

UNIVERSITY OF PARDUBICE
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**ANALYSIS OF THE TRANSPORT OF DANGEROUS GOODS IN THE CZECH
REPUBLIC AND THE REPUBLIC OF SOUTH AFRICA AND SUGGESTIONS
FOR CHANGES**

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Poděkování:

Tímto bych chtěl poděkovat všem, kteří mi v průběhu tvorby mé bakalářské práce pomáhali a poskytli mi potřebné materiály i informace. Zvláštní poděkování patří vedoucí práce Ing. Pavlíně Brožové, Ph.D., která mi svými podněty a připomínkami pomohla s vypracováním této bakalářské práce.

Anotace:

V bakalářské práci jsou představeny základní znalosti o právních předpisech, typech režimů dopravy, označování, balení, manipulaci a identifikaci nebezpečného zboží pro veřejnost. Tyto znalosti jsou nutné pro bezproblémovou přepravu nebezpečných věcí. V bakalářské práci je ještě uvedena analýza přepravy nebezpečných věcí z České republiky do Belgie a ze Zimbabwe do Jihoafrické republiky.

Klíčová slova:

ADR, Česká republika, IATA, IMDG, Jihoafrická republika, nebezpečné zboží, RID, SABS

Title:

ANALYSIS OF THE TRANSPORT OF DANGEROUS GOODS IN THE CZECH REPUBLIC AND THE REPUBLIC OF SOUTH AFRICA AND SUGGESTIONS FOR CHANGES

Annotation:

The thesis introduces the basic knowledge of the legislation, types of modes of transport, labeling, packaging, handling and identification of dangerous goods to the public. These skills are necessary for smooth transport of dangerous goods. The thesis is still an analysis of transport of dangerous goods from the Czech Republic to Belgium and from Zimbabwe to South Africa.

Keywords:

ADR Czech Republic, Dangerous goods, IATA, IMDG, Republic of South Africa, RID, SABS

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INTRODUCTION

Transportation plays a major role in our daily lives and it is a vital tool used by everyone to transport people and goods to and from anywhere around the world . The need for transportation led to the evolution of integrated transport systems which also involves the transportation of dangerous goods as one of the systems. Dangerous goods are goods or substances that pose risk to our environment, health and property if they are not properly transported or handled. Various means of transport can be used to transport dangerous goods and this can be by road, rail, air or water (sea and inland) transport. The list of dangerous goods consists of explosives, flammable solids or liquids, radioactive and toxic chemicals, infectious substances, etc.

Transportation of dangerous goods takes place in areas where people and the environment are particularly exposed and it is regulated by international regulations for individual mode of transport. The most significant is the United Nations Recommendations on the Transport of Dangerous Goods Regulations (the UN Recommendations which aim to eliminate or minimize risks, promote safety and facilitate the transport of dangerous goods.

The aim of this thesis is to introduce basic knowledge on legislation, types of modes transport, labelling, packaging, handling and identifying dangerous goods to the public which are rarely exposed to it. Analyse between Czech Republic and the Republic of South Africa and make suggestions for change based on the results of the analysis in order to efficiently transport dangerous goods.

1 LEGISLATION OF TRANSPORT OF DANGEROUS GOODS IN CZECH REPUBLIC AND REPUBLIC OF SOUTH AFRICA

Czech Republic and Republic of South Africa are subjected to the agreement concerning the international transportation of dangerous goods.

- *ADR* - Road transport
- *RID* - Rail Transportation
- *IMDG* - Marine transportation
- *IATA DGR* (Dangerous Goods Regulations) – Air transportation

1.1 LEGISLATION

1.1.1 *Road Transport*

The European Agreement concerning the International Carriage of Dangerous Goods by Road commonly known as **ADR** (*from the French abbreviation Accord européen relatif au transport international des marchandises Dangereuses par Route*). This agreement was done in Geneva, Switzerland on 30. September 1957 under the auspices of the United Nations Economic Commission for Europe, and it entered into force on 29. January 1968. The Agreement was amended in New York on 21. August 1975 and entered into force on 19. April 1985. A new amended ADR 2011 entered into force on 1. January 2011. The ADR changes every two years and its goal is to increase safety of international transport of dangerous goods by road. The conditions for ADR are set out in **Annex "A"** (General provisions concerning dangerous substances and articles) and **Annex "B"** (Provisions on vehicles and transportation).

Annex A: General provisions and provisions concerning dangerous articles and substances

Part 1 - General provisions

Part 2 - Classification

Part 3 - Dangerous goods list, special provisions and exemptions related to limited and excepted quantities

Part 4 - Packing and tank provisions

Part 5 - Consignment procedures

Part 6 - Requirements for the construction and testing of packagings, intermediate bulk containers (IBCs), large packagings and tanks

Part 7 - Provisions concerning the conditions of carriage, loading, unloading and handling

Annex B: Provisions concerning transport equipment and transport operations

Part 8 - Requirements for vehicle crews, equipment, operation and documentation

Part 9 - Requirements concerning the construction and approval of vehicles

Czech Republic

Czechoslovakia was a member of ADR since 1986. The amendment of ADR was published by of the Minister in the Official Gazette Foreign Affairs under decree No. 64/1987 Coll. Like other international treaties and agreements, this agreement was based on the Constitutional Law No. 4/1993 Coll. as part of the legal system of the Czech Republic provisions related to the dissolution of Czechoslovakia. Now the following provisions are used to govern the transportation of dangerous goods.

- Act No. 111/1994 Coll. On road transport
- Decree No. 187/1994 Coll. As amended by Decree No. 48/1998 Coll., Which implements the provisions of the above Law No. 111/1994 Coll.

Republic of South Africa

The Hazchem Regulations promulgated under the Hazardous Substances Act, 1973 and which controlled the transport of dangerous substances by road tanker since 10. January 1987 were replaced on 3. August 2001 by a set of regulations made under section 54 (Chapter VIII) of the National Road Traffic Act, 1996. With the implementation of these Dangerous Goods Regulations this control passed from the Department of Health to the Department of Transport and was extended to include the transport of all dangerous goods in packs or bulk.

The National Road Traffic Act 93 of 96

On 1 August 2001, chapter VIII of the Act "Transportation of Dangerous Goods and Substances by Road" came into operation. Legislation regarding this act was published in the Government Gazette on 17 March 2000. The agreements stated below needed to be implemented by the end of October 2001.

This Act, chapter VIII of the Road Traffic Act 93 of 1996, brings into law all the *South African Bureau of Standards* (SABS) Codes of Practice pertaining to the following:

- *SABS 1398* "Road tank vehicles for petroleum-based flammable liquids";

- *SABS 1518* "Transportation of dangerous goods – design requirements for road tankers";
- *SABS 0228* "The identification and classification of dangerous substances and goods";
- *SABS 0229* "Packaging of dangerous goods for road and rail transportation in South Africa";
- *SABS 0230* "Transportation of dangerous goods - Inspection requirements for road vehicles";
- *SABS 0231* "Transportation of dangerous goods - Operational requirements for road vehicles";
- *SABS 0232-1* "Transportation of dangerous goods - Emergency information systems", Part 1: "Emergency information system for road transportation";
- *SABS 0232-3* "Transportation of dangerous goods - Emergency information systems", Part 3: "Emergency action codes"; and
- *SABS 0233* "Intermediate bulk containers for dangerous substances" is incorporated into these regulations by notice published by the Minister in the Gazette.

One of the codes of practice, SABS 0231, (Transportation of Dangerous Goods, and the Operational Requirements for Road Vehicles) covers three separate issues namely:

- The loading of Dangerous Goods or Substances - Consignor responsibility
- The transportation of Dangerous Goods or Substances - Operator responsibility
- The unloading of Dangerous Goods or Substances - Consignee and Operator responsibility.(1)

1.1.2 Rail transport

RID - *Regulations Concerning the International Transport of Dangerous Goods by Rail.*

RID sets out the minimum standards for safe packing and transport of various types of dangerous goods travelling to or through another country. These standards concern, inter alia, packaging, labelling, and consignment procedures. The dangerous goods covered by the RID are classified in accordance with the UN system, and the IAEA Regulations have been adopted to apply to the rail transport. The provisions governing the international transport of dangerous goods in the European region were first considered in the 1950s, RID served as a development model. Not only has the European Agreement concerning the International

Carriage of Dangerous Goods by Road (ADR) been closely aligned with RID from the outset, the modal authorities responsible for both sets of provisions have continued to work jointly since that time to update the two sets of regulations in a harmonised manner. The two sets of regulations are updated and amended, like the other major modal transport regulations, biennially. The revised editions of the two sets of regulations incorporate the latest agreed changes to the UN Recommendations (UN Model Regulations). These regulations were restructured in 2001 and obtained a whole new layout. RID is grouped into seven parts. Each part is subdivided into chapters and each chapter into sections and sub-sections and five appendices:

- ***Parts of RID***

Part 1 - General Provisions

Part 2 - Classification of

Part 3 - lists of dangerous goods, special provisions and exemptions související carriage of dangerous goods packed in limited quantities

Part 4 - Provisions on the use of containers and tanks

Part 5 - Provisions for sending

Part 6 - Requirements for the construction and testing of packagings, IBCs, large packagings, and tanks

Part 7 - Provisions for transportation, loading, unloading and handling

- ***Appendices of RID***

Appendix 1 - Czech-German alphabetical list of dangerous goods

Annex 2 - Czech-French alphabetical list of dangerous goods

Appendix 3 - International Supplement

Appendix 4 - Miscellaneous

Appendix 5 - Other

A new amended RID 2011 entered into force on 1. January 2011. RID changes every year.

