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# Transport and handling of dangerous cargoes in port areas : weaknesses of existing international and Estonian regulations

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**WORLD MARITIME UNIVERSITY**

**Malmö, Sweden**

**TRANSPORT AND HANDLING OF DANGEROUS  
CARGOES IN PORT AREAS:**

**Weaknesses of Existing International and Estonian Regulations**

**By**

**TARMO OTS**

**Estonia**

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

**MASTER OF SCIENCE**

in

**MARITIME ADMINISTRATION AND  
ENVIRONMENT PROTECTION**

2000

## ***FORMAT OF THE DECLARATION***

I certify that all the materials in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The content of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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## **ABSTRACT**

Title of Dissertation: **Transportation and Handling of Dangerous Cargoes in Port Areas; The Weaknesses of Existing International and Estonian Regulations**

Degree: **MSc**

The aim of the dissertation is to introduce different aspects concerning dangerous cargo, its handling and transportation in port areas. As this topic is wide, the dissertation covers many areas.

To emphasize the importance of dangerous cargo transportation in world trade, the overview of quantities of this type of cargo handled in different port all around the world is given. The author also explains the importance to keep statistics over movement of dangerous cargo and shows how collected information helps to increase safety and public awareness.

The definition “dangerous cargo” contains hundreds of substances with different characteristics. The dissertation explains physical and chemical criteria which makes handling of these substances dangerous.

To show that dangerous cargo is dangerous, accidents through the history is described. As during last decades different methods have been worked out to decrease the risk of possible incidents. The author analyses the role of management, technology and training in avoidance of accidents. Large part of the dissertation is dedicated to analyses of the international and national (Estonian) legislation concerning handling and transport of dangerous goods in port areas. In Estonian chapter main violations of enforcing existing regulations in terminals are showed.

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## LIST OF ABBREVIATIONS

ADR	European agreement concerning the international carriage of dangerous goods by road
MOU	Memorandum of Understanding
BC Code	Bulk Cargo Code
CAS	Chemical Abstract Service
CMI	Comittee Maritime Internationale
EINECS	European Inventory of Existing Commercial Chemical Substance
ELINICS	European List of Notified Chemical Substance
EU	European Union
HCB	Hazardous Cargo Bulletin
HNS	Hazardous Noxious Substances
ILO	International Labour Organization
IMDG Code	International Maritime Dangerous Goods
IMO	International Maritime Organization
ISGOTT	International Safety Guidline of Oil Tankers& Terminals
LPG	Light Petrol Gas
MARPOL	International Convention for the Prevention of Pollution from Ships
MEPC	Marine Environment Protection Committee
OTIF	Intergovernmental Organization for Interntional
RID	Regulations concerning the international carriage of dangerous goods by rail
SAFIR	Safety and Improvement Reporting System
SOLAS	International Convention for the Safety of Life at Sea

STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
TEU	20-foot container
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
VOC	Volatile organic compounds
WMU	World Maritime University

## CHAPTER 1

### INTRODUCTION

#### **1.1 Topic description**

By its nature, shipping, especially transport of harmful cargoes, can be called the second most dangerous industry after the nuclear power industry (Rawson, 1994). Only vessels have the capability to dump half a million tonnes of dangerous liquid substances into the sea with a single accident which can cause both environment catastrophe and death of tens or even hundreds of people. In 1998, five billion tonnes of cargo was carried by ships around the world. According to the IMO, approximately 50% of these goods can be classified as hazardous. 100 thousand chemical substances are defined as dangerous which, if wrongly handled, can cause death of people, environmental disaster or destruction of property. It is impossible to predict the impact of the accidents with dangerous substances as all chemicals behaving depend on their characteristics, quantity and weather conditions.

A port is an area where people should take into consideration the danger of transport, handling and storing dangerous cargo. It is a place where not only large quantities, but also different substances, are stored which if mixed may be induce accidents. As port is a meeting point of different modes of transportation then both land and sea transport safety regulations must be taken very carefully into consideration. History shows that there is a need to do that. The five of ten biggest man- made explosions happened in port areas (Compton, 1999). According to statistics most maritime accidents related to dangerous cargo happen in harbours.

