0	0	0	0	No harm	No loss	no effect	no effect
Assignment	1	2	3	4	5					
frequency	V	O	M	S	F					

V: very; O: occasionally; M: May; S: sometimes; F: often

Table F-3: Risk Matrix of Dangerous Goods Road Transport

The colour zone of Table F-3 is the risk level consistent with the value of the risk factor. According to international best practice, the risk level is divided into three aspects as shown in Table F- 4.

The risk level is classified as low risk zone, the general risk zone and the significant risk zone, separately assigned level I, level II and level III.

Risk value	Risk level	Remarks
12 - 25	Significant Risk	Level - III
3 - 10	General Risk	Level- II
0 - 2	Low Risk	Level - I

Table F-4: Classification of Risk Level

F.3.4 Risk Factors Control

Combined with the risk factors for the dangerous goods road transport in Table 8.1, the following evaluation objectives are listed. According to several international real cases of dangerous goods road transport accidents the consequences level and the statistics of the accident rate could be defined with the following formula:

$$R = I \times P$$

Where R: accident risk factor; I: accident impact factor; P: accident probability factor.

The risk factor calculated from the above formula is then determined according to Table F-5 for the risk level.

Evaluation Target	Consequence Severity Level	Occurrence Frequency	Risk Factor	Risk Level
Speeding	5	4	20	III
Overload	4	4	16	III
Fatigue Driving	2	2	4	II
Drunk Driving	4	1	4	II
Insufficient Driver Experience	2	1	2	I
No Keeping Enough Distance	3	3	9	II
Do not Follow the driving Route	2	2	4	II

Puncture	2	1	2	I
Steering Wheel is out of Control	3	1	3	II
Break Failure	4	1	4	II
Directional Lamp Failure	2	1	2	I
Low Visibility	2	2	4	II
Road Slippery	2	2	4	II
Bad Weather	2	2	4	II
Tunnel	2	2	4	II
Sharp Bend	3	3	9	II

Table F-5: Risk Level of the Target Event

From the above table can be drawn that speeding and overload is the most important risk factors in dangerous goods road transport, and it is also unacceptable. Dangerous goods transport enterprises need to rectify and control the risk immediately. Secondly, the drivers' fatigue driving, drunk driving, not keeping enough distance, not driving on the route, the steering wheel in the vehicle equipment is out of control, the brake failure in the personnel factor and environmental factors of low visibility, bad weather, road slippery, tunnel and the sharp break is a general risk, is in the case of business costs allowed, the need to develop measures to reduce the risk. Finally, due to lack of experience in drivers, the vehicle puncture, the direction of light failure caused by the lower level of risk, companies can suspend rectification and through the daily management to continue to improve.

F.4 Suggestions and Measures for Risk Management

F.4.1 Strengthen the Professional Training of Employees

For dangerous goods road transport, safe must be put in the first place. Because of their nature, the transport of dangerous goods vehicles in the event of a traffic accident or improper operation in the transport process, is likely to cause major traffic accidents, or adverse environmental impact. According to the international statistics of road transport accidents in previous years, the hazardous vehicles could be considered as a valuable reason for the occurrence of traffic accidents.

- **From the Driver's Point of View**

The personnel are the most important factors leading to the accident. Many dangerous goods transport drivers lack the necessary dangerous goods safety knowledge, in case of emergency

cannot be timely and effective disposal, which may lead to more serious accidents. In addition to official training, Enterprises can arrange for professionals to conduct lectures regularly on the driver, watch the relevant incident video and understand the relevant information statistics as well as establish a safety training base, which can carry out the simulation of the accident, let the drivers familiar with the rescue steps after the accident. More importantly, not only to let the driver understand the safety of transport dangerous goods common sense, but also let the driver understand the importance of safe driving, do preventive driving.

- **From the Perspective of Business Executives**

It is not enough for the driver to do safe driving, because it needs the manager does the preparation of the driver before driving the car as a prerequisite, including vehicle inspection, dangerous goods packaging, route planning, etc., and strictly prohibited overload overrun behavior. In transport, the management of the enterprise cannot be relaxed, the monitoring center should be aware of the high risk of dangerous goods transport supervising of traffic conditions, driver driving situation, reminding the driver promptly through the GPS voice, to prevent fatigue driving and speeding. For the safety training of managers, for the leading cadres at all levels, mainly to implement laws and regulations, strengthen safety awareness, increase safety knowledge as the main content; direct management personnel to implement the sense of responsibility, master the safety management methods, enhance safety skills as the main content.

F.4.2 Strengthen Law Enforcement Supervision to Prevent Illegal Acts

The Traffic control relevant authority should strengthen the law banning the transport of dangerous goods do not have the right to carry out illegal transport behavior of enterprises, severely punish illegal vehicles, tanks, illegal crime, thorough investigation of no effective dangerous goods transport licenses, driving licenses and driving permits, as well as other driving drivers and escorts, to try to eliminate all possible dangers on the road .At the same time, law enforcement agencies should also increase the intensity of the order of the transport of dangerous goods, thorough investigation does not follow the provisions of line travel, speeding, fatigue driving, along the illegal handling of dangerous chemicals and other illegal acts.

F.4.3 Monitor, Improve Laws and Regulations

Cross-functional departments led to the phenomenon of uncoordinated management occurred, inefficient management. Therefore, to do enterprise risk control first, all regulatory departments should work closely together and co-management. Second, continuous review to improve the laws and regulations, to solve the embarrassing situation and to match the international standards and applicability providing comprehensive and unified laws and regulations, so that dangerous goods road transport enterprises have clear legal rules and regulations.

F.4.4 Improve the Information Construction, Achieve Resource Sharing

Dangerous goods road transport needs security assurance, with advanced information technology and strict scientific management this must be through the network technology to establish an

information platform in order to enable the management of enterprises in the process of monitoring the entire road transport, and always ensure the smoothness of transport and cargo safety. So that we can further improve the level of scientific management of enterprises in the entire dangerous goods road transport process to achieve proper improvement.

APPENDIX G: CIVIL DEFENSE REQUIREMENTS IN THE TRANSPORT OF DANGEROUS GOODS BY ROADS

The appendix provides the civil defence requirements in the transport of dangerous goods based on GCC recommendations on preventative requirements for hazardous materials - Part 4 which could be obtained from Abu Dhabi Civil Defence Authority and is available on the following website:

https://cdservices.moi.gov.ae/Protective_Precautions.pdf .

The appendix considers the transport of the following dangerous goods:

- Flammable/Combustible Liquid
- Liquefied Natural Gas (LNG)
- Liquefied Petroleum Gas (LPG)
- Compressed Gases

G.1 Flammable / Combustible Liquid

G.1.1 Detentions

- **Flammable Liquid:** Any liquid has flash point less than 60° C
- **Combustible Liquid:** Any liquid has flash point higher than 37.8 ° C and below 93.3° C.
- **Flash Point:** The lowest temperature where the liquid releases enough fumes to combine with the air and form an ignition mixture to cause a flash when exposing the mixture to a ignition source. The severity of the flammability fluid increases when its flash point decreases.
- **Flammable/Combustible Liquid Tanker:** It is a design-specific vehicle integrated (installed) with a liquid transport tank or asphalt (bitumen). The term tank is given to both the transported tank (solo) and the vehicle integrated into the tank.

G.1.2 Tank Requirements

G.1.2.1 Tank Design

1. The design and manufacture of the tank must be observed in accordance with the international specifications adopted so that the tank bears the weight of the liquid and resists the expansion (pressure)resulting from the fumes of the liquids and their decomposition outputs, and resists the corrosion of potential impurities with the liquid.

2. All installations and equipment in the tank must be resistant to petroleum products and must be in accordance with the international standards adopted.

3. A manufacturing certificate must be provided to the tank that the design, manufacturing and testing have been carried out in accordance with the international specifications adopted.

4. The static pressure on the tank should be tested by water 3 m above the tank for 3 hours.

5. The body of the tank must be cylindrical and made of materials have durable not less than hard iron. (known as Black Steel) and the capacity of the tank corresponds to the thickness of its wall according to the following table:

Capacity (liters)	Thickness (mm)
From 4500 to 9000	3, At the bottom of the tank 5
More than 9000	4, At the bottom of the tank 6

Table (G.1): Minimum thicknesses of the tank according to capacity

6. The iron used must conform to the international specifications adopted.

7. The tank must have a capacity not less than 4,500 liters including an overhead vacuum (above the liquid) to accommodate the fumes of the liquids provided that the vacuum volume is not less than 5% of the total capacity of the tank.

8. The surface of the tank's body must be intact and flawless. The scratches and cracks in the tank must be strictly prohibited from being concealed using car pastes.

9. A corrosion-resistant metal plate must be installed on the base of the tank near the front of the vehicle on the right side with the following data:

   a) The name of the manufacturer of the tank.
   b) The date of the manufacture of the tank.
   c)The permitted substance and the total capacity of the tank.
   d) Pressure designed for the tank and the date of its testing.
   e) The quality of the metal used to manufacture the tank and the quality of the lining used.

10. The tank must be equipped with internal breakers with equal distances and openings so that:

    a) The distance between each breaker should not more than 1.5 m and not less than 90 cm.
    b) The thickness of the breaker should not be less than the thickness of the metal used to manufacture the tank itself.

c)The area of the openings in the breaker should not less than 20% of the total breaker area.

11. The tank should be equipped with an overhead opening with a hinged cover with openings that open automatically in the event of increased internal pressure of the tank in order to drain the excess pressure.

    a) If the tank is designed with compartments to load more than one product, a separate filling slot for each one must be provided.

    b) The perimeter of the tank cover should be provided with a insulating material to prevent the leakage of the liquids.

    c)The tank cover must be equipped with four openings, two of which are to drain the excess pressure of the vapor of the liquid, one for ventilation and one for measuring the level of the liquid in the tank.

12. The tank must be equipped with a rear or side ladder that reaches the surface of the tank for inspection purposes.

13. Front and rear shock protectors should be painted with red and yellow phosphorous stripes that are alternating and oblique to facilitate their vision.