Czech Republic

The regulations concerning the international carriage of dangerous goods by rail started to be applied in the beginning of 2003 in the Czech Republic.

Republic of South Africa

SANS 10405:2009 is one of the regulations used for the transport of dangerous goods by rail, published by the South African Bureau of Standards (SABS). The SANS 10405:2009 standards were derived from the Regulations concerning the international carriage of dangerous goods by rail (RID). This document was published in May 2009. This document replaces SANS 10232-2:1997 Edition1. It specifies the requirements for the safe transport of dangerous goods by rail in terms of operational requirements, design requirements and emergency preparedness. It also includes documentation, loading, dispatch, placarding, contingency planning and occurrence management, offloading, security issues and training.

(2)

1.1.3 *Air transport*

ICAO - *International Civil Aviation Organization and IATA – International Air Transport Association*

Air transport of dangerous goods is monitored by The International Civil Aviation Organisation (ICAO) and International Air Transport Association (IATA). The basic manual for transport of dangerous goods is called *IATA DGR* (the IATA Dangerous Goods Regulation). The regulations for transport of dangerous goods by air in both manual are not the same. IATA DGR is valid and applicable to all air carriers that are members of IATA and all the sender, recipient, and the "handling" agents who provide air transport, ground handling and handling of dangerous goods.

Safe Transport of Dangerous Goods by Air (L 18)

The regulation issued by the Ministry of Transport to implement § 102, paragraph 1, Law No. 49/1997 Coll. Civil aviation and amending Act No. 455/1991 Coll. on trading, as amended. Binding interpretation of this regulation, if necessary, issued by the director of the Civil Aviation. This legislation is the Czech translation of Appendix 18 (Annex 18) to the Convention on International Civil Aviation. Manual comes once a year in English and other languages, includes characteristics of the different classes of dangerous goods, a detailed alphabetical list of substances and articles stating the permitted weight or volume per packaging unit. The manual specifies for each type as well as the degree of danger and other specific characteristics.

1.1.4 *Sea transport*

IMDG - *International Maritime Dangerous Goods Code.*

International Code for sea transport of dangerous goods (IMDG Code) issued in 1965 contains detailed conditions of transport, labelling, packaging and emergency assistance for each substance or dangerous goods. IMDG Code is updated every two years by IMO organizations.

SOLAS - Safety of Life at Sea

International Convention for the Safety of Life at Sea (SOLAS), 1974. At the convention, the transport of dangerous goods is addressed in *Chapter VII - Carriage of dangerous goods*. The regulations are contained in the following parts:

Part A - Carriage of dangerous goods in packaged form - includes provisions for the classification, packing, marking, labelling and placarding, documentation and storage of dangerous goods.

Part A-1 - Carriage of dangerous goods in solid form in bulk - covers the documentation, storage and segregation requirements for these goods and requires reporting of incidents involving such goods.

Part B - covers Construction and equipment of ships carrying dangerous liquid chemicals in bulk and requires chemical tankers to comply with the International Bulk Chemical Code (IBC Code).

Part C - covers Construction and equipment of ships carrying liquefied gases in bulk and gas carriers to comply with the requirements of the International Gas Carrier Code (IGC Code).

Part D - includes special requirements for the carriage of packaged irradiated nuclear fuel, plutonium and high-level radioactive wastes on board ships and requires ships carrying such products to comply with the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (INF Code).

Issued by the *IMO Convention - Maritime International Organization*, founded 1948 in Geneva. The chapter requires carriage of dangerous goods to be in compliance with the relevant provisions of the International Maritime Dangerous Goods Code (IMDG Code). (3)

Czech Republic acceded to this SOLAS Convention in 1980 and became a member in 1993.

ADN - *European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways*

The European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN) was done at Geneva on 26 May 2000 on the occasion of a Diplomatic Conference held under the joint auspices of the United Nations Economic Commission for Europe (UNECE) and the Central Commission for the Navigation of the Rhine (CCNR). It entered into force on 29 February 2008.

ADN consists of a main legal text (the Agreement itself) and annexed Regulations and aims at:

- Ensuring a high level of safety of international carriage of dangerous goods by inland waterways;
- Contributing effectively to the protection of the environment, by preventing any pollution resulting from accidents or incidents during such carriage; and
- Facilitating transport operations and promoting international trade in dangerous goods.

2 ANALYSIS OF TRANSPORTATION OF DANGEROUS GOODS IN THE CZECH REPUBLIC AND REPUBLIC OF SOUTH AFRICA

2.1 CLASSIFICATION OF DANGEROUS GOODS

Dangerous goods are usually classified with reference to their immediate risk.

2.1.1 Dangerous goods

Dangerous goods are substances that pose a risk to people, property, or the environment if they are not handled or transported properly, due to their chemical or physical properties. The way in which different classes of dangerous goods are handled in transport will depend upon these properties and hazards, for example:

- The type of packaging that can be used.
- What classes of dangerous goods can be transported together in freight containers.
- Where and how the goods can be stored within the port and on the ship.

There are nine classes of dangerous good and this includes:

Class 1 – Explosives

Class 2 – Gasses

Class 3 – Flammable liquids

Class 4.1 – Flammable solids

Class 4.2 – Substances liable to spontaneous combustion

Class 4.3 – Substances that in contact with water, emit flammable gases

Class 5.1 – Oxidizing agents

Class 5.2 – Organic peroxides

Class 6.1 – Toxic substances

Class 6.2 – Infectious substances

Class 7 – Radioactive Materials

Class 8 – Corrosive substances

Class 9 – Other dangerous goods

2.1.2 *Characteristics of dangerous goods*

Class 1 – Explosives

Explosive substance is a solid or liquid substance that in itself is capable by chemical reaction to produce an explosion or a substance that has been produced to function by explosion.

Class 1.1 – substances and articles that have a mass explosion hazard for example grenades, mines, nitro-glycerine, etc.

Class 1.2 – substances and articles that have a mass projection hazard but not a mass explosion hazard for example rockets and warheads.

Class 1.3 – substance and articles that have a fire hazard and minor blast hazard/minor projection or both for example projectiles, signal smoke, and tracers for ammunition.

Class 1.4 – substances and articles that comprises of minor explosion hazard for example ammunition, airbags, and model rocket motors.

Class 1.5 – very insensitive substances that has mass explosive hazard for example casting agents, ammonia nitrate fuel, oil mixture.

Class 1.6 – extremely insensitive substances that has mass explosive hazard for example insensitive articles and military.

Class 2 – Gasses

Gas is a substance which at 50°C has a vapour pressure greater than 300 kPa or is completely gaseous at 20°C at standard pressure 101, 3 kPa.

Gas can be transported in different physical states:

- As a compressed gas.
- Liquefied gas (high/low pressure).
- Refrigerated liquefied gas.
- Dissolved gas.

Class 2.1 Flammable gases

These gases which easily ignite and burn at 20°C at standard pressure 101, 3 kPa when in a mixture of 13 % or less volume with air.

Class 2.2 – Non-flammable, non toxic gases

Gases that are not transported at a pressure of less than 280kPa at 20°C or as refrigerated liquids, and mostly they are asphyxiates (these are gases that replace oxygen in the atmosphere) and oxidizing (these are gases that provide and oxygen contribute to combustion).

Class 2.3 – Toxic gases

Toxic gases are gases known as toxic or corrosive which cause hazard to human health or living organisms.

Class 3 – Flammable liquids

These are liquids or a mixture of liquids or liquids with solids in a solution (paint, liquors, etc.) which emits flammable vapour.

Class 4 – Flammable solids

Class 4.1 Flammable solids

These are solids that can cause fire through friction, substances which are self reactive and can undergo a strong exothermic reaction or solid desensitized explosive which may explode if not diluted sufficiently.

Class 4.2 – Substances liable to spontaneous combustion

Substance that are liable to spontaneous rating under normal conditions, or when in contact with the air.