Estonian ports play quite a significant role in liquid dangerous cargo shipments in the Baltic Sea area being a link between Russia and the world. Estonia geographical vicinity to Finland gives the country the possibility to be a shortest and

quickest way between northern Scandinavia and the Baltic States. Estonian ports are mainly transshipment ports. It means the cargo moves to and from the other states by rail and road. The use of intermodal transport makes important not to follow only regulations specified to maritime but also to land transport. In addition to the economic importance, the Baltic Sea is a unique water area in the world where freshwater and marine organisms live side by side. Even a medium size chemical or oil spill can cause long term pollution with severe consequences as water exchange between the Baltic Sea and the North Sea takes 35 years (Liiv& Marksoo, 1998). As the country is an IMO member state and a main candidate to join the European Union, it is very important to know the legislation of both institutions and examine its impacts on Estonian maritime activities.

As the author of the dissertation is interested in safety of transportation of oil and its products as this is most quickly developing trade area in Estonian ports then quite a significant part of the dissertation is dedicated to that area. The author's aim is to give an overview of handling of dangerous good, possible threats that exist around this topic and comparison of existing IMO, EU and Estonian rules.

The objectives of the dissertation are following:

Firstly, to give an overview of the statistics of dangerous cargo movement in different parts of the world and to show how to use this information. Secondly, to describe different type of dangerous substances and show what kind of physical and chemical features make them dangerous to people and the environment. Thirdly, to emphasise the main reasons of accidents and "near misses" and give ideas how to avoid them. Fourthly, to analyse the IMO and the EU legislation concerning the transport, handling and storing of hazardous materials. Do the existing rules decrease the risk of accidents? What are the differences between IMO and EU legislation? Why does the European Commission demand more than IMO? These and other questions will be answered in the dissertation. Finally, the situation of handling of dangerous cargoes in Estonia is introduced and weaknesses in the current system are emphasised.

## **1.2 Research plan**

As the dissertation “Transport and handling of dangerous cargoes in port areas; the weaknesses of existing international and Estonian regulations“ consists of statistics, facts, regulations analyses and a description of implementing them, different research methods were used. When statistics and legislation can be analysed behind the computer screen or on the basis of the literature, then the implementation of regulations can be checked only in the middle of port operations. For that reason the author of the dissertation spent his time in different libraries reading specific literature, but also visited different institutions and stevedore companies. Estonian Ministry of Transportation and Communication (legislative organ), the Estonian National Maritime Board (implementing and controlling organ) and the Port of Tallinn authority and different port operators like Pakterminal, Eurodeck, Neste (liquid bulk operators) and Ferry Terminal as the main container operator were visited. These appointments gave the author change to listen to both legislation drafters’ and terminal operators’ opinions about legislative acts with aim to understand the strengths and weaknesses of existing regulations. Due to Internet databases it was possible to find out all of the complete texts of the European Commission’s directives and Estonian legislation. The analyses of materials published in the magazines “Cargo Systems”, “Port Development International”, and the “Hazardous Cargo Bulletin” available in the WMU library helped to bring out weaknesses and problems related to dangerous cargo.

## **1.3 Difficulties**

The author must thanks all governmental and non- governmental officers, especially in the Pakterminal and Neste terminal for cooperation and any kind of help. The most difficult part during the research and writing process was to collect relevant statistics concerning dangerous cargo movement in Estonia. The main reason was that general statistics of dangerous cargo movement does not exist. The information found was not updated and it was impossible to visit all related companies and institutions during a few weeks. Another problem rised when the author asked information about accidents and “near misses” in Estonian terminals.

Managers did not hide the fact that minor incidents have happened. Unfortunately they decided to refuse to give more accurate information. During the research process the author familiarized with literature which introduce port operations and maritime transport. To his surprise, problems related to handling of dangerous cargo, especially liquid harmful substances are not often analysed in maritime publications.



**CHAPTER 2**  
**THE DANGER OF HAZARDOUS SUBSTANCES**  
**AND THEIR POSSIBLE IMPACTS**

Chemicals cause danger during their transport. Their damaging effect varies considerably, depending on their classification. In this chapter the definition of dangerous cargo is introduced. The author also describes different classes of chemicals and analyses characteristics which make substances dangerous. Finally, different impacts both to humans and the environment is analysed.