14. The tank must be equipped with a clear and safe measurement method indicating the level of liquid in the tank.

G.1.2.2 Tank Unloading and Filling

1. The tank must be equipped with a gravity dump pipe with a valve at the end.

2. The pumping rate should be at least 700 (l/min).

3. When the install and use of liquid pump is required, it must be of the type approved and special for the liquid itself.

4. The discharge pipe must be provided with a metal cover with tight closure.

5. Rear shock protectors should stand out the discharge valve with at least 20 cm.

6. The tank must be equipped with sturdy wooden pieces (crammed under tyres) to restrict the movement of the vehicle during filling and unloading.

7. The base of the tank on both sides must be equipped with a copper angle of minimum thickness of 6 mm for grounding purposes.

8. The grounding cable must be attached next to the filling point with the copper angle installed in the tank structure during the filling and unloading process.

9. During the filling process, the tank must be stopped outdoor and traffic-free for vehicles, personnel and other obstacles that may hinder the speed of tank removal in emergencies.

10. The tank engine must be shut down during the filling and unloading of liquids, and all tank valves and connections must be completely closed and returned to safe position. The ground tank filling point should be closed before the engine restarts.
11. It is prohibited to keep the driver inside the driving cabin while filling and unloading the tank and must even be near the tank to ensure that the operations are made in properly and safely manner.
12. Make sure that the type of liquid is known before starting the uploading or filling process.
13. Uploading or filling must be stopped immediately after a spill or emergency rash of the liquid gas and fire extinguishers must be equipped for possible need. Leaked liquid should be immediately covered by sand for the subsequent disinfection processes.

G.1.2.3 Precautionary Measures to Prevent Leakage

1. A manual key must be installed to separate electricity from the discharge pump so that the key should be outside the tank and is easily accessible and used in emergencies.
2. Extensions from the tank to the uploading hose (or any other valves) must be durable and certified to ensure that they are free of potential leaks.
3. Uploading hoses must be corrosive resistant to the effects of petroleum liquids and their lengths must be certified.
4. Uploading hoses must be equipped with connectors and cleats easy to jaw and install.
5. Uploading hoses must be kept intact and in special storage cabinets relevant to the purpose or in special storage channels mounted on both sides of the tank.
6. There must be a (neck) barrier around the filling hole welded on the back of the tank at a height of 10 cm ending with two drainage tubes 12 mm in diameter extending down the tank from the back with two valves installed behind the rear shock protector to drain the liquid flowing around the filling vents in a safe manner.

G.1.2.4 Fire Prevention Requirements

1. The exhaust unit exit (Exhaust) for the tanks must be fixed to the bottom and extended up to the front of the vehicle and equipped with a spark arrester.
2. A metal plate should be installed behind the driving cabin at 25 cm from the ground to avoid leaks or the flow of liquids on the exhaust exit tube.
3. Tank batteries must be kept out of the engine, allowed to be installed behind the driving cabin (so that the driver can access them) in a ventilated box from liquid-resistant materials and not be connected to electricity.
4. In addition to the automatic electrical breaker, the tank must be equipped with a manual breaker so that the driver can cut off the electric circuit of the tanker.

5. All electrical extensions (behind the driving cabin) must be in copper or galvanized iron pipes.
6. An electric cigarette lighter is prohibited in the driving cabin.
7. The tank should be painted white with a 20 cm wide strip painted red in the middle on its perimeter with warning signs addressing: adhesion - danger**,** in white in both Arabic and English. In addition, the international warning sign for flammable liquid gas shall be attached to the tank with letters at least 15 cm high.
8. The HazChem hazardous materials advisory poster for incidents must be placed on both sides of the tank and on the back and at a level and position that is clearly visible from a distance.
9. It is forbidden to transport any material in the tanker rather than the material authorized to be transported.
10. Tanks for the transport of one fluid group should be used to transport another group only after ensuring that the tank and all its extensions and connections are completely empty from the first group.
11. The tanker must be equipped with 2 of 9 kg dry powder extinguishers, considering the following:
    a) Place the extinguishers in a visible position behind the driving cabin on both sides, or place them on the chassis under the tank so that they are easy to bring when needed.
    b) The driver must be trained to use the extinguishers.
12. Smoking is prohibited while driving (or filling or unloading) the liquid tanks.
13. If the tank stands on public streets, it must be at least 15 meters away from any building or facility except for the fluid transport building.
14. The speed of the tank must not be more than 50 (km/h) when the tank is full and 60 (km/h) when it is empty.

G.1.2.5 Tank Inspection and Maintenance

1. The tank engine must be apparently sound and free of any fuel leaks.
2. The tank must be subject to periodic mechanical maintenance so that it always works properly and safely.
3. The technical inspection of the vehicle's brake system must be periodically verified and a reference document must be kept for driving distances, maintenance and repairs which should be submitted to the competent authorities upon request.
4. Any indoor maintenance for the tanks is prohibited.
5. The use of open flames and any other ignition sources is prohibited in/and during maintenance of the tanks.

6. The use of the tank is not permitted until it is confirmed that it is safe, clean, free of grease and lipid oils and is safe from liquid leaks.
7. The tank operator should be familiar with the security and safety procedures related to the transportation of the flammable/combustible liquids, understand the nature of their hazards, methods of dealing with them, and call emergency services in cases of fire.
8. The tank must be kept clean and washed properly and safely in daily bases in accordance to the approved procedures.

G.1.3 Fir Prevention Requirements for Asphalt Transport TANKS

1. Must comply with the clause 1.2 when designing asphalt transport tanks. The tank can be gray or black.
2. If the tank is used to spray asphalt, the asphalt must be liquified by a liquid fuel or gas stove.
3. Basic components of the asphalt tank stove include:
    a) Fuel tank and fuel delivery pipes.
    b) Controls for organizing and stopping ignition.
    c) Ventilation and discharge of fireplace gases.
4. Abu Dhabi Civil Defense Authority (Firefighting) must be reviewed to obtain the necessary license to operate the stove before using it.
5. Regular maintenance of the stove must be performed.
6. The perimeter of the stove should always be kept clean and the waste and flammable materials should not be allowed to accumulate.
7. In case of asphalt or fuel leaking from the stove, immediate action must be taken to stop the leak in order to reduce the likelihood of fire and then repair the defect to stop the leak.
8. The person in charge of the stove must be trained to use fire extinguishers and how to behave properly in emergencies.
9. If LPG is used for the stove, no more than one cylinder is allowed for purpose. The cylinder must be in a vertical position during use and tightly fastened in an open space away from the stove. The cylinder must be protected by barriers from the risk of shock or fall and its extensions to be intact.
10. The stove should be closed after the asphalt is liquified and before using the tank to spray the liquid asphalt.

G.2 Liquefied Natural Gas (LNG)

G.2.1 Detentions

- **Natural Gas:** Located above the oil layer in the oil reservoirs in the ground and produced by its natural pressure that pushes it to the surface with oil in drilling operations. It consists of

85% methane, 10% ethane, 3% propane and other gases in very small proportions. It is lighter than air and has no color and smell unless it has a scent added to alert its presence. Its concentration of ignition (in the air) is from 3.8% to 17%. It is used as a cooking fuel and is involved in the manufacture of ammonia and in many petrochemical industries.

- **Liquefied Natural Gas (LNG): it is the** natural gas in its liquid state when it is too cooled to very low temperatures below 0°C.

G.2.2 Transport and Filling of LNG

1. Natural gas may not be filled in any tank unless certified materials with a distinctive smell are added to it so that it can infer gas when it leaks emergency at a concentration of 25% of the minimum ignition in the air.
2. The new tank must be dried before filling through passing dry nitrogen gas into it and then ensuring (with gas detectors) that the concentration of hydrocarbon fumes in the tank has been reduced to below 25% of the minimum limit for its ignition. The tank shall be tested to the highest static design pressure before using and filling it.
3. It is forbidden to fill any tank in which leakage is discovered in the filling area. The tank should be taken out to a secured safe place according to the approved procedures. The filling area shall be evacuated area and the owner and the Abu Dhabi Civil Defense Authority (firefighting) shall be contacted.
4. The LNG leak area can be distinguished by the steam cloud caused by water vapor condensation in the air.
5. It is forbidden to fill the natural gas tank with more than 90% of its capacity.
6. Guidelines and warning signs should be placed at the filling point of the tank such as Danger, No smoking, A Liquefied Gas Filling Point.
7. The tanker must be connected to grounding cable before the LNG discharge and filling process.

G.2.3 Fire Prevention

1. Provide the reservoir and gas consumption areas with a gas warning system, so that the system gives a signal to the automatic closure valve to work when the concertation of leaked gas in the air reaches to 25% of the gas explosion lower limit. The system shall consist of a control panel and gas detectors manufactured according to the adopted international standards.
2. Warning signs should be placed in the reservoirs area in the following terms: Liquefied Natural Gas, No Smoking, No Open Flame, No Heating Equipment, No Welding Equipment.

3. Avoid smoking, open flame presence and using of heating and welding equipment for closer than 3 m from any natural gas tank during the filling process.
4. No employer or operator may fill the natural gas in a reservoir, tank or cylinder not designed for natural gas purposes.
5. At least one person who is competent and has sufficient experience in the field must be present during the process of filling or transporting natural gas.
6. The site must be provided with hand-held extinguishers during the processes of transporting and filling natural gas in accordance with the requirements of the Abu Dhabi Civil Defense Authority (Firefighting).
7. HazChem marking and labelling must be applied to natural gas tanks.

G.2.4 Maintenance

1. All pressure vessels and accessories, natural gas extension networks, fumigation devices, control tools, etc., must be maintained and always ensure that they are sound and functioning properly.
2. Periodic maintenance must be carried out for the tanks, valves and electrical equipment by a specialized technical team.
3. The periodic maintenance of tanks, extensions, valves and fumigation devices must be carried out in accordance with the factory's instructions to ensure the safety of equipment. The periodic maintenance records should be prepared and submitted to the Abu Dhabi Civil Defense Authority (Firefighting) upon their request.