Class 4.3 – Substances that emit flammable gases when they are in contact with water

This is a substance that interacts with water and become spontaneous or emits flammable gas in dangerous quantities.

Class 5 – Oxidizing agents and Organic peroxides

Class 5.1 – Oxidizing agents

These are substances that are not combustible but are capable of yielding oxygen or contribute to the combustion of the other materials.

Class 5.2 – Organic peroxides

These are organic substances that have a bivalent structure (two oxygen atoms joint together (–o–) and these substances can:

- Burn rapidly
- Sensitive to impact or friction
- React dangerously with other substances
- Causes damage to the eyes
- Liable to explosive decomposition

Class 6 – Toxic substances and Infectious substances

Class 6.1 – Toxic substances

These are substances that are harmful to the environment and to human health if inhaled or through skin contact.

Class 6.2 – Infectious substances

These are substances that contain pathogens micro- organism (viruses, bacteria, fungi, etc.) or recombinant micro- organism (mutant) that causes infection disease in animals or humans.

Class 7 – Radioactive Materials

These are any materials containing radionuclide where both the activity concentration and the total activity in the consignment exceed the value.

Class 8 – Corrosive substances

These are substances by chemical reaction will cause severe damage when in contact with a living tissue and it can damage other goods or the means of transport in case of a leakage.

Class 9 – Miscellaneous dangerous goods








These are substances not included in other classes of dangerous goods, these are inter alia substances transported at a temperature that is greater than or equal to 100°C and greater than or equal to 200°C in a liquid form.

2.2 IDENTIFICATION OF DANGEROUS GOODS

2.2.1 Labelling and characteristics of the labels of dangerous goods






Source for **Picture 1 – 9**:

<http://en.wikipedia.org/wiki/Dangerous_goods>

	Hazardous Materials Class 1: Explosives		
	Hazardous Materials Class 1.1: Explosives		Hazardous Materials Class 1.2: Explosives
Mass Explosion Hazard		Blast/Projection Hazard	
	Hazardous Materials Class 1.3: Explosives		Hazardous Materials Class 1.4: Explosives
Minor Blast Hazard		Major Fire Hazard	
	Hazardous Materials Class 1.5: Blasting Agents		Hazardous Materials Class 1.6: Explosives
Blasting Agents		Extremely Insensitive Explosives	

Picture 1: Class 1- Explosives

- Background: orange
- Figures: black
- Numerals shall be about 30 mm in height and be about 5 mm thick (for a label measuring 100 mm x 100 mm)





		Hazardous Materials Class 2.1: Flammable Gas			
	Hazardous Materials Class 2.2: Nonflammable Gas			Hazardous Materials Class 2.3: Poisonous Gas	
	Hazardous Materials Class 2.2: Oxygen (Alternative Placard)			Hazardous Materials Class 2.3: Inhalation Hazard (Alternative Placard)	

Picture 2: Class 2 - Gases

Table 1: Characteristics of the labels

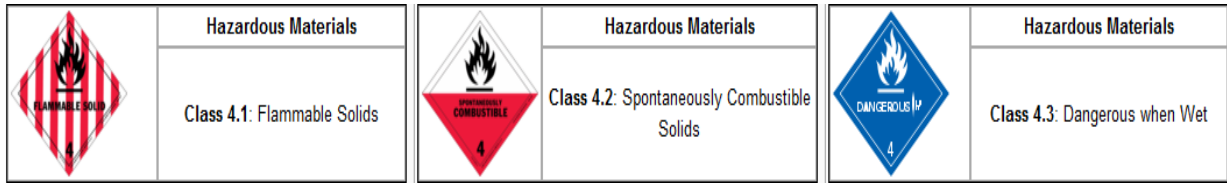
Name	Symbol	Colour of symbol	Background
Flammable gases	flame	black or white	Red
Non flammable, non-toxic gases	gas cylinder	black or white	Green
Toxic gases	skull and crossbones	black	White

Source: Author

	Hazardous Materials Class 3: Flammable Liquids			Hazardous Materials Class 3: Combustible (Alternate Placard)	
	Hazardous Materials Class 3: Fuel Oil (Alternate Placard)			Hazardous Materials Class 3: Gasoline (Alternate Placard)	

Picture 3: Class 3 - Flammable Liquids

- Symbol (flame): black or white
- Background: red



Picture 4: Class 4 - Flammable Solids

- | | | |
|--|---|--|
| <ul style="list-style-type: none"> • Symbol (flame): Black • Background: White with seven vertical red stripes | <ul style="list-style-type: none"> • Symbol (flame): Black • Background: Upper half white, Lower half red | <ul style="list-style-type: none"> • Symbol (flame): Black or white • Background: blue |
|--|---|--|



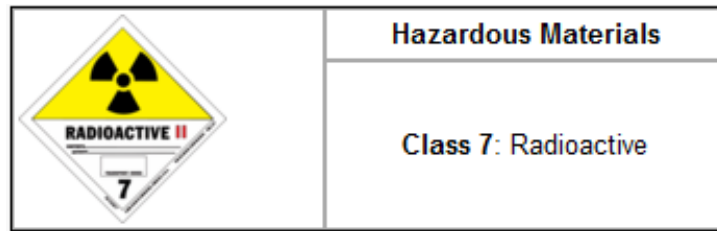
Picture 5: Class 5 - Oxidizing Agents and Organic Peroxides

- Symbol (flame over circle): black;
- Background: yellow



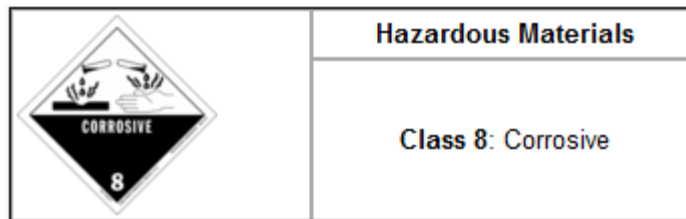
Picture 6: Class 6 - Toxic and Infectious Substances

- | | |
|--|--|
| <ul style="list-style-type: none"> • Symbol (skull and crossbones): black; • Background: white | <p>The lower half of the label may bear the inscriptions: infectious substance and in case of damage or leakage immediately notify public health authority;</p> <ul style="list-style-type: none"> • Symbol (three crescents superimposed on a circle) and inscriptions: black • Background: white |
|--|--|



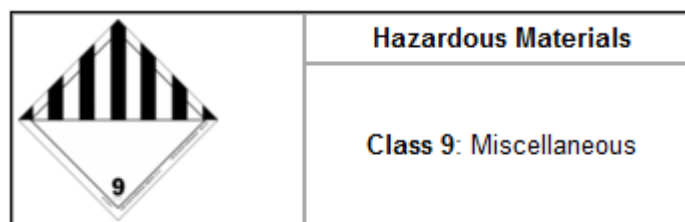
Picture 7: Class 7 - Radioactive Substances

- Category II - Yellow
- Symbol (trefoil): black;
- Background: upper half yellow with white border, lower half white;
- Text (mandatory): black in lower half of label: RADIOACTIVE



Picture: 8: Class 8 - Corrosive Substances

- Symbol (liquids, spilling from two glass vessels and attacking a hand and a metal): black
- Background: upper half white and lower half black with white border



Picture 9: Class 9 - Miscellaneous

- Symbol (seven vertical stripes in upper half): black
- Background: white

Czech Republic uses labels same identifying labels as South Africa.

2.2.2 UN numbers

UN (abbreviation of United Nations) numbers are four digits numbers used in the international transport to identify classes of the hazardous materials. These numbers are assigned by the United Nations Committee of Experts on the Transportation of the Dangerous Goods, the issuers of the recommendations addressing the international transport of dangerous goods by sea, air, road, rail, and inland waterways (The Orange Book). The UN numbers range from UN0001 to UN3500 and are ideally preceded by the letters "UN" (for example, "UN1993").



Picture 10: Example of UN number

Source (4)

2.2.3 The hazard identification – Kemler's code

The hazard identification number consists of two or three figures. In general, the figures indicate the following hazards:

Table 2: The hazards of substances according to Kemler's code

2	Emission of gas due to pressure or to chemical reaction
3	Flammability of liquids (vapours) and gases or self- heating liquid
4	Flammability of solids or self- heating solid
5	Oxidizing (fire- intensifying) effect
6	Toxicity or risk of infection
7	Radioactivity
8	Corrosives
9	Risk of spontaneous violent reaction – include <i>the nature of a substance that might have a risk of explosion, disintegration, and polymerization reaction following the release of considerable heat or flammable and/or toxic gases.</i>
0	Additional digit without meaning
X	If a hazard identification number is prefixed by the letter "X", this indicates that the substance will react dangerously with water.