**2.1 Definition of dangerous cargo**

In the maritime literature and legislation expressions “dangerous cargoes and goods”, “harmful substances”, and “hazardous materials” can be seen. The variety of terminology causes confusion and rises the question: “What is the difference between these words?” Captain Roos, the Harbour Master of the Bremenhaven gives good explanation. According to him there are three areas which are related to dangerous substances: production, transport and use. To make better distinctions between them, in the transport chain dangerous substances should be called “Dangerous Cargoes”. The IMO uses in its documents both the phrase “dangerous goods” (SOLAS, IMDG Code) and “Dangerous cargoes” (“Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas”). The US authorities prefer “hazardous materials”. Therefore, there is no exact phrase which is used everywhere in the world and different words is used to describe same thing.

What are dangerous cargoes? Broadly, these are cargoes that endanger lives, people, property and the marine environment (Rawson, 1994). IMO defines dangerous cargoes in the “Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas” in the following way:

*Means any of the following cargoes, whether packaged, carried in bulk packagings or in bulk within the scope of following regulations:*

- 1. petroleum in any form including crude oil, fuel oil, sludge, oil refuse and refined products mentioned in annex I of MARPOL 73/78.*
- 2. Noxious liquid substances falling into category A, B, C, D of MARPOL annex II.*
- 3. Dangerous hazardous and harmful substances and materials including marine pollutants and wastes covered by IMDG Code.*
- 4. Solid bulk materials possessing chemical hazards and solid bulk materials hazardous only in bulk covered by annex B of the BC Code.*

The same document adds more.

*The term “dangerous cargoes” includes any empty uncleaned packagings which previously contained dangerous cargoes, unless the packagings have been sufficiently cleaned....*

*Though, the definition is wide and almost every port in every country handle some of these substances or items mentioned in Conventions.*

## **2.2 The classification of dangerous chemicals**

Today there are 100 million different kinds of chemicals in the world that can be referred to as dangerous. It is estimated that not less than 100,000 of them are commercially traded (Brünings, 1999). Every year 10-20 thousand new chemicals are developed, around 2000 of them entering to commercial business. The transport of dangerous substances by sea is especially dangerous as the amounts on board can be big if to compare with land transport. In a chemical tanker it is possible for each cargo tank to carry 20 to 2000 times the quantity of single road tanks (James, 1994).

Hazardous materials can cause serious harm to human health and the environment. The damaging effect of chemicals varies considerably, mostly depends on their type, toxic content, reactivity, condition of discharge concentration and amount. Some hazards come from the substance itself but some are the result of contact between two chemicals. The research to find out the hazards of certain chemicals and their mixture has been a long- term process where different methods have been used. According to K. Brünings (1999) the following ways are the most common:

1. practical historical knowledge (showed the hazards of explosives)
2. long term experiences ( showed the hazards of asbestos)
3. accidents
4. laboratory tests

On the basis of the characteristics of substances, UN experts on the transportation of dangerous goods prepared the book “Minimum Requirements for the Transportation of Dangerous Goods “ in 1956, which divides chemicals into nine groups according to their characteristics. These groups are the following:

1. explosives
2. gases
3. flammable liquids
4. flammable solids
5. oxidizing substances
6. poisonous substances
7. radioactive materials
8. corrosives
9. miscellaneous dangerous goods

#### 2.2.1 Description of classes.

In this paragraph different groups of chemicals, which are most often transported, are described.

##### *Flammable substances*

The terms “flammable” and “inflammable” are synonyms and refer to the ability of a substance to burn. A naked flame is not the only possibility to cause the fire, a spark from static electricity or the impact of something hard on an iron surface can be sufficient. For instance, carbon disulphide can be ignited by the heat of a steam pipe (Brice, 1990). Read more about flammable materials in paragraph 2.3.1.

##### *Oxidising substances*

These are substances which decompose to release oxygen and can assist fire. A combination of flammable and oxidising materials is dangerous and can cause an

explosion. Chlorates, perchlorates and nitrates are good examples of oxidising substances (Brice, 1990).