G.3 Liquefied Petroleum Gas (LPG)

G.3.1 Detentions

- **Liquefied Petroleum Gas (LPG):** An oil product generally consisting of a combination of Propane gas at 20 or 25% and Butane by 80 or 75%. It's a gas heavier than air. It is colorless and non-toxic and has a flash point -37.8 ^{O}C and a ignition degree ranging from 426.7 ^{O}C to 537.8 ^{O}C. Produced as a secondary element in petroleum refining processes. It is liquified by press at normal temperatures and stored in cylinders and canisters for cooking, lighting and heating purposes, and as fuel for some internal combustion engines.

G.3.2 General Requirements

1. Appropriate fire prevention precautions for the transport, circulation or storage of LPG should be implemented before obtaining the required approval from the Abu Dhabi Civil Defense Authority (Firefighting).

2. The application of the approved standard specification for LPG workers must be followed.
3. Any activities or work relating to the storage, transport or distribution of LPG cylinders is prohibited without prior approval from the Abu Dhabi Civil Defense Authority (Firefighting).
4. All LPG tanks, cylinders and their accessories used in gas trading must be according to approved international standards.
5. The circulating gas cylinders must conform to the approved gulf standard specifications.

G.3.3 LPG Transport:

G.3.3.1 Gas Cylinder Transport Vehicles

Gas cylinder transport vehicles: they are specially designed to transport a range of LPG cylinders.

➢ **General Conditions:**

1. LPG transport vehicles must be diesel-powered types.
2. It is forbidden to use any vehicle for transporting, selling and distributing of gas cylinders without meet all the requirements of safety and obtain a permit from the Abu Dhabi Civil Defense Authority (Firefighting).
3. The vehicle licensing should be periodically renewed according to the Abu Dhabi Civil Defense Authority (Firefighting) technical examination procedures.
4. The distribution of the cylinder's suppliers is prohibited from supplying gas cylinders to the stores which are not licensed for gas cylinders storage.
5. The use of closed vehicles (such as passenger cars) is prohibited from transporting two LPG cylinders with a capacity of 25 kg per cylinder.

➢ **LPG Cylinder Transport Vehicle Design Requirements:**

1. LPG transport vehicles must meet safety requirements in terms of processing and performance.
2. The surface and bottom of vehicle's box should be closed. The box should be ventilated through a solid iron mesh barrier equipped on both sides of the vehicle. The floor should be of compact wood or durable, friction-resistant and spark-resistant insulator suitable for purpose.
3. The box of the cylinder transport vehicle must be well-made and fixed with provisions on the vehicle.
4. The box should be equipped with a solid bond to prevent the movement of the cylinders, shaking and bumping into each other during the vehicle movement.

1. The elevation of the cylinder box roof should not exceed 45 cm from the head of the cylinders in order to ensure adequate ventilation and the ease of placing and removing cylinders from the box, considering that the storage above the cylinders is not allowed.
2. The metal parts in the box (on which cylinders lay on) should be covered with an insulating material to prevent the friction between them and the cylinders during the vehicle movement.
3. The vehicle must be painted in a distinctive color and is marked as "Danger - Flammable Gas Cylinders " and followed the application of HazChem international markings and labelling for hazardous materials transport vehicles.
4. The gas cylinder transport vehicle must be equipped with a small hand cart used by the staff to transport the cylinder from the vehicle to the client's location.
5. The vehicle must be provided with a shock reliever at front and rear of the vehicle. The reflective striped phosphorus tape is attached to the vehicle's back to facilitate the vehicle distinguish.
6. The vehicle must be equipped with sturdy wooden pieces that are jammed under the tyres to stop their moving while loading and downloading cylinders.
7. The vehicle must be equipped with enough front and rear light signals to at least six, two are mounted at the top of the driving cabin in addition to the side lights showing the boundaries of the tank.
8. The vehicle must be equipped with an electric circuit manual breaker within the reach of the vehicle's driver, in addition to the electric circuit automatic breaker to be activated when the load on the electrical extensions is increased.
9. The casing of the vehicle's electrical extensions must be of the thick, durable, hard type material resisting to damage factors, and the external extensions must be in metal tubes.
10. Exhaust drain unit must be installed downwards the front corner of the vehicle below the shock proof and its end is equipped with spark arrester to prevent sparks coming out.
11. The brake system must be sound and strong.
12. The engine must operate properly and its appearance must be sound and free of any fuel leakage.

- **Daily Inspection of Gas Cylinder Transport Vehicles:**

The authority, which has a license to transport and distribute gas cylinders, must inspect the following points on a daily basis regarding the safety and validity of the vehicle and before starting to use them:

1. Electrical connections in relation to electrical insulation, resistance to moisture and heat, damaged materials and the validity of the electrical current breakers in the failure cases.
2. Check the validity and cleanliness of the engine and fuel lines before each trip including inspecting the engine oil, cooling water and motion belts.
3. Verify the efficiency of the vehicle's brakes as they work properly.
4. Adjust the air pressure in the vehicle's tires.
5. Check the validity of vehicle lights including warning signal lights and mirrors.
6. Check the validity of the steering wheel.

- **Safety Precautions in the Handling, Transportation and Distribution of Gas Cylinders:**

1. The cylinders must be installed in their normal vertical state as per clause 3.2 and the total cylinder weights should not exceed 90% of the vehicle's permitted load.
2. The entire body of the cylinder must be inside the vehicle without appearing anything from it outside or behind the vehicle.
3. The vehicle's load must not exceed the limit set in the license for cylinders.
4. The vehicle must have a speed not more than 60 (km/h) with the words "speed 60 (km/h)" written on a panel mounted on the back of the vehicle.
5. Cylinders must be handled with a high degree of caution and care and it is forbidden to throw, roll or shock them even if they are empty.
6. The cylinder transport vehicle must be free of flammable materials.
7. It is forbidden to load and transport gas cylinders (empty or full) with other objects, and the use of cylinder transport vehicle for other purposes is prohibited.
8. Parking "waiting" for gas cylinder transport vehicles (packaged or full) in places have a lot of passers is prohibited except at specified periods of loading and uploading in distribution areas.
9. If the vehicles loaded by gas cylinders are disabled, it is forbidden to leave them on main roads or in residential. The company should inform the Abu Dhabi Civil Defense Authority (Firefighting), security authority and the company responsible official and take what is necessary to ensure the safety of the situation. In addition, the company should drag the vehicles to the workshops of the owner company after unloading the cylinders with the must stop the engine until the completion of the upload process.
10. The vehicle must be fully parked during loading and uploading operations in the fresh air.
11. In any case, the driver of the vehicle must be accompanied by a loading assistant in the vehicles that are loaded by more than 10 cylinders.

12. It is not permitted to transport or use any gas cylinder unless it is certified by the relevant authority, and to be completely intact and free of visible defects such as the bodies roughness, paint damage, scratches, cracks and bruises.
13. Attempts to hide scratches, scars and cracks from the body of the gas cylinder are prevented from using the putty or other substances.
14. No cylinder is permitted unless it is equipped with a metal protective collar mounted to its valve in order to prevent shocks and damage during transport and handling.
15. The gas cylinder is not allowed to be loaded and transported unless its valve is sealed and the lid is installed on it.
16. In any case, the cylinder valves must be sealed.
17. Empty cylinders must be transported in the same way as filled cylinders.
18. Vehicles not designed to load LPG cylinders are prohibited from entering the loading area.
19. Guidance panels must be placed on the doors of the vehicle on the two sides addressing the distributor name, the license number and the phone number.

- **Fire Prevention Requirements in the Handling, Transportation and Distribution of Gas Cylinders:**

1. The vehicle must be equipped with at least 2 9 kg of multi-purpose dry powder fire extinguishers, which are mounted outside the vehicle on both sides of the driving cabin (from behind), within the vehicle's dimensions.
2. Smoking is strictly prohibited while working on LPG cylinder transport vehicles and electric cigarette lighters and as same are prohibited inside the driving cabin.
3. Workers must be trained to follow the correct methods of loading, transporting and uploading gas cylinders and making them aware of their risk. The driver of the vehicle must always carry the guide to deal with the prevention of LPG accidents as well as the vehicle's license for the transportation of gas cylinders.
4. It is forbidden to leave the vehicle loaded with gas cylinders unattended.
5. In the event of a vehicle overturning or experiencing a serious accident, people should be removed from the area of the accident, preventing the prohibition of all forms of ignition sources and informing the company's official and the use of civil defense (fire) and security agencies to deal with the accident, organize traffic and breaker up the gathering around the accident.

G.3.3.1 LPG Transport Tanker

It is a design-specific vehicle and integrated with an LPG transport tank. The term tank is given to both the transported tank (solo) and the vehicle integrated into the tank.

- **General Conditions:**

1. The use of the LPG tank is permitted when all the requirements of the "safety" are met, and the necessary license is obtained from the competent authorities such as the General Directorate of Traffic and Abu Dhabi Civil Defense Authority (Firefighting) and the license is renewed periodically - after passing all the requirements of technical examination.
2. LNG supply providers are prohibited from supplying unauthorized sites with LPG storage.

- **Design Requirements:**

1. The design and manufacture of the tank must be in accordance with international standards adopted to resist the quality of the gas, the transport capacity and the operating pressure.
2. The tank discharge exit must be equipped with an automatic insulation valve to close the discharge tube closes when accidentally separated from the filling hose while the tank is filled.
3. The vehicle engine must be of the diesel-fueled and meet the safety requirements in terms of processing and performance.
4. The tank should be painted white and marked with **danger, liquefied flammable gas** - with the obligation to apply Haz-Chem international markings and symbols for hazardous materials transport vehicles.
5. The vehicle must be equipped with a shock reliever (support) that is solid in front and rear and the back is glued to reflective striped phosphorus tape - to facilitate the vehicle's discrimination.
6. The vehicle must be equipped with sturdy wooden pieces (crammed under the tyres) to stop its movement during packing and unloading.
7. The vehicle must be equipped with enough front and rear light signals to at least six, two of which are installed at the top of the driving cabin as well as side lights showing the boundaries of the tank.
8. The vehicle must be equipped with a manual electric breaker for its electric circuit, one at the rear of the tank and another at the filling and unloading connections, to enable the vehicle commander to stop the filling or unloading process in emergencies.