Source: <http://cep.mdcz.cz/dok2/DokPub/dok.asp>, (Author)

2.3 METHOD OF CARRIAGE OF DANGEROUS GOODS

General Provisions

Transport of dangerous goods must be carried out by means of transport with provisions for transporting units, bulk and for carriage in tanks, and it must comply with the provisions relating to the loading, unloading and handling.

Transporting in units/pieces

This involves gas containers, and items which can be transported without packaging, crates or handling products because of their size, weight or shape. This does not apply to goods which are neither transported in bulk nor to substances carried in tanks. Unless otherwise specified, items may be transported:

- in closed vehicles or in closed containers
- in uncovered vehicles or uncovered containers
- Packages containing containers made of materials which are sensitive to moisture must be transported in sealed containers

Transporting in bulk

It is the carriage of solids or articles without packaging in vehicles or containers. This does not apply to things like pieces or units are transported, nor to substances carried in tanks. Dangerous goods may be transported in bulk in vehicles or containers, unless special provision permits. However, uncleaned empty containers may be transported in bulk if it is not explicitly prohibited by other regulations.

Transporting in a tank

Tank is defined as a large receptacle (portable or fixed) , container, or structure for holding a liquid or gas for an example tanks for storing oil including its operating and structural equipment. Dangerous goods may be transported in tanks only if the code or if the tank is approved by the competent authority. Transportation must be in accordance with the provisions of ADR / RID and all vehicles must comply with the prescribed provisions.

2.4 PACKAGING OF DANGEROUS GOODS

Dangerous goods must be packed in good quality packages, including IBCs and large packages. These packages must be strong enough to withstand:

- regular shock during loading and vibration during transportation
- transshipment between means of transport or storage places(e.g. warehouse)
- moving of pallets or bundles
- manual or mechanized handling
- temperature changes
- humidity or pressure

Packages including large vessels for intermediate bulk containers (IBCs) and large packaging, must be manufactured and sealed so that under normal conditions of transportation must avoid leakage or damage to the goods transported, especially as a result of vibration or of temperature changes and humidity or pressure. Packing of all dangerous goods is assigned to one of the three groups which are used to indicate the degree of danger and determining the degree of protective packaging required for dangerous goods during transportation.

Table 3: Packaging Group

Packing Group	Labelling of packages	Use of packaging
I	X	Great Danger
II	Y	Medium Danger
III	Z	Minor Danger

Source: Author

Dangerous items cannot be packed together in the same outer packaging or large packaging with dangerous or other goods that can react with each other to produce:

- fire or develop a considerable heat
- flammable, asphyxiates or poisonous gases
- corrosive substances
- unstable substances

2.4.1 *Types of packages*

Unless otherwise stated, the following packages may be used:

- barrels
- wooden barrels
- canisters
- boxes or crates
- bag or sacks
- composite packaging – plastic
- Composite packaging – glass, porcelain, ceramics
- group packages
- re– packaging
- packaging of fine metal

2.4.2 *Intermediate bulk containers (IBCs) and their markings*

Large containers so called intermediate bulk containers are rigid or flexible shipping containers with a capacity exceeding 3 cubic meters or some of solid substances 1, 5 cubic meters, are designed for mechanical handling and resist stress during handling and transportation. Types of IBC:

- Metal IBC
- Flexible IBC
- Rigid plastics IBC
- Composite IBC with plastics inner receptacle
- Cardboard IBC
- Timber IBC

Large packaging consists of outer packaging which contains items or inner packaging which:

- is designed for mechanical handling,
- exceeds 400 kg net weight, or 450 litres of internal volume,
- Has a volume of more than 3 cubic meters.

Large containers must be manufactured and tested in accordance with a quality assurance program, which the competent authority has found as satisfactory in order to ensure that each manufactured packaging matches your requirements.

2.4.3 *Pressure receptacles, aerosol dispensers and small receptacles containing gas*

For the carriage of gases in units often use the following packages:

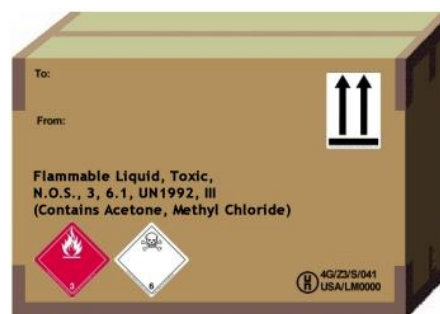
- Bottles
- Bundle
- Pressure drum
- Tubular container
- Cryogenic container
- Cartouche
- Aerosol or aerosol spray

2.4.4 *Labeling packages*

Each package must be accompanied by labelling – UN code, that is:

- Durable
- Clearly visible
- The dimension of appropriate sized package must be placed where it is clearly visible.

Packages of a total weight greater than 30 kg shall be labelled with signs, or it's duplicate on the top or side of packaging. The letters, numbers, and symbols must be at least 12 mm high, except for packages containing 30 litres or 30 kg or less, which must be at least 6 mm high and in addition to packages containing 5 litres or 5 kg or less must have appropriate dimension.(5)



Picture 11: Package Markings

Source: (6)

➤ **intermediate bulk containers**

Each container IBC manufactured and intended for the carriage of dangerous goods must have a label that is permanently legible and located so that it is clearly visible. Letters, digits, and symbols must be at least 12 mm high.

➤ **large packaging**

Each large packaging that is manufactured and designed for the transport of dangerous goods should be accompanied by durable and legible marking.

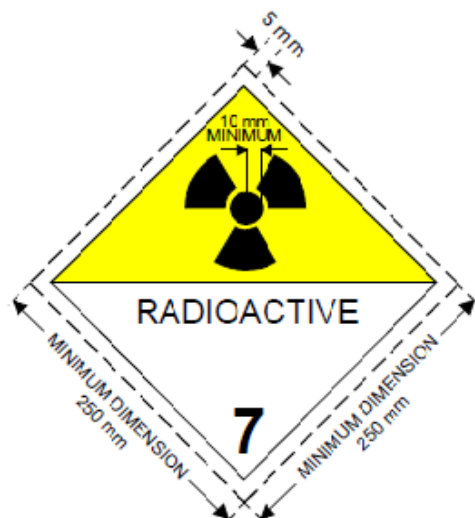
➤ **Pressure receptacles, aerosol dispensers and small receptacles containing gas**

These packages are also subject to mandatory testing and labelling, which differ according to whether they are used once for packaging or refillable.

2.5 PLACARDING

Placards shall be affixed to the exterior surface of large containers, MEGCs, tank–containers, portable tanks, and wagons and vehicles, these placards must correspond with the requirements of labelling.

2.5.1 Hazard warning diamonds

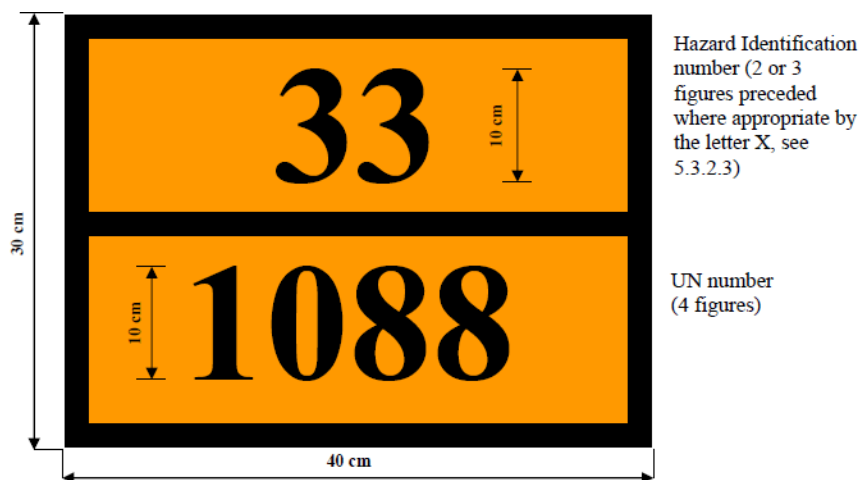


Picture 12: Hazard warning diamonds

Source: (7)

2.5.2 Orange placard

Orange plate must be 40 cm wide and 30 cm height. The hazard identification number and the UN number shall consist of black digits 100 mm high and of 15 mm stroke thickness. The hazard– identification number shall be inscribed in the upper part of the plate and the UN number in the lower part; they shall be separated by a horizontal black line, 15 mm in stroke width, extending from side to side of the plate at mid height. The hazard identification number and the UN number shall be indelible and shall remain legible after 15 minute engulfment in fire. (1)



Picture 13: Orange placard

Source (7)