#### *Radioactive substances*

These substances emit ionising rays or particles. In high doses radiation burns tissues, leading to radiation sickness. Lower doses can induce cancer of various forms and leukaemia (Brice, 1990).

#### *Corrosives*

These substances eat their way through metals, plastic, other materials and tissues. Strong acids are obvious examples. Strong alkalis are also corrosives but they do not attack any metals except aluminium.

#### *Poisonous substances*

These substances can cause illness or death after one short exposure either by swallowing, skin contact or inhalation. The effect of these substances can be reversible or permanent. For example, the inhalation of some solvent vapours can cause unconsciousness, which may wear off if the victim is moved to the clean air zone. The absorption of a small amount of methanol, at the same time, can cause permanent blindness.

### **2.3 Physical and chemical criteria which makes chemicals dangerous**

Flammability is the main hazards faced by those handling dangerous cargo, it is followed by corrosivity and toxicity. Flammable dangerous goods comprise a vast range of products across the solid- liquid- gas spectrum from metal carbides and organic peroxides to liquefied gases and oil products. It is important to be familiar with the danger of flammability as the volume of this type of cargo is big. At the same time corrosives, toxic and radioactive substances are transported in relatively small quantities and under very controlled conditions. Although through Estonian ports mainly flammable cargoes are transported, then mainly their chemical criteria are under the view in the dissertation. In addition, many accidents with seafarers and terminal workers happen when they are affected by a lack of oxygen. For that reason one paragraph is dedicated to introduce dangers related to oxygen consumption problem.

### 2.3.1 Flammability

Fires, explosions and poisoning vapours are main source of threats which are met during the handling of flammable substances. Flammable and explosives materials do not burn by themselves. Specific physical and chemical conditions influence the process. The source of ignition (spark or fire), fuel and oxygen must be present. If one of these elements showed on the chart 1 misses, fire will not occur (Bond, 1991).

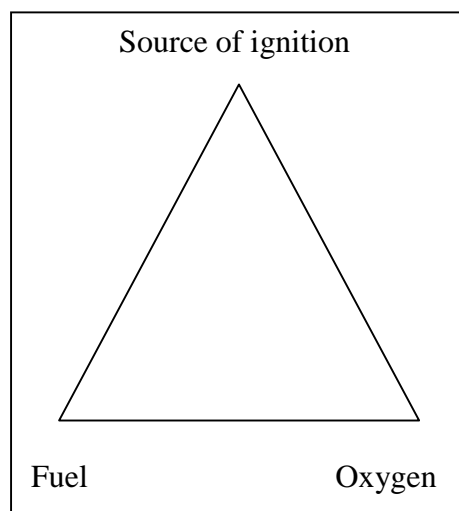


Chart 1. The fire triangle

The flashpoint and the suitable mixture of air and gas are main conditions for combustion and explosions. A **flashpoint** of a flammable liquid is the lowest temperature at which it gives off sufficient vapour to form an ignitable mixture near the surface of the liquid (ISGOTT, 1996). Substances with low flashpoints are more dangerous than the substance with high one. According to flashpoint it is possible to group liquids chemicals into two categories entitled non- volatile and volatile.

#### *Non-volatile liquids*

Chemicals with flashpoints over + 61°C belong to the group. These liquids produce in normal temperature vapour which flammable concentration is below the lower limit. In other words, their gases cannot burn and the substance is not considered as dangerous (Brünings, 1999). The category includes fuel oils, heavy gas oils and diesel oils.

### *Volatile liquids*

Chemicals with flashpoints below +61° belong to the group. Liquids in this category are capable to produce in normal temperature air/gas mixtures above upper flammable limits. Examples in this category are jet fuel, kerosene, petrol and crude oil. Volatile liquids are divided into three subgroups according to their danger:

1. Substances with low flashpoint below –18°C.

The most well known substance is petrol with a flashpoint between -27 °C and -50°C).

2. Intermediate substances have flashpoint between –18°C and +23°C.

3. High flashpoint liquids have a critical temperature up to +23°C to +61°C. Diesel oil (+43°C to +88°C) belongs to that class.

As it was mentioned before the temperature of flammable vapours is not enough to ignite a fire, the sufficient **