9. The vehicle must be equipped with a manual breaker near the vehicle's driver to enable cutting off the electrical circuit during the filling and unloading process and in emergency situations, in addition to the automatic breaker that automatically cuts the vehicle's electrical circuit when the load on the electrical extensions is increased.
10. The wrapping of the vehicle's electrical cable extensions must be of thick type, tension-resistant and damage factors, and the external extensions must be in metal pipes.
11. The Exhaust drain unit must be mounted downwards the vehicle's front corner under the shock protector and its end must be equipped with spark arrester to prevent sparks from coming out.
12. The brake system must be sound and strong.
13. The engine must operate properly, and its appearance must be sound and free of any fuel leakage.

- **Daily Inspection Requirements for LPG Tank:**

The requirements of clause 3.2.1 must be adhered to in this regard.

- **Safety Requirements in Transporting and Driving Gas Tanks on the Roads:**

1. The vehicle load should not exceed the quantity and operating pressure prescribed for the tank.
2. The vehicle must be more than 60 (km/h) with the words "speed 60 (km/h) written on a plate mounted on the back of the tank.
3. The vehicle must be clean and free of any other ignition materials.
4. Parking or waiting for a packed or empty tank in crowded places is prohibited, as well as on roads blocked on LPG tankers.
5. In the event of failure, it is forbidden to leave the full or empty tank on the main roads or in residential areas. The company should notify the Abu Dhabi Civil Defense Authority (Firefighting), the security authorities and the own company responsible official team to take what is necessary to ensure the safety of the situation, and to drag the vehicles to the workshops of the company, with the preference of emptying it before withdrawing. In all cases, the tank must be emptied before entering the maintenance workshop.

- **Safety Requirements to be Followed in Tank Filling and Unloading Processes:**

The filling and unloading of the tank must be carried out under the supervision of a technical person trained in facing and implement emergency procedures and his responsibilities shall be as follows:

1. Any leaked tank in the filling site is prohibited from filling and must be immediately withdrawn to a safe place (in accordance with the special relevant procedures) with the evacuation of the area and the recall of the owner and civil defense (Firefighting).
2. Filling is forbidden at night unless the lighting is adequate, protected and spark proof.
3. During filling and unloading, the tank must be parked in a safe place and away from the risk of collision, making sure that the manual brakes are tightened, and the wood pieces are placed under the tyres to stabilize the vehicle's movement completely.
4. The tank engine must be completely isolated and shut down, including any moving units or electrical equipment, except for gas filling and unloading equipment.
5. Workers must wear protective gloves during the filling and unloading process.
6. The LNG reservoir must be inspected to verify its suitability to receive the quality and quantity of the gas.
7. Make sure that the tank to be filled and its extensions are in a sound state, free of defects or failures and suitable in terms of design to withstand pressure and quality of the gas transported.
8. The tank must be grounded (connected to grounding cable) before and during the filling and uploading process to discharge static electricity from it, and ensure that the grounding cable is removed from the vehicle before moving.
9. Pressure meters should be monitored during tank filling and reservoir uploading to prevent the LPG rash, and the meter reading should be re-inspected after the operation has been completed.

- **Fire Prevention Requirements for LPG Tankers:**

1. The vehicle must be equipped with at least 2 of 12 kg multi-purpose dry powder fire extinguishers installed outside the vehicle on both sides of the driving cabin (from behind) within the vehicle's dimensions.
2. Smoking is strictly prohibited during transportation, filling and unloading of LPG tanks as well as the presence of electric cigarette lighters and so on is prohibited inside the driving cabin.
3. Workers should be aware of the LPG dangers and trained to follow the correct procedures for transporting, filling and unloading gas tanks. The vehicle ‘s driver must always carry a guide for dealing with emergency accidents of LPG tanks as well as the necessary license for the vehicle to transport gas.

4. It is forbidden to leave the vehicle unattended, whether packed or empty.

5. In the event of a tank overturning or having a serious accident, transport the persons from the incident place, banning all forms of ignition sources from the area and informing the officials of the company. In addition, ask for civil defense (Firefighting) and security agencies support to contain the incident, organize traffic and ending up the crowd around the incident.

6. The tank vehicle must always be maintained to sustain its validity and integrity through regularly comprehensive technical examination. The contractor or tank owner must maintain a permanent reference record of the tank's work periods, distances, maintenance and repair work to be submitted to the competent authorities upon request.

G.4 Compressed Gases

G.4.1 Detentions

- **Compressed Gases:** Gases that retain their gas status when packaged inside the cylinders. The packing process is carried out under relatively high pressure and the conditions of normal or very low temperatures.

- **Liquefied Gas:** Gases that could be liquid and gaseous conditions under the pressure of packaging and at normal temperature 25 ^{O}C. These gases can be classified according to the conditions of their packaging into two types:

  a) Gases with medium pressure and very low cooling (- 190 ^{O}C), such as oxygen, nitrogen and argon.
  b) High-pressure and lightly cooled gases (-20 ^{O}C), such as carbon dioxide and nitrous oxide.
  c)Cooling liquefied gases are called cryogenics or cold gases.

- **Medical Gases:** Gases that are used in the medical fields for surgical and an aesthesia purposes and are highly pure.

- **Toxic Gases:** Highly toxic gases that, if they come to living organisms and humans by touch, swallowing or inhalation, have the potential to damage and destroy the tissues and organs of the body or injure the functioning of the body's vital functions and may lead to death - depending on the extent of gas exposure, concentration, rate, location and area of absorption of the body.

- **Flammable Gas:** Gas**,** which, if combined in appropriate proportions with air, oxygen or other oxidants, burns under normal pressure conditions and gas ignition temperature.

G.4.2 General Requirement

1. The clause concerned the processes related to the transportation, trading, storage and handling of compressed flammable, toxic, industrial or medical gases packed in cylinders, fixed or transported tanks or used within an extension network.

2. Preliminary approval must be obtained from the Abu Dhabi Civil Defense Authority (Firefighting) and then the issuance of a necessary license (for the storage or circulation of compressed flammable, toxic, industrial or medical gases including their extension network for the followings:

   a) quantities of compressed flammable gas that do not exceed 60 m^3.
   b) quantities of non- flammable compressed gas that does not exceed 180 m^3.

   Calculating the volume of compressed gas depends on the size of the vacuum occupied by it in the natural pressure and temperature (1 air pressure, 25 ^{O}C).

3. The distinction of compressed gas cylinders must be abided in accordance with the international specification adopted by the Abu Dhabi Civil Defense Authority (Firefighting) in this regard.

4. The installation (or attempt to repair) of any extensions for the use of compressed gases is prohibited except by specialists.

5. Customers of these gases should be fully aware of suppliers and how to contact them when needed in case of emergency.

6. When dealing with these gases, protective clothing, which does not interact with the skin when fire, should be worn to protect the skin as well as visor face masks, glasses and gloves for the compressed gases handling which should be the type that is easy to take off when the gas leaks into it, as well as appropriate rubber shoes.

7. A prior contingency plan (written) must be prepared in coordination with the Abu Dhabi Civil Defense Authority (Firefighting) on dealing with compressed gas accidents.

G.4.3 Compressed Gas Transport Tanks

Compressed gas Tanker: It is a design-specific vehicle integrated with a compressed gas tank. The term tank in this item is given to both the transported tank (solo) and the vehicle integrated into the tank.

1. Compressed gases must be filled in special designed tanks licensed by the Abu Dhabi Civil Defense Authority (Firefighting).

2. The tank is forbidden to be filled with any gas until it has been completely cleaned of any other gases that may interact with it, by pushing it with inert gas.

3. The international marking and symbols system must be applied on the tanks.
4. Any tank where the leak is detected at the packing site is prohibited from filling and must be immediately withdrawn to a safe place (in accordance to special procedures) with the evacuation of the area and the recall of the owner and Abu Dhabi Civil Defense Authority (firefighting).
5. Special parking should be allocated for filling and unloading compressed gas tanks.
6. The packing and unloading process must be carried out with trained supervisors who are fully aware of the seriousness of the gases and how to deal with them in emergencies through using the relevant protective devices.
7. The tank must be grounded before the discharge process begins when the contents are flammable.
8. It is prohibited to initiate the process of filling or unloading before the complete braking of the tank has been confirmed using of manual brakes.
9. Warning plates and signs should be placed during and until the completion of the filling or unloading process to warn non-specialists not to approach. The plate should be 30×40 centimeters and written in white on a blue background and carrying phrases such as Stop, Dangerous gases.
10. The tank valves must be sealed after uploading and then place the words "gas tank" ... - empty on it with the name of the gas in the vacuum depending on the gas type before leaving the tank.
11. Excessive force is prohibited in closing tank valves when filling or unloading, especially in the event of leakage, tampering in extensions or using a hammer to open any valve that is difficult to open with the call of competent authorities such as Abu Dhabi Civil Defense Authority (firefighting), owner, supplier, etc.
12. Make sure that the tank is completely free of all its contents before subjecting it to any welding or maintenance operations.

G.4.4 Special Protective Requirements for some Compressed Gases

1. **Cryogenics (called frost or cooled gases):** They are gases that are highly cooled to a temperature that may reach to 180°C below zero, such as oxygen, nitrogen and argon.

   Oxygen vessels and cylinders should be disinfected from grease, oils and any contaminants before being filled.

   Ignition sources should be putted away from compressed oxygen gas and liquid.

Storage of flammable gas cylinders with oxygen cylinders is prohibited.

Water should be removed from safety valves to avoid its freezing on it, which may lead to failure of the safety valve to function.

2. **Highly flammable gases** (hydrogen-acetylene): It is prohibited to store such cylinders near flammable solvents or combustion residues or near electrical connections or any ignition sources.

3. **Medical gases (cyclopropane, nitrous oxide, medical oxygen, helium):**

   Customers in the fields of medical gases should be fully aware of the characteristics and dangerously of these gases.

   The gas valve must be fully opened when used, to ensure that the gas flow does not fall below the limit, due to the importance and specificity of medical uses.