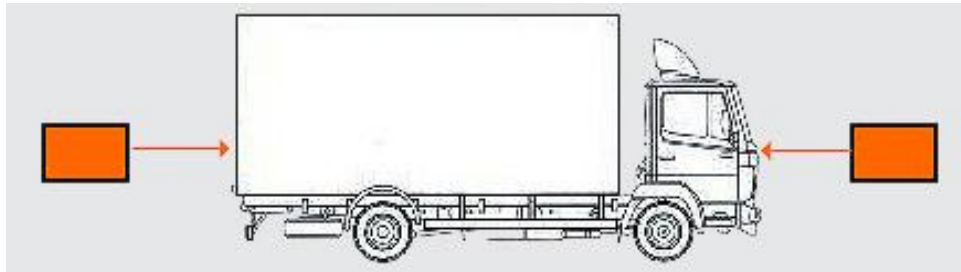
2.5.3 Placarding and marking of vehicles

Marking and placarding applies to vehicles and containers, tank container, MEGCs (multi element gas container) and portable tanks. *Placarding* is a process of placing hazard warning diamonds according to the type of load (example 2.1.5) on containers, tanks, etc, while *marking* refers to a process of placing orange placard on a vehicle and container, tanks, etc. When the vehicle is required to be placarded, the placarding must be all of the following:

- Securely fixed to the vehicle or placed securely in a frame that is securely fixed to the vehicle.
- Legible, not obscured and not obscuring other statutory marking, for example, registration plates.
- Durable and weather resistant.
- Mounted on a part of the vehicle of a contrasting colour to the colour of the placard unless the border is of a contrasting colour and design.

Vehicles carrying packages

The orange plate is fixed at front and back of the vehicle and the vehicle carrying explosives (class 1) or radio-active (class 7) substances shall be affixed to both sides and at the rear of the vehicle.

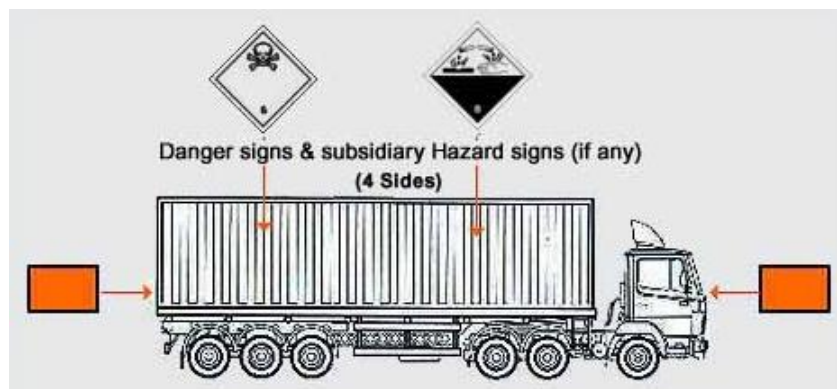


Picture 14: Vehicles carrying packages

Source: (8)

Carrying packages in freight containers

The freight container should display relevant placards (hazard diamonds) on all four sides of the container also uses the same conditions of placarding as the vehicle carrying packages (above).

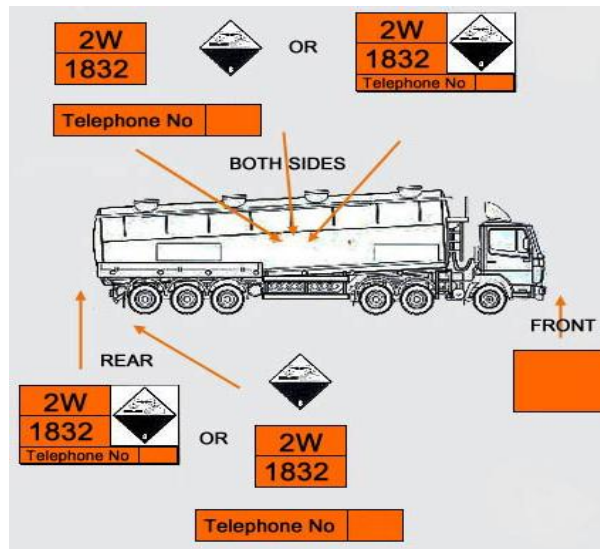


Picture 15: Carrying packages in freight containers

Source: (8)

Tanks, tank containers

The placards shall be affixed to both sides and at each end of the MEGC, tank container or portable tank. When the tank-container or portable tank has multiple compartments and carries two or more dangerous goods, the appropriate placards shall be displayed along each side at the position of the relevant compartments and one placard of each model shown on each side at both ends. Czech Republic and South Africa use different markings.



Picture 16: Tanks, tank containers

Source: (8)

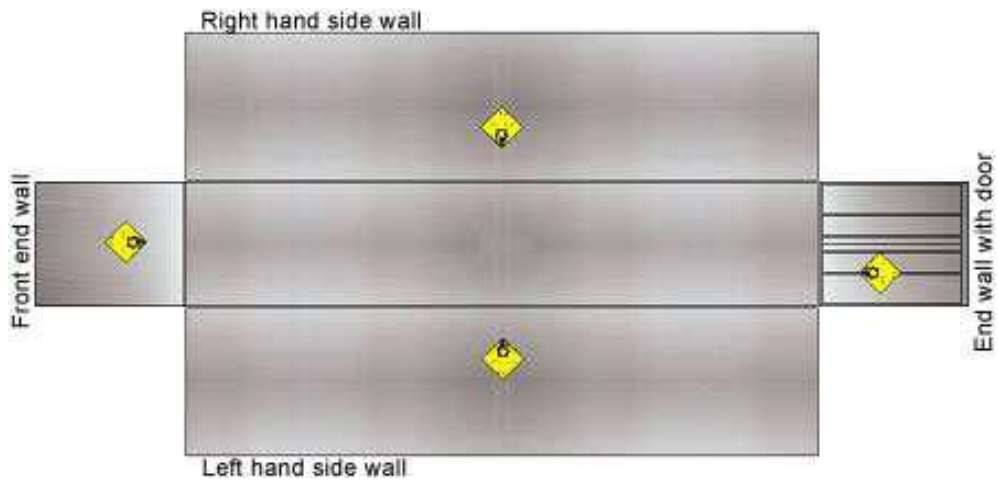
The picture above (Picture 15) shows an example of how tanks or tank containers are marked in South Africa. The placard must have a telephone number for specialist advice 24 hours. In Czech Republic they use a similar way of marking which is on both sides of the tank or tank container, but they use only the orange plate and a hazard warning diamond without phone number see below (**Picture 16**).



Picture 17: Tanks, tank containers

Source: (9)

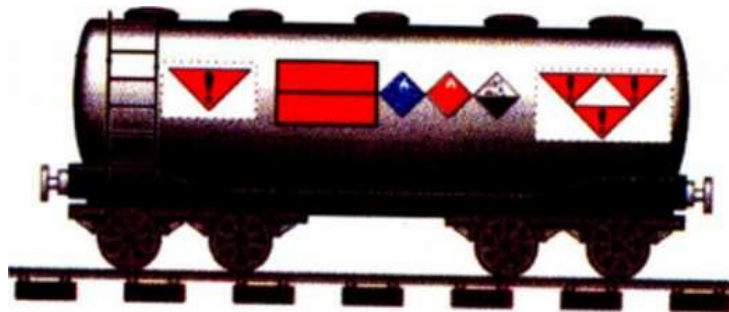
Railway wagon: One on either side, the marking of a container for maritime transport is according to the IMDG Code guidelines (see **Picture 17: Marking of container**)



Picture 18: Marking of container

Source: (10)

Picture 18 shows how a universal container is labelled according to IMDG.



Picture 19: Example of railroad tank cars

Source: (11)

Picture 19 shows a railway wagon with a fixed tank.

3 MODEL EXAMPLE OF TRANSPORT OF DANGEROUS GOODS IN CZECH REPUBLIC AND REPUBLIC OF SOUTH AFRICA

Model examples of transport of dangerous goods deals with the route planning (having permits to use certain routes if needed), method of packaging, identifying the dangerous goods (labelling dangerous goods, packages and the vehicle that will be transporting the goods), calculating criteria (delivery time, resting time (AETR), price for transportation, total distance and etc.) and documents for shipment (documents accompanying the shipment, driver, dispatcher, the customs authority and etc.).

3.1 DOCUMENTATION

Transport documents are required for most dangerous goods and these documents are kept in:

- the cab of the motor vehicle
- the possession of the train crew member
- a holder on the bridge of a vessel, or
- an aircraft pilot's possession.

The language to be used on the transport documents can be one or more (English, Czech, Afrikaans, etc) or shall be according to the agreements concluded by the countries partaking in the transport operation provided.

3.1.1 General information required in the transport document:

- the UN number preceded by the letters "UN";
- the proper shipping name supplemented;
- the classification code for substances and articles of Class 1;
- for radioactive material with a subsidiary risk uses special provision;
- the number and a description of the packages when applicable;
- packing group;
- the name and address of the consignor;
- the name and address of the consignee(s);
- a declaration as required by the terms of any special agreement

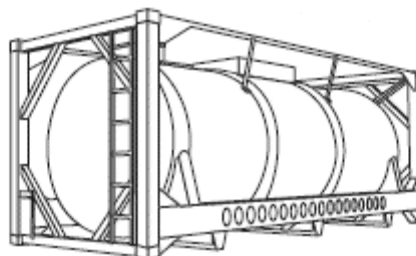
3.1.1 Documents to be carried on the transport unit

- transport document(s) containing prescribed information for each dangerous substance, material or article being carried – for example their UN number, their technical name in brackets in addition to the name under which they are being shipped
- emergency instructions in writing
- means of identification, including a photograph for each member of the vehicle crew
- according to ADR provisions:
 - The certificate of ADR approval referred
 - The driver's training certificate
 - A copy of the competent authority approval (documents indicating mass for each substance, mixed packing of two goods, etc.)
- Container/vehicle packing certificate according to IMDG code (this is not required for portable tanks, tank-containers and MEGCs).

When dangerous goods are packed or loaded into any container or vehicle, those responsible for packing the container or vehicle shall provide a “container/vehicle packing certificate” specifying the container/vehicle identification code and certifying that the operation has been carried out in accordance with the required conditions.

3.2 TRANSPORTING 40FT INTERMODAL TANK CONTAINER WITH PROPANE FROM ZIMBABWE (HARARE) TO THE REPUBLIC OF SOUTH AFRICA (JOHANNESBURG) BY ROAD AND RAILWAY TRANSPORT

The picture below shows the intermodal tank that is transported on rail and road



Picture 20: Intermodal tank

Source: (12)

The distance between Harare and Johannesburg by road transport is 1 117 km and 1 375 km by rail. The table below is for road vehicle weight limits of South Africa and Zimbabwe.

Table 4: Weight limit of vehicles

Country	Single kg	Tandem kg	Trindem Kg	Max. GCM kg	Max. Length m
South Africa	9 000	18 000	24 000	56 000	22
Zimbabwe	7 700	16 400	24 600	48 700	22

Source: http://overload.csir.co.za/pad27/docs/Pad27_A4.pdf

The weight limit of containers on rail wagons is according to the International Standards Organisation (ISO) requirements; this applies to both South Africa and Zimbabwe.

Table 5: The weight limit of containers

CODE	OUTER LENGTH OF CONTAINER	OUTER WIDTH OF CONTAINER	OUTER HEIGHT OF CONTAINER	MAXIMUM GROSS MASS
<i>*IA</i>	12 meter	2,438 meter	2,43 meter	30 480 kg
<i>*IAA</i>	12 meter	2,438 meter	2,591 meter	30 480 kg
<i>*IC</i>	6 meter	2,438 meter	2,438 meter	24 000 kg
<i>*ICC</i>	6 meter	2,438 meter	2,591 meter	24 000 kg
<i>**IC</i>	6 meter	2,438 meter	2,438 meter	20 320 kg
<i>**ICC</i>	6 meter	2,438 meter	2,591 meter	20 320 kg
<i>***ICCC</i>	6,2 meter	2,600 meter	2,800 meter	24 000 kg
<i>◆ID</i>	3 meter	2,438 meter	2,438 meter	10 160 kg
<i>**ID</i>	3 meter	2,438 meter	2,438 meter	10 160 kg

Source:

<http://www.spoornet.co.za/Website/documents/TFR%20Standard%20Conditions%20of%20Carriage%202012_13%20V9%20Clean.pdf>

3.2.1 Documents to be held by the driver

- A professional driving permit, if applicable
- A document containing a clear indication of the route to be followed by the vehicle, planned in accordance with code of practice SABS 0231 "Transportation of dangerous goods - Operational requirements for road vehicles"
- document with general information as stated above(3.1.1)
- custom clearance documentation
- Tremcard - is a transport emergency card to be carried by the driver for each classified substance on the load, indicating the hazards of the load and the actions to be taken by the driver, in the event of an incident

3.2.2 Documents that must be in the possession of the train crew member:

- Vehicle list – document that has information about the wagons and the load on a train
- Consignment Note & Wagon Label
- Custom clearance documentation(according to Act 91 of 1964)
- Consignment documents(for goods transported over the boarder to and from)
 - Consignments to and from other African Countries: A copy of the SAD 500 Custom & Excise/Customs Release Notification document duly processed at a Customs and Excise regional office.
- Document with general information as stated above(3.1.1)
- A route plan
- A Tremcard - is a transport emergency card to be carried by the driver for each classified substance on the load, indicating the hazards of the load and the actions to be taken by the driver, in the event of an incident.

3.2.3 Planned routes

Direction by road

Zimbabwe (Harare – Chivhu – Mvuma – Chilimanzi – Masvingo – Ngunda – Rutenga – Beitbridge (border gate), total distance 584 km and the route used A4.)

South Africa (Beitbridge – Musina – Louis Trichardt – Polokwane – Mokopane – Bela Bela – Pretoria – Midrand – Johannesburg, total distance 872 km and the route used N1.)



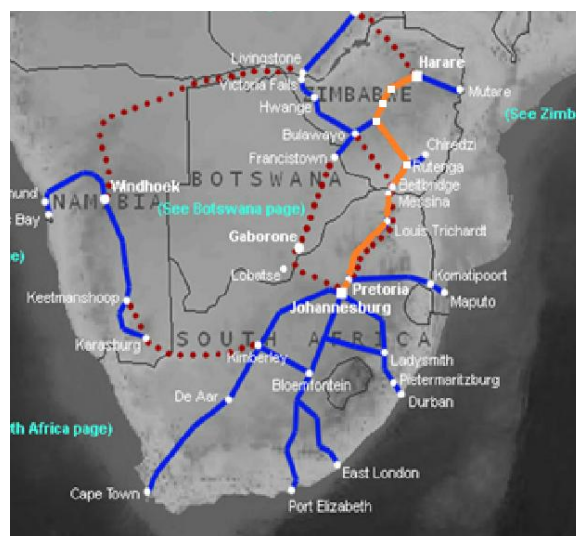
Picture 21: Map of planned route by road (A4 and N1)

Source: (13)

Direction by rail

Zimbabwe (Harare – Chegutu – Kwekwe – Gweru – Rutenga – Beitbridge – Musina)

South Africa (Musina – Mopane – Louis Trichardt – Soekmekaar – Polokwane – Makopane – Naboomspruit – Bela Bela – Hammanskraal – Pyrmid – Pretoria – Centurion – Midrand – Sandton – Rosebank – Johannesburg)



Picture 22: Map of planned route by rail

Source: Author (14)

General information

Table 6: General shipment information

Class	2.1
Shipping Name	Propane
UN number	UN1978
Type of container	40ft propane container (Intermodal tank container)
Material	Q345R
Design pressure:	1.8 MPa
Volume	45m ³
Filling ratio	0.42
Payload	18 tons
Total distance by road	1 140 km
Total distance by rail	1 375 km
Cost of transport by road	R58 157,00 (139 576,80 Kč)
Cost of transport by rail	R30 619 (73 485,60 Kč)

Source: Author

R – Rand, South African currency

Kč – Czech crown

Price per kilometer

Road = price/distance (km) = (139 576, 80) / (1 140) = 122, 44 Kč /km

Rail = price/distance (km) = (73 485, 60) / (1 375) = 53, 44 Kč/km

Price per ton

Road = price/weight (t) = (139 576, 80) / (18) = 1 744, 41 Kč/t

Rail = price/weight (t) = (73 485, 60) / (18) = 1 000, 84 Kč/t

Resting driving times for shipment by road

South Africa uses truck stops as a resting place for the truck drivers, but there is not any law enforcement that states as to how many hours the driver should operate the vehicle and the breaking time. The drivers are encouraged to stop at every truck stop, unlike in Europe where they use **ERTA** (*European Road Transport Agreement*) or **AETR**.