   Any attempts to mix these gases into cylinders without the approval of the supplier and manufacture are prohibited.

   The gas valve should be opened slowly and cautiously, after removing the lid, for short time to get rid of potential dust and dirt.

   The gas valve opening direction must be away from individuals using only the equipment dedicated to the opening process.

   The using of the gas is prohibited if it may be contaminated with foreign substances from any sources unless it is equipped with filters for pollutants or non-return valves.

   The name of the gas must be recorded clearly on the cylinder, and this is taken primarily before the color is considered.

   Cylinders of these gases are prohibited from trading with hands or gloves contaminated with oils and grease.

   Colors must be followed in the distinction of medical gases according to the following table and according to the distinctive colors of the gas cylinders included in the supplement:

Gas name	Cylinder / Gas container color	Gas name	Cylinder / Gas container color
oxygen	green	Cycloproban	orange
Carbon dioxide	gray	helium	brown

Nitrous oxide	Pale blue	Ethylene	red
Carbon dioxide + Oxygen	gray + Green	helium + Oxygen	brown + Green

Table (G.2): Colors to be Followed in the Distinction of Medical Gases

4. Toxic gases:

Persons dealing with these gases must have sufficient contact information with those concerned and specialized in these gases (such as the supplier) in emergencies.

Respirators and gas masks for toxic gases must be provided and used in emergencies, especially when the gas concentration exceeds the permitted rate, and must be kept in its designated area away from pollution.

The appropriate volume of cylinders should be used for the desired purpose and should be provided only for the specified time for use and removed as soon as completed.

APPENDIX H: SAFETY DATA SHEET (SDS)

The information in the SDS should be presented using the following 16 headings in order given below:

SECTION 1: Identification of the substance/mixture and of the company/ undertaking

1.1 Product identifier:
- Product Name:
- Product Code:
- Product Type:
- Other means of identification:

1.2 Relevant identified uses of the substance or mixture and uses advised against

1.3 Details of the supplier of the safety data sheet

1.4 1.4 Emergency telephone number

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture
- Product definition
- Classification according to Regulation

2.2 Label elements
- Signal word
- Hazard statements
- Precautionary statements
  - General
  - Prevention
  - Response
  - Storage
  - Disposal
  - Supplemental label elements
  - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles
- Special packaging requirements
  - Containers to be fitted with child-resistant fastenings
  - Tactile warning of danger

2.3 Other hazards
- Product meets the criteria according to the Regulation
- Other hazards which do not result in classification

SECTION 3: Composition/information on ingredients

3.1 Mixtures

SECTION 4: First aid measures

4.1 Description of first aid measures

- General
- Eye contact
- Inhalation
- Skin contact
- Ingestion
- Protection of first-aiders

4.2 Most important symptoms and effects, both acute and delayed

- Over-exposure signs/symptoms
  - Eye contact
  - Inhalation
  - Skin contact
  - Ingestion

4.3 Indication of any immediate medical attention and special treatment needed

- Notes to physician
- Specific treatments

SECTION 5: Firefighting measures

5.1 Extinguishing media

- Suitable extinguishing media
- Unsuitable extinguishing media

5.2 Special hazards arising from the substance or mixture

- Hazards from the substance or mixture
- Hazardous combustion products

5.3 Advice for firefighters

- Special protective actions for fire-fighters
- Special protective equipment for fire-fighters

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- For non-emergency personnel
- For emergency responders

6.2 Environmental precautions

6.3 Methods and material for containment and cleaning up

6.4 Reference to other ADR /National regulations sections

SECTION 7: Handling and storage

7.1 Precautions for safe handling

7.2 Conditions for safe storage, including any incompatibilities

7.3 Specific end use(s)

- Recommendations:
- Industrial sector specific solutions

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

- Occupational exposure limits
- Recommended monitoring procedures

8.2 Exposure controls

- Appropriate engineering controls
- Individual protection measures
  - Hygiene measures
  - Eye/face protection
- Skin protection
  - Gloves
  - Body protection
  - Other skin protection
- Respiratory protection
- Environmental exposure controls

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

- Appearance
  - Physical state
  - Colour
  - Odour
  - Odour threshold
- pH
- Melting point (dust)
- Initial boiling point and boiling range

- Flash point
- Evaporation rate
- Flammability (solid, gas)
- Lower explosion limit (dust)
- Minimum ignition energy (mJ)
- Vapour pressure
- Vapour density
- Density
- Solubility(ies)
- Partition coefficient: n-octanol/ water
- Auto-ignition temperature
- Decomposition temperature
- Viscosity

9.2 Other information

SECTION 10: Stability and reactivity

10.1 Reactivity

10.2 Chemical stability

10.3 Possibility of hazardous reactions

10.4 Conditions to avoid

10.5 Incompatible materials

10.6 Hazardous decomposition products

SECTION 11: Toxicological information

11.1 Information on toxicological effects

- Acute toxicity
  - Acute toxicity estimates
- Irritation/Corrosion
- Sensitisation
- Mutagenicity
- Carcinogenicity
- Reproductive toxicity
- Specific target organ toxicity (single exposure)
- Specific target organ toxicity (repeated exposure)
- Aspiration hazard

11.2 Other information

SECTION 12: Ecological information

12.1 Toxicity

12.2 Persistence and degradability

12.3 Bio accumulative potential

12.4 Mobility in soil

- Soil/water partition coefficient (KOC)
- Mobility

12.5 Results of PBT and vPvB assessment

12.6 Other adverse effects

SECTION 13: Disposal considerations

13.1 Waste treatment methods

- Product
  - Methods of disposal
  - Hazardous waste
  - Disposal considerations
- Packaging
  - Methods of disposal
  - Disposal considerations
  - Special precautions

SECTION 14: Transport information

14.1 UN number

14.2 UN proper shipping name

14.3 Transport hazard class(es)

14.4 Packing group

14.5 Environmental hazards

14.6 Special precautions for user

14.7 Transport in bulk according to IMO instruments

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

15.2 safety assessment

SECTION 16: Other information

APPENDIX I: INTERNATIONAL BEST PRACTICE FOR DANGEROUS GOODS VEHICLE CONSTRUCTION AND APPROVAL REQUIREMENTS

I.1 General

The appendix presents the international best practice which could be considered as guidelines for the competent authority for detailed requirements or the future enhancement of the current ones for the approval of dangerous goods vehicle construction materials and electrical equipment.

The appendix is based on ADR regulations, which is consistent with United Nations Recommendations, Annex B: Provisions concerning transport equipment and transport operations Part 9 Requirements concerning the construction and approval of vehicles.

The concerned ADR regulations should be read in conjunction of the mentioned international best practice illustrated in the following international regulations and references.

- The International Electrotechnical Commission (IEC) international standards for all electrical, electronic, and related technologies – collectively known as "electrotechnology".
- UNECE Vehicle Regulations for the technological innovations of vehicles to make them safer and more environmentally sound.
- European Economic Community (EEC) Regulations.

I.2 Vehicle Category

According to the best international practice, the dangerous goods vehicles are commonly categories into categories N and O as shown in following Table I-1

Category	Description
N	**Power-driven vehicles having at least four wheels and used for the carriage of goods**
N1	Vehicles used for the carriage of goods and having a maximum mass not exceeding 3.5 tons. (Pick-up Truck, Van)
N2	Vehicles used for the carriage of goods and having a maximum mass exceeding 3.5 tones but not exceeding 12 tons. (Commercial Truck)
N3	Vehicles used for the carriage of goods and having a maximum mass exceeding 12 tons. (Commercial Truck)
O	**Trailers (including semi–trailers)**
O1	Trailers with a maximum mass not exceeding 0.75 tons.
O2	Trailers with a maximum mass exceeding 0.75 tons, but not exceeding 3.5 tons.
O3	Trailers with a maximum mass exceeding 3.5 tons, but not exceeding 10 tons.
O4	Trailers with a maximum mass exceeding 10 tons.

Table I-1: International Dangerous Goods Vehicles Categories N and O

"Vehicle": means any vehicle, whether complete (e.g. one stage-built vans, lorries, tractors, trailers), incomplete (e.g. chassis, chassis-cab, trailer-chassis) or, completed (e.g. chassis-cab fitted with a bodywork), intended for the carriage of dangerous goods by road.

"Base vehicle": means a chassis-cab vehicle, a tractor for semi-trailer, a trailer-chassis or a trailer with a self-supporting body intended for the carriage of dangerous goods.

The following definitions are practically considered for vehicles according to the transported goods to facilitate the vehicles inspection and certifying:

"EX/II vehicle" or "EX/III vehicle": means a vehicle intended for the carriage of explosives substances and articles (Class 1);

"FL vehicle": means a vehicle intended for the carriage of liquids having a flash-point of not more than 61°C (with the exception of diesel fuel complying with standard EN 590: 1993, gas oil, and heating oil (light) - UN No.1202 - with a flash-point as specified in standard EN 590: 1993) or flammable gases, in tank-containers, portable tanks or MEGCs of more than 3 m^3 capacity, fixed tanks or demountable tanks of more than 1 m^3 capacity or a battery-vehicle of more than 1 m^3 capacity intended for the carriage of flammable gases;

"OX vehicle": means a vehicle intended for the carriage of hydrogen peroxide, stabilized or hydrogen peroxide, aqueous solution stabilized with more than 60 per cent hydrogen peroxide (Class 5.1, UN No. 2015) in tank-containers or portable tanks of more than 3 m^3 capacity, fixed tanks or demountable tanks of more than 1 m^3 capacity.

"AT vehicle": means a vehicle, other than FL or OX, intended for the carriage of dangerous goods in tank-containers, portable tanks or MEGCs of more than 3 m^3 capacity, fixed tanks or demountable tanks of more than 1 m^3 capacity or a battery vehicle of more than 1 m^3 capacity other than an FL vehicle.

I.3 Approval of EX/II, EX/III, FL, OX and AT Vehicles

According to international best practice and The ADR regulations the carriage of certain hazardous material is done through special vehicles, as listed below:

- Flammable liquids – FL & AT vehicles.
- Explosive material – EXII & EXIII vehicles.
- Oxidizing Agents – OX vehicles.

No special certificates of approval shall be required for vehicles other than EX/II, EX/III, FL, OX and AT vehicles, apart from those required by the general safety regulations normally applicable to vehicles in the country of origin.

The carriage of other types of hazardous materials may be done using normal goods carrying vehicles. However, prior to the organization of such transport, the services of a Dangerous Goods Safety Advisor (DGSA) shall be engaged by the transport operator in order to ensure that all necessary safety precautions are taken.

Single Approval

EX/II, EX/III, FL, OX and AT vehicles shall be subject to an annual technical inspection in their country of registration to make sure that they conform to the general safety regulations (concerning brakes, lighting, etc.); if these vehicles are trailers or semi-trailers coupled behind a drawing vehicle, the drawing vehicle shall be subject to technical inspection for the same purposes. When vehicles are required to be fitted with an endurance braking system, the manufacturer of the vehicle or his duly accredited representative shall issue a declaration of conformity at the first technical inspection.

Conformity of EX/II, EX/III, FL, OX and AT vehicles is subject to a certificate of approval issued by the competent authority of the country of registration for each vehicle whose inspection yields satisfactory results. The validity of a certificate of approval shall expire not later than one year after the date of the technical inspection of the vehicle preceding the issue of the certificate. Figure I.1 shows the certificate of approval model (format A4). The approval certificate for a vacuum-operated waste tank-vehicle shall bear the following remark: "**vacuum-operated waste tank-vehicle** ".

<table>
<tr><td colspan="4">CERTIFICATE OF APPROVAL FOR VEHICLES CARRYING CERTAIN DANGEROUS GOODS

This certificate testifies that the vehicle specified below fulfils the conditions prescribed by National Regulations</td></tr>
<tr><td>1. Certificate No.:</td><td>2. Vehicle manufacturer:</td><td>3. Vehicle Identification No.:</td><td>4. Registration number (if any):</td></tr>
<tr><td colspan="4">5. Name and business address of carrier, operator or owner:</td></tr>
</table>

6. Description of vehicle:[1]

7. Vehicle designation(s) according to 9.1.1.2 of ADR:[2]

EX/II EX/III FL OX AT

8. Endurance braking system:[3]

O Not

O The effectiveness according to National Regulations is sufficient for a total mass of the transport unit of ____t [4]

9. Description of the fixed tank(s)/battery-vehicle (if any)**:**

9.1 Manufacturer of the tank:
9.2 Approval number of the tank/battery-vehicle:
9.3 Tank manufacturer's serial number/Identification of elements of battery-vehicle:
9.4 Year of manufacture:
9.5 Tank code according to National Regulations
9.6 Special provisions according to National Regulations [6]:
9.7

10. Dangerous goods authorized for carriage:

The vehicle fulfils the conditions required for the carriage of dangerous goods assigned to the vehicle designation(s) in No. 7.

10.1 In the case of an EX/II or EX/III vehicle [3]? goods of Class 1 including compatibility group J

? goods of Class 1 excluding compatibility group J

10.2 In the case of a tank-vehicle/battery-vehicle [3]

O only the substances permitted under the tank code and any special provisions specified in No. 9 may be carried [5]

or

O only the following substances (Class, UN number, and if necessary packing group and proper shipping name) may be carried:

Only substances which are not liable to react dangerously with the materials of the shell, gaskets, equipment and protective linings (if applicable) may be carried.

11. Remarks:

12. Valid until: Stamp of issuing service

Place, Date, Signature	
13. Extensions of validity	
Validity extended until	Stamp of issuing service, place, date, signature:

According to the definitions for power-driven vehicles and for trailers of categories N and O [2]
Delete what is not appropriate.

[2] Strike out what is not appropriate

[3] Mark the appropriate.

[4] Enter appropriate value. The value will not limit the "registration / in-service maximum permissible mass" indicated in the registration document(s).

[5] Substances assigned to the tank code specified in national regulations

[6] Not required when the authorized substances are listed in No. 10.2NOTE: This certificate shall be returned to the issuing service when the vehicle is taken out of service; if the vehicle is transferred to another carrier, operator or owner, as specified in No. 5; on expiry of the validity of the certificate; and if there is a material change in one or more essential characteristics of the vehicle.

Figure I.1 shows the Common Certificate of Approval Model

Type Approval

At the request of the manufacturer or his duly accredited representative, base vehicles of new motor vehicles and their trailers which are subject to single approval may be type approved by a competent authority in accordance with ECE Regulation No. 105 or Directive 98/91/EC provided that the requirements of the said Regulation or the said Directive correspond to those of clause 3 of this appendix. This type approval, granted by the transporter as ensuring the conformity of the base vehicle when the approval of the complete or completed vehicle is obtained, provided that no modification of the base vehicle alters its validity.

When the base vehicle has been type-approved, compliance with clause I.4 below, shall be verified on the completed vehicle.

I.4 Construction of Base Vehicles Requirements

Base vehicles of EX/II, EX/III, FL, OX and AT vehicles shall comply with the requirements of this Chapter, according to the Table I.2 below. For vehicles other than of EX/II, EX/III, FL, OX and AT:

the requirements of 2.1 are applicable to all vehicles and the requirements of 5 are applicable to all motor vehicles with a maximum mass exceeding 12 tons.

TECHNICAL SPECIFICATIONS		**VEHICLES**				
		EX/II	EX/III	AT	FL	OX
1	ELECTRICAL EQUIPMENT					
1.1	Wiring		X	X	X	X
1.2	Battery master switch					
1.2.1			X		X	
1.2.2			X		X	
1.2.3					X	
1.2.4			X		X	
1.3	Batteries	X	X		X	
1.4	Permanently energized circuits					
1.4.1					X	
1.4.2			X			
1.5	Electrical installation at rear of cab		X		X	
2	BRAKING EQUIPEMENT					
2.1	General provisions	X	X	X	X	X
2.2	Anti-lock braking system		X	X	X	X
2.3	Endurance braking system		X	X	X	X
2.4	Emergency braking devices for					

	trailers					
2.4.1		X				
2.4.2			X			
3	PREVENTION OF FIRE RISKS					
3.1	Vehicle cab					
3.1.1		X	X			
3.1.2						X
3.2	Fuel tanks	X	X		X	X
3.3	Engine	X	X		X	X
3.4	Exhaust system	X	X		X	
3.5	Vehicle endurance braking		X	X	X	X
3.6	Combustion heaters					
3.6.1 3.6.2 3.6.5		X	X	X	X	X
3.6.3 3.6.4					X	
3.6.6		X	X			
4	SPEED LIMITATION DEVICE	X	X	X	X	X
5	COUPLING DEVICE OF TRAILERS	X	X			

Table I.2: Technical Specifications of EX/II, EX/III, FL, OX and AT vehicles

1. **Electrical Equipment**

1.1 Wiring

1.1.1 The size of conductors shall be large enough to avoid overheating. Conductors shall be adequately insulated. All circuits shall be protected by fuses or automatic circuit breakers, except for the following:

- from the battery to the cold start and stopping systems of the engine;
- from the battery to the alternator;
- from the alternator to the fuse or circuit breaker box;
- from the battery to the starter motor;
- from the battery to the power control housing of the endurance braking system (see 2.3), if this system is electrical or electromagnetic;
- from the battery to the electrical lifting mechanism for lifting the bogie axle.

The above unprotected circuits shall be as short as possible.

1.1.2 Cables shall be securely fastened and positioned in such a way that the conductors are adequately protected against mechanical and thermal stresses.

1.2 Battery Master Switch

1.2.1 A switch for breaking the electrical circuits shall be placed as close to the battery as practicable.

1.2.2 A control device to facilitate the disconnecting and reconnecting functions of the switch shall be installed in the driver's cab. It shall be readily accessible to the driver and be distinctively marked. It shall be protected against inadvertent operation by either adding a protective cover, by using a dual movement control device or by other suitable means. Additional control devices may be installed provided they are distinctively marked and protected against inadvertent operation.

1.2.3 The switch shall have a casing with protection degree IP 65 in accordance with IEC Standard 529.

1.2.4 The cable connections on the switch shall have protection degree IP 54. However, this does not apply if these connections are contained in a housing which may be the battery box. In this case it is sufficient to insulate the connections against short circuits, for example with a rubber cap.

1.3 Batteries

The battery terminals shall be electrically insulated or covered by the insulating battery box cover. If the batteries are not located under the engine bonnet, they shall be fitted in a vented box.

1.4 Permanently Energized Circuits

1.4.1 (a) Those parts of the electrical installation including the leads which shall remain energized when the battery master switch is open, shall be suitable for use in hazardous areas. Such equipment shall meet the general requirements of IEC 60079, parts 0 and 14 and the additional requirements applicable from IEC 60079, parts 1, 2, 5, 6, 7, 11, 15 or 18;

(b) For the application of IEC 60079 part 14 [1], the following classification shall be used: Permanently energized electrical equipment including the leads which is not subject to 1.2 and 1.3 shall meet the requirements for Zone 1 for electrical equipment in general or meet the requirements for Zone 2 for electrical equipment situated in the driver's cab. The requirements for explosion group IIC, temperature class T6 shall be met.

1.4.2 Bypass connections to the battery master switch for electrical equipment which must remain energized when the battery master switch is open shall be protected against overheating by suitable means, such as a fuse, a circuit breaker or a safety barrier (current limiter).

1.5 Provisions concerning that part of the Electrical Installation Situated to the rear of the Driver's Cab

The whole installation shall be so designed, constructed and protected such that it cannot provoke any ignition or short-circuit under normal conditions of use of vehicles and that these risks can be minimized in the event of an impact or deformation. In particular:

1.5.1 Wiring: The wiring located to the rear of the driver's cab shall be protected against impact, abrasion and chafing during normal vehicle operation. Examples of appropriate protection are given in figures 1, 2, 3 and 4 below. However, the sensor cables of anti-lock braking devices do not need additional protection.