Table 7: Analysis of driving according to the AETR (English ERTA - *European Road Transport Agreement*)

Day	Activity	From – to	Time (hours)	Distance (km)	Σkm	
1	Driving to the port	07:00 – 07:15	0,25	12	12	HARARE. → BEITBRIDGE
	Loading & Documents for transportation	07:15 – 09:00	1,75	-	12	
	Driving to customs office	09:00 – 09:15	0,25	12	24	
	Customs office	09:15 - 11:15	2			
	Driving	11:15 – 15:15	4	280	304	
	Safety break	15:15 – 16:00	0,75	-	304	
	Driving	16:00 – 20:00	4	280	584	
	Idle at the state border	20:00 – 00:00	4	-	584	
	Daily resting period	00:00 – 11:00	11	-	-	
2	Drive	11:00 – 15:00	4	280	864	BEITBRIDGE → JOHANNESBU
	Safety break	15:00 – 15:45	0,75	-	864	
	Drive	15:45 – 19:45	4	280	1 144	
	Safety break	19:45 – 20:30	0,75	-	1 144	
	Driving to customs office	20:30 – 20:45	0,25	12	1 456	
	Customs office	20:45 – 00:45	4	-	-	
	Unlodging	00:45 – 02:45	2	-	-	
	Total(Σ)			43,75		

Source: Author

Total time (43,75h)

Total time of shipment is divided into *productive time* (the time which the driver was operating the vehicle) and the *non-productive time* (the resting time of the driver).

- productive time = 16,5 h
- non-productive time = 27,25h

Productive transit time (%) by road

(Productive time (driving time)) / (Total time) • 100 = Productive transit time (%)

$$16,5 / 43,75 = \mathbf{38\%}$$

Delivery time

Road = AETR/N561 + R

$$= 43,75 + 12$$

$$= 55,75\text{h} (\approx 2\frac{1}{2} \text{ days})$$

AETR/N561 – total time according to European Road Transport Agreement (see **Table 7**)

R – Reserve time (12 hours)

Rail = VL + PL (+P)

$$= 12 + 96 + 12$$

$$= 120\text{h} (5 \text{ days})$$

VL - period for consignments (12 hours)

P – Additional (12 hours)

PL – shipping time (96 hours)

3.3 TRANSPORTING ISO TANK CONTAINER WITH PROPANE FROM CZECH REPUBLIC (UHERSKÉ HRADIŠTĚ) TO BELGIUM (CHARLEROI) BY ROAD AND RAILWAY TRANSPORT

The distance from Uherské Hradiště to Charleroi by road is 1 180 km and by train is 1 302 km.

3.3.1 Documents to be held by the driver

- Concession
- License - valid in the European Union
- A document containing a clear indication of the route to be followed by the vehicle
- The accompanying list (see 3.1.1)
- Certificate of approval of vehicle
- A route plan

3.3.2 Documents that must be in the possession of the train crew member:

- Waybill
- Emergency instructions in writing
- Consignment Note & Wagon Label

3.3.3 Planned routes

Direction by road

Uherské Hradiště – Praha – Plzeň – Rozvadov – Nürnberg – Würzburg – Frankfurt nad Mohanem – Bonn – Aachen – Liège – Charleroi

Czech Republic (E50)

Germany (E50, E56, E45 E43, E41, E42, E35)

Belgium (E40, E42)



Picture 23: Map of planned route by road

Source: maps.google.com

Direction by rail

Uherské Hradiště - Staré Město u Uherského Hradiště – Břeclav – Wien – Grenberg – Kinkempolis – Charleroi

Table 8: Rail link

Arrival	č. vlaku	Station	Departure	č. vlaku
		Uherské Hradiště	Day 1: 12 hours	82213
Day 1: hours	82213	Staré Město u Uherského Hradiště	Day 1: 21 hours	61230
Day 1: 23 hours	61230	Břeclav	Day 2: 10 hours	
Day 2: 12 hours		Wien	Day 2: 18 hours	
Day 3: 13 hours		Grenberg	Day 3: 18 hours	43164
Day 3: 23 hours	43164	Kinkempolis	Day 4: 3 hours	54701
Day 3	54701	Charleroi		

Source: Autor (with the help from ČD cargo)

General information

Table 9: General shipment information

Class	2.1
Shipping Name	Propane
UN number	UN1978
Type of container	40ft propane container (ISO tank container)
Material	Q345R
Design pressure:	1.8 MPa
Volume	45m ³
Filling ratio	0.42
Payload	18.9 tons
Total distance by road	1 180 km
Total distance by rail	1 302 km
Cost of transport by road	75 000 Kč (without tax)
Cost of transport by rail	63 485, 60 Kč

Source: Author

Price per kilometer

Road = price/distance (km) = (75 000) / (1 180) = 63, 56 Kč /km

Rail = price/distance (km) = (63 485, 60 Kč) / (1 302) = 48, 76 Kč/km

Price per ton

Road = price/weight (t) = (139 576, 80) / (18) = 937, 50 Kč/t

Rail = price/weight (t) = (63 485, 60) / (18) = 3 526, 98 Kč/t

Resting driving times for shipment by road

Table 10: Analysis of driving according to the **AETR** (English **ERTA** - *European Road Transport Agreement*) before joining the European Union

Driving time before entering the European Union (EU)				
Activity	From - to	Time (hours)	Distance km	Σkm
Driving to the port	6:00 - 8:30	2,5	166	166
Loading & Documents for transportation	8:30 - 10:00	1,5	0	166
Driving to customs office	10:00 - 10:15	0,25	12	178
Customs office - clearance	10:15 - 14:15	4	0	178
Drive	14:15 - 18:45	4,5	245	423
Safety break	18:45 - 19:30	0,75	0	423
Drive	19:30 - 21:00	1,5	83	506
Daily resting period	21:00 - 8:00	11	0	506
Idle at the state border	8:00 - 13:15	5	0	506
Drive	13:15 - 17:45	4,5	245	751
Daily resting period	17:45 - 4:45	11	0	751
Drive	4:45 - 8:00	3,1	223	974
Safety break	8:00 - 8:45	0,75	0	974
Drive	8:45 - 11:45	4	204	1 178
Customs clearance before unloading	11:45 - 14:00	2,15	0	1 178
Total		56,5		1 178

Source: Author

Table 11: Analysis of driving according to the **AETR** (English **ERTA** - *European Road Transport Agreement*) after joining the European Union

Driving time after entering the European Union (EU)				
Activity	From - to	Time (hours)	Distance(km)	Σkm
Driving to the port	6:00 - 8:30	2,5	166	166
Loading & Documents for transportation	8:30 - 10:00	1,5	0	166
Drive	10:00 - 13:30	3,5	245	411
Safety break	13:30 - 14:15	0,75	0	411
Drive	14:15 - 17:45	3,5	245	656
Daily resting period	21:00 - 8:00	11	0	656
Jízda	8:00 - 11:15	3,5	245	901
Safety break	11:15 - 12:00	0,75	0	901
Drive	12:00 - 15:30	3,5	245	1 146
Safety break	15:30 - 16:15	0,75	0	1 146
Drive	16:15 - 16:45	0,5	34	1 180
Unloading	16:45 - 17:45	1	0	1 180
Total		32,75		1 180

Source: Author

Total time:

- before entering EU (**56,5 hours**)
- after entering EU(**32,75 hours**)
- productive time:
 - before entering EU(20,4 hours)
 - after entering EU(17 hours)
- non-productive time :
 - before entering EU(37,15 hours)
 - after entering EU(15,75 hours)

Productive transit time (%) by road

(Productive time (driving time)) / (Total time) • 100 = Productive transit time (%)

- *Before entering the European Union*

$$(20,4 \text{ h}) / (57,55 \text{ h}) = \mathbf{35,45 \%}$$

- *After entering the European Union*

$$(17 \text{ h}) / (32,75 \text{ h}) = \mathbf{51,91 \%}$$

Delivery time

Before entering the European Union

$$\begin{aligned} \text{Road} &= \text{AETR/N561} + \text{R} \\ &= 57,55 + 12 \\ &= 69,55\text{h} (\approx 3 \text{ days}) \end{aligned}$$

After entering the European Union

$$\begin{aligned} \text{Road} &= \text{AETR/N561} + \text{R} \\ &= 32,75 + 12 \\ &= 44,75\text{h} (\approx 2 \text{ days}) \end{aligned}$$

AETR/N561 – total time according to European Road Transport Agreement (Table 9 and Table 10)

R – Reserve time (12 hours)

According to JPP CIM:

$$\begin{aligned} \text{Rail} &= \text{VL} + \text{PL} + \text{P} \\ &= 12 + 96 + 12 \\ &= 120 \text{ hours (4.5 days)} \end{aligned}$$

VL - period for consignments (12 hours)

PL – shipping time (24 h per every 400 km)

P – Additional (12 hours)

Comparing transportation

Transportation of goods by road transport is expensive, but faster as compared to rail transport, which is cheaper, has a longer shipping route and greater travel time. It is better to use the road to meet the logistics principle of Just in Time (JIT). Transporting dangerous

goods by rail is safer and reduces air pollution compared to the road transport. Thanks to the open border system in Europe that contributed towards decreasing:

- delivery time (by almost 24 hours)
- transport costs

Table 12: Transport Comparison

		Transportation by road		Transportation by rail
		in EU	Before entering EU	
Uherské Hradiště to Charleroi	Transport time (hours)	32,75	57,55	99
	Price	75 000,- Kč		63 485, 60 Kč
	Price for transporting 1 ton	937, 50 Kč		3 926,98 Kč
	Price for transporting 1 km	63, 56 Kč Kč		48, 76 Kč/km
	Delivery time	1 days 9 hours 1,5 days	2 days 22 hours 3 days	4 days 3 hours 4,5 days
	The resulting speed of the shipment	36 km/h	20,46 km/h	13,15 km/h
Harare to Johannesburg	Transport time (hours)	43,75		120
	Price	R58 157,00 (139 576,80 Kč)		R30 619 (73 485,60 Kč)
	Price for transporting 1 ton	1 744,41 Kč		918,57 Kč/t
	Price for transporting 1 km	122, 44 Kč. /km		53, 44 Kč/km
	Delivery time	2 days 7 hours 2,5 days		5 days
	The resulting speed of the shipment	26,06 km/h		11,46 km/h

Source: Author

3.4 SUGGESTIONS FOR CHANGES

International transportation of dangerous goods is regulated by ADR, IATA, IMDG and RID, and this brought a common understanding of preventing accidents and damage to our environment. Most of the countries use different provisions to govern transport of dangerous goods (for example Czech Republic uses Act No. 111/1994 Coll. On road transport and South Africa uses the Road Traffic Act 93 of 1996). Most of South African regulations on transportation of dangerous goods are adopted from the European regulations.

Countries under the European Union use an *open boarder system* which enables free movement of people or goods between different jurisdictions with limited or no restrictions to movement, this eables free flow of goods (free trade). In Sothern Africa there is controlled open border system and this leads to:

- Spending a lot of time in a que, waiting for clearance at the boarder gates (boarder delays);
- An increase in transport costs;
- Poor transit (obstacle to free trade)

It is better to introduce open boarder system in the Southern Africa in order to reduce delivering time and transport costs.

Southern Africa should introduce an agreement based on the driver resting times like the *European Road Transport Agreement* (AETR), this will increase transport safety since the drivers will have enough time to rest. Currently the truck stops which are mostly on the regional and national roads are being used as resting places for drivers

Table 13: AETR (the driving time, breaks and rest periods)

Breaks from driving	A break of no less than 45 minutes must be taken after no more than 4.5 hours of driving. The break can be divided into two periods - the first at least 15 minutes long and the second at least 30 minutes - taken over the 4.5 hours.
Daily driving	Maximum of 9 hours, extendable to 10 hours no more than twice a week.
Weekly driving	Maximum of 56 hours.
Two-weekly driving	Maximum of 90 hours in any two-week period.

Daily rest	Minimum of 11 hours, which can be reduced to a minimum of 9 hours no more than three times between weekly rests. May be taken in two periods, the first at least 3 hours long and the second at least 9 hours long. The rest must be completed within 24 hours of the end of the last daily or weekly rest period.
Multi-manning daily rest	A 9-hour daily rest must be taken within a period of 30 hours that starts from the end of the last daily or weekly rest period. For the first hour of multi-manning, the presence of another driver is optional, but for the remaining time it is compulsory.
Ferry/train daily rest	A regular daily rest period (of at least 11 hours) may be interrupted no more than twice by other activities of not more than 1 hour's duration in total, provided that the driver is accompanying a vehicle that is travelling by ferry or train and has access to a bunk or couchette.

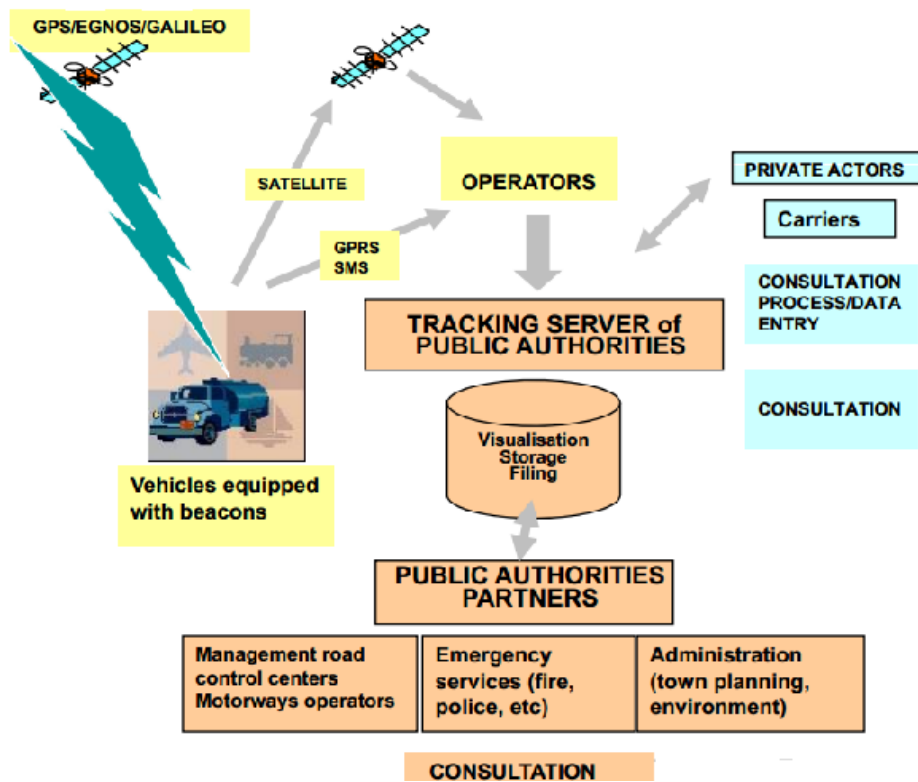
Source: <<http://www.transportsfriend.org/hours/work.html>>

The authorities should also create a system which the public can easily search and identify the types of dangerous goods by a mobile telephone or through the internet, like the one in Czech Republic (found on *Dopravní informační systém DOK*)

South Africa and Czech Republic can use a modern tracking system for vehicles, especially vehicles transporting dangerous goods this will improve safety of the transport process. An example of the tracking system is the *Qualcomm system*. The system is connected to the vehicle data base and it can:

- Track your vehicles or trailers through GPS system;
- Improves cargo safety;
- Improved vehicle maintenance and safety;
- Allows massaging between the driver and dispatch (eg. Incase of changes);
- Alerts drivers about traffic conditions;
- Measures engine performance, driving speed, driving times and it can also check oil pressure etc.
- In case of emergency the system automatically alerts the dispatcher and all law agencies (eg fire fighters, police, etc.)

(26)



Picture 24: Satellite tracking system

South Africa needs to educate the public more about the dangerous goods, how to call for help incase of emergency, introduce dangerous goods programmes in schools and this will help to increase safety to our environment.

CONCLUSION

The regulations for transporting dangerous goods continue to change regularly with a year or two interval(s). Therefore the transport provider should keep on adopting with the changes or updates of the regulations so that he could comply with the exact processes for transporting dangerous goods as stated in the dangerous goods manuals. Improving safety is the reason why these regulations are being updated frequently. Most of the countries use their own provisions to govern the transportation of dangerous goods inside the borders of their borders, but most of the provisions are adopted from the UN regulations for transportation of dangerous goods internationally (ADR, RID, IMDG and IATA).

It is important to educate the public, to train crew members, drivers, people handling (loading and unloading) about the dangerous goods, to introduce a better way for tracking vehicles carrying dangerous goods and to introduce the driving time, breaks and rest periods in the Southern Africa.

The aim of this project was to determine the ways of identifying, labelling, packaging of dangerous goods according to the UN regulations. If the regulations are not followed properly this poses danger to the environment, health and property, therefore when transporting dangerous goods it is necessary to follow the regulations in order to maintain safety during the transport process.

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LIST OF ABBREVIATIONS

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways

ADR - Road transport

CCNR - Central Commission for the Navigation of the Rhine

DGR - Dangerous Goods Regulations

ERTA (AETR) - European Road Transport Agreement

h – Hour(s)

IATA - International Air Transport Association

kPa - kilopascals

IBCs - Intermediate bulk containers

ICAO - International Civil Aviation Organization

IGC Code- International Gas Carrier Code

km - kilometers

IMDG Code- International Maritime Dangerous Goods Code

IMO - Maritime International Organization

ISO - International Standards Organisation

JIT - Just in Time

Kč – Czech crown

MEGCs - multi element gas container

P – Additional (12 hours)

PL – shipping time

R – Rand, South African currency

R – Reserve time

RID - Regulations Concerning the International Transport of Dangerous Goods by Rail

SABS- South African Bureau of Standards

SANS – South African National Standards

SOLAS - Safety of Life at Sea

UN – United Nations

UN code - United Nations Code

VL - period for consignments