1.5.2 Lighting: Lamp bulbs with a screw cap shall not be used.

1.5.3 Electrical connections: Electrical connections between motor vehicles and trailers shall have a protection degree IP54 in accordance with IEC standard 529 and be designed to prevent accidental disconnection. Examples of appropriate connections are given in ISO 12 098:1994 and ISO 7638:1985.

2. Braking Equipment

2.1 General Provisions

In addition to the following technical provisions, to be applied in accordance with the table of I-2, motor vehicles and trailers intended for use as transport units for dangerous goods shall fulfil all relevant technical requirements of ECE Regulation No.13 or Directive 71/320/EEC, as amended, in accordance with the dates of application specified therein.

2.2 Anti-lock Braking System

2.2.1 Motor vehicles having a maximum mass exceeding 16 tons, or authorized to tow a trailer with a maximum mass exceeding 10 tons, shall be equipped with an anti-lock braking system of category 1 according to ECE Regulation No. 13, Annex 13.

2.2.2 Trailers having a maximum mass exceeding 10 tons shall be equipped with an anti-lock braking system of category A according to ECE Regulation No. 13, Annex 13.

2.3 Endurance Braking System

2.3.1 Endurance braking system means a system intended to stabilize vehicle speed on a long descent, without the use of the service, secondary or parking braking systems.

2.3.2 Motor vehicles having a maximum mass exceeding 16 tons or authorized to tow a trailer with a maximum mass exceeding 10 tons shall be fitted with an endurance braking system which complies with the following requirements:

(a) The endurance braking system may be a single device or a combination of several devices. Each device may have its own control;

(b) All three endurance braking control options provided for in paragraph 2.14 of ECE Regulation No. 13 [5] shall be permitted, but, in the case of a failure of the anti-lock system, integrated or combined retarders shall be switched off automatically;

(c) The effectiveness of the endurance braking system shall be controlled by the anti-lock braking system such that the axle(s) braked by the endurance braking system cannot be locked by the endurance braking system at speeds above 15 km/h. However, this provision shall not apply to that part of the braking system constituted by natural engine braking;

(d) The endurance braking system shall comprise several stages of effectiveness, including a low stage appropriate for the unladen condition. Where the endurance braking system of a motor vehicle is constituted by its engine, the different gear ratios shall be considered to provide the different stages of effectiveness;

(e) The performance of the endurance braking system shall be such that it fulfils the requirements of ECE Regulation No. 13, Annex 5 (Type II A test), with a laden vehicle mass comprising the laden mass of the motor vehicle and its authorized maximum towed mass but not exceeding a total of 44 tons;

(f) If the motor vehicle does not fulfil the performance requirements for the endurance braking system as defined in (e) above, it shall at least fulfil the requirements of ECE Regulation No. 13, Annex 5, and shall be restricted to being coupled only to a trailer fitted with an endurance braking system. Such a motor vehicle shall be fitted with a control device for the endurance braking system on the trailer.

2.3.3 If a trailer is equipped with an endurance braking system it shall fulfil the requirements of ECE Regulation No. 13, Annex 5, and the provisions of 2.3.2 (a) to (d) above.

2.4 Emergency Braking Devices for Trailers

2.4.1 Trailers shall be equipped with an effective system for braking or restraining them if they become detached from the motor vehicle towing them.

2.4.2 Trailers shall be fitted with an effective braking device which acts on all the wheels, is actuated by the drawing vehicle's service-brake control and automatically stops the trailer in the event of breakage of the coupling.

NOTE: *The use of* trailers *equipped only with an inertia braking system shall be limited to a maximum load of 50 kg net explosive mass.*

3. **Prevention of Fire Risks**

3.1 Vehicle Cab

3.1.1 Only material not readily flammable shall be used in the construction of the driver's cab. This provision will be deemed to be met if, in accordance with the procedure specified in ISO standard 3795:1989, samples of the following cab components have a burn rate not exceeding 100 mm/min: seat cushions, seat backs, safety belts, head lining, opening roofs, armrests, all trim panels including door, front, rear, and side panels, compartment shelves, head restraints, floor coverings, sun visors, curtains, shades, wheel housing covers, engine compartment covers, mattress covers and any other interior materials, including padding and crash-deployed elements, that are designed to absorb energy on contact by occupants in the event of a crash.

3.1.2 Unless the driver's cab is made of materials which are not readily flammable, a shield made of metal or other suitable material of the same width as the tank shall be fitted at the rear of the cab. Any windows in the rear of the cab or in the shield shall be hermetically closed and made of fire-resistant safety glass with fire-resistant frames. Furthermore, there shall be a clear space of not less than 15 cm between the tank and the cab or the shield.

3.2 Fuel Tanks

The fuel tanks for supplying the engine of the vehicle shall meet the following requirements:

(a) In the event of any leakage, the fuel shall drain to the ground without coming into contact with hot parts of the vehicle or the load;

(b) Fuel tanks containing petrol shall be equipped with an effective flame trap at the filler opening or with a closure enabling the opening to be kept hermetically sealed.

3.3 Engine

The engine propelling the vehicle shall be so equipped and situated to avoid any danger to the load through heating or ignition. In the case of EX/II and EX/III vehicles the engine shall be of compression-ignition construction.

3.4 Exhaust System

The exhaust system as well as the exhaust pipes shall be so directed or protected to avoid any danger to the load through heating or ignition. Parts of the exhaust system situated directly below the fuel tank (diesel) shall have a clearance of at least 100 mm or be protected by a thermal shield.

3.5 Vehicle Endurance Braking

Vehicles equipped with endurance braking systems emitting high temperatures placed behind the rear wall of the driver's cab shall be equipped with a thermal shield securely fixed and located between this system and the tank or load so as to avoid any heating, even local, of the tank wall or the load.

In addition, the thermal shield shall protect the braking system against any outflow or leakage, even accidental, of the load. For instance, a protection including a twin-shell shield shall be considered satisfactory.

3.6 Combustion Heater

3.6.1 *(*Reserved*)*

3.6.2 The combustion heaters and their exhaust gas routing shall be designed, located, protected or covered so as to prevent any unacceptable risk of heating or ignition of the load. This requirement shall be considered as fulfilled if the fuel tank and the exhaust system of the appliance conform to provisions similar to those prescribed for fuel tanks and exhaust systems of vehicles in 9.2.4.3 and 9.2.4.5 respectively.

3.6.3 The combustion heaters shall be put out of operation by at least the following methods:

(a) Intentional manual switching off from the driver's cab;

(b) Stopping of the vehicle engine; in this case the heating device may be restarted manually by the driver;

(c) Start-up of a feed pump on the motor vehicle for the dangerous goods carried.

3.6.4 After running is permitted after the combustion heaters have been put out of operation. For the methods of 3.6.3 (b) and (c) the supply of combustion air shall be interrupted by suitable measures after an after running cycle of not more than 40 seconds. Only heaters shall be used for which proof has been furnished that the heat exchanger is resistant to the reduced after running cycle of 40 seconds for the time of their normal use.

3.6.5 The combustion heater shall be switched on manually. Programming devices shall be prohibited.

3.6.6 Combustion heaters with gaseous fuels are not permitted.

4. **Speed Limitation Devices**

Motor vehicles (rigid vehicles and tractors for semi-trailers) with a maximum mass exceeding 12 tons, shall be equipped with a speed limitation device according to the technical requirements of ECE Regulation No. 89 [6], as amended. The set speed V as defined in paragraph 2.1.2 of ECE Regulation No. 89 [6] shall not exceed 85 km/h.

Note: ECE Regulations No. 89: uniform provisions concerning the approval of:

I. Vehicles with regard to limitation of their maximum speed;
II. Vehicles with regard to the installation of a speed limitation device (SLD) of an approved type; III. Speed limitation devices (SLD).

As an alternative, the corresponding provisions of directive 92/6/EEC and directive 92/24/EEC of the Council may apply provided that they have been amended in accordance with the latest amended form of ECE Regulation No. 89 applicable at the time of the vehicle approval.

5. **Coupling Devices of Trailers**

Coupling devices of trailers shall comply with the technical requirements of ECE Regulation No. 55 or Directive 94/20/EC, as amended, in accordance with the dates of application specified therein.

I.5 Additional Requirements Concerning Complete or Completed EX/II and EX/III Vehicles

I.5.1 Materials to be used in the Construction of Vehicles Bodies

No materials likely to form dangerous compounds with the explosive substances carried shall be used in the construction of the body.

I.5.2 Combustion Heaters

Combustion heaters shall not be installed in load compartments of EX/II and EX/III vehicles.

Combustion heaters shall meet the requirements of clause 4 and the following:

(a) The switch may be installed outside the driver's cab;

(b) The device may be switched off from outside the load compartment; and

(c) It is not necessary to prove that the heat exchanger is resistant to the reduced after running cycle.

No fuel tanks, power sources, combustion air or heating air intakes as well as exhaust tube outlets required for the operation of the combustion heater shall be installed in the load compartment. It shall be ensured that the heating air outlet cannot be blocked by cargo. The temperature to which packages are heated shall not exceed 50 ºC.

I.5.3 EX/II Vehicles

The vehicles shall be designed, constructed and equipped so that the explosives are protected from external hazards and the weather. They shall be either closed or sheeted. Sheeting shall be resistant to tearing and be of impermeable material, not readily flammable. It shall be tautened so as to cover the vehicle on all sides, with an overlap of not less than 20 cm down the sides of the vehicle, and be kept in position by a lockable device.

The load carrying compartment of closed vehicles shall not have windows and all openings shall have lockable, close-fitting doors or covers.

I.5.4 EX/II Vehicles

These vehicles shall be closed. The loading surface, including the front wall, shall be continuous. The insulating and heat resisting properties of the body shall be at least equivalent to those of a partition consisting of a metal outer wall lined with a layer of fire-proofed wood of 10 mm thickness; or the body shall be of a construction which shall ensure that no flame penetration of the wall or hot spots of more than 120 °C on the inner wall surface will occur within 15 minutes from the start of a fire resulting from the operation of the vehicle, such as a tyre fire. All the doors shall be capable of being locked. They shall be so placed and constructed as to overlap the joints.

I.5.5 Load Compartment and Engine

The engine shall be placed forward of the front wall of the load compartment; it may nevertheless be placed under the load compartment, provided this is done in such a way that any excess heat does not constitute a hazard to the load by raising the temperature on the inner surface of the

I.5.6 Load Compartment and Exhaust System

The exhaust system of EX/II and EX/III vehicles or others parts of these complete or completed vehicles shall be so constructed and situated that any excess heat shall not

constitute a hazard to the load by raising the temperature on the inner surface of the load compartment above 80 ºC.

I.5.7 Load Compartment and Exhaust System

The electrical installation on EX/III vehicles shall meet the requirements of item 1 of clause 3

The rated voltage of the electrical system shall not exceed 24V.

The electrical installation in the load compartment shall be dust-protected (at least IP54 or equivalent) or, in the case of Compatibility Group J, at least IP65 (e.g. flame-proof Eex d).

I.6 Additional Requirements Concerning the Construction of Bodies of the Complete or Completed Vehicles Intended for the Carriage of Dangerous Goods in Packages (other than EX/II and EX/III Vehicles)

Combustion heaters shall meet the following requirements:

(a) The switch may be installed outside the driver's cab;

(b) The device may be switched off from outside the load compartment; and

(c) It is not necessary to prove that the heat exchanger is resistant to the reduced after running cycle.

If the vehicle is intended for the carriage of dangerous goods for which a label conforming to models Nos. 1, 1.4, 1.5, 1.6, 3, 4.1, 4.3, 5.1 or 5.2 is prescribed, no fuel tanks, power sources, combustion air or heating air intakes as well as exhaust tube outlets required for the operation of the combustion heater shall be installed in the load compartment. It shall be ensured that the heating air outlet cannot be blocked by cargo. The temperature to which packages are heated shall not exceed 50º C. Heating devices installed inside the load compartments shall be designed so as to prevent the ignition of an explosive atmosphere under operating conditions.

Additional requirements concerning the construction of the bodies of vehicles intended for the carriage of given dangerous goods or specific packagings shall be in accordance with the indications in Column (16) of Table A of Chapter 3.2, for a given substance.

I.7 Additional Requirements Concerning the Construction of Bodies of the Complete or Completed Vehicles Intended for the Carriage of Dangerous Goods Solid in Bulk

Combustion heaters shall meet the following requirements:

(a) The switch may be installed outside the driver's cab;

(b) The device may be switched off from outside the load compartment; and

(c) It is not necessary to prove that the heat exchanger is resistant to the reduced after running cycle.

If the vehicle is intended for the carriage of dangerous goods for which a label conforming to models Nos. 4.1, 4.3 or 5.1 is prescribed, no fuel tanks, power sources, combustion air or heating air intakes as well as exhaust tube outlets required for the operation of the combustion heater shall be installed in the load compartment. It shall be ensured that the heating air outlet cannot be blocked by cargo. The temperature to which the load is heated shall not exceed 50 ºC. Heating devices installed inside the load compartments shall be designed so as to prevent the ignition of an explosive atmosphere under operating conditions.

Additional requirements concerning the construction of the bodies of vehicles intended for the carriage of dangerous solids in bulk may be in accordance with the indications in Column (17) of Table A of Chapter 3.2, for a given substance.

I.8 Additional Requirements Concerning the Construction of Bodies of the Complete or Completed Vehicles Intended for the Carriage of Temperature Controlled Self-Reactive Substances for Class 4.1and organic Peroxides of Class 5.2

Insulated, refrigerated and mechanically-refrigerated vehicles intended for the carriage of temperature controlled self-reactive substances of Class 4.1 and organic peroxides of Class 5.2 shall conform to the following conditions:

(a) the vehicle shall be such and so equipped as regards its insulation and means of refrigeration, that the control temperature prescribed in 2.2.41.1.17 and 2.2.52.1.16 and in 2.2.41.4 and 2.2.52.4 for the substance to be carried is not exceeded. The overall heat transfer coefficient shall be not more than 0.4 W/m^2K;

(b) the vehicle shall be so equipped that vapours from the substances or the coolant carried cannot penetrate into the driver's cab;

(c) a suitable device shall be provided enabling the temperature prevailing in the loading space to be determined at any time from the cab;

(d) the loading space shall be provided with vents or ventilating valves if there is any risk of a dangerous excess pressure arising therein. Care shall be taken where necessary to ensure that refrigeration is not impaired by the vents or ventilating valves;

(e) the refrigerant shall not be flammable; and

(f) the refrigerating appliance of a mechanically refrigerated vehicle shall be capable of operating independently of the engine used to propel the vehicle.

I.9 Additional Requirements Concerning Fixed Tanks (Tank-Vehicles), Battery- Vehicles and Complete or Completed Vehicles used for the Carriage of Dangerous Goods in Demountable Tanks with Capacity Greater Than 1 M^3 or in Tank-Container, Potable Tanks or MEGCs on A Capacity Greater than 3 M^3 (FL, OX and AT Vehicles)

I.9.1 General Provisions

In addition to the vehicle proper, or the units of running gear used in its stead, a tank-vehicle comprises one or more shells, their items of equipment and the fittings for attaching them to the vehicle or to the running-gear units.

Once the demountable tank has been attached to the carrier vehicle, the entire unit shall meet the requirements prescribed for tank-vehicles.

I.9.2 Requirements Concerning Tanks

Fixed tanks or demountable tanks made of metal shall meet the relevant requirements of ADR – Chapter 6 as well as the elements of battery-vehicles and of MEGCs in the case of cylinders, tubes, pressure drums and bundles of cylinders and in the case of tanks.

Tank-containers made of metal and tanks made of fibre-reinforced plastics material shall meet the requirements of ADR – Chapter 6, portable tanks shall also meet the requirements of ADR or, if applicable, those of the IMDG Code

Vacuum-operated waste tank-vehicles shall meet the requirements of ADR – Chapter 6.

I.9.3 Fastenings

Fastenings shall be designed to withstand static and dynamic stresses in normal conditions of carriage, and minimum stresses as defined in ADR – Chapter in the case of tank-vehicles, battery-vehicles, and vehicles carrying demountable tanks.

I.9.4 Earthing of FL Vehicles

Tanks made of metal or of fibre-reinforced plastics material of FL tank-vehicles and battery elements of FL battery-vehicles shall be linked to the chassis by means of at least one good electrical connection. Any metal contact capable of causing electrochemical corrosion shall be avoided.

I.9.5 Stability of Tank-Vehicles

The overall width of the ground-level bearing surface (distance between the outer points of contact with the ground of the right-hand tyre and the left-hand tyre of the same axle) shall be at least equal to 90% of the height of the centre of gravity of the laden tank-vehicle. In an articulated vehicle the mass on the axles of the load-carrying unit of the laden semi-trailer shall not exceed 60% of the nominal total laden mass of the complete articulated vehicle.

In addition, tank-vehicles with fixed tanks with a capacity of more than 3 m^3 intended for the carriage of dangerous goods in the liquid or molten state tested with a pressure of less than 4 bar, shall comply with the technical requirements of ECE Regulation No. 111 for lateral stability, as amended, in accordance with the dates of application specified therein.

I.9.6 Rear Protection of Vehicles

A bumper sufficiently resistant to rear impact shall be fitted over the full width of the tank at the rear of the vehicle. There shall be a clearance of at least 100 mm between the rear wall of the tank and the rear of the bumper (this clearance being measured from the rearmost point of the tank wall or from projecting fittings or accessories in contact with the substance being carried). Vehicles with a tilting shell for the carriage of powdery or granular substances and a vacuum-operated waste tank with a tilting shell with rear discharge do not require a bumper if the rear fittings of the shell are provided with a means of protection which protects the shell in the same way as a bumper.

NOTE 1: This provision does not apply to vehicles used for the carriage of dangerous goods in tank-containers, MEGCs or portable tanks.

NOTE 2: For the protection of tanks against damage by lateral impact or overturning, ADR – Chapter 6

I.9.7 Combustion Heaters

Combustion heaters shall meet the requirements of clause 4 and the following:

(a) The switch may be installed outside the driver's cab;

(b) The device may be switched off from outside the load compartment; and

(c) It is not necessary to prove that the heat exchanger is resistant to the reduced after running cycle. In addition, for FL vehicles, they shall also meet the requirements of clause 4.

If the vehicle is intended for the carriage of dangerous goods for which a label conforming to models Nos. 3, 4.1, 4.3, 5.1 or 5.2 is prescribed, no fuel tanks, power sources, combustion air or heating air intakes as well as exhaust tube outlets required for the operation of the combustion heater shall be installed in the load compartment. It shall be ensured that the heating air outlet cannot be blocked by cargo. The temperature to which the load is heated shall not exceed 50 ºC. Heating devices installed inside the load compartments shall be designed so as to prevent the ignition of an explosive atmosphere under operating conditions.

I.9.8 Electrical Equipment

The electrical installation on FL vehicles shall meet the requirements of clause 4. However additions to or modifications of the electrical installations of the vehicle shall meet the requirements for the electrical apparatus of the relevant group and temperature class according to the substances to be carried.

Electrical equipment on FL vehicles, situated in areas where an explosive atmosphere is, or may be expected to be, present in such quantities as to require special precautions, shall be suitable for use in a hazardous area. Such equipment shall meet the general requirements of IEC 60079 parts 0 and 14 and the additional requirements applicable form IEC 60079 parts 1, 2, 5, 6, 7, 11 or 18. The requirements for the electrical apparatus of the relevant group and temperature class according to the substances to be carried shall be met.

For the application of IEC 60079 part 14, the following classification shall be used:

ZONE 0 Inside tank compartments, fittings for filling and discharge and vapour recovery lines.

ZONE 1 Inside cabinets for equipment used for filling and discharge and within 0.5 m of venting devices and pressure relief safety valves.

Permanently energized electrical equipment, including the leads, which is situated outside Zones 0 and 1 shall meet the requirements for Zone 1 for electrical equipment in general or meet the requirements for Zone 2 electrical equipment situated in the driver's cab. The requirements for the relevant group of electrical apparatus according to the substances to be carried shall be met.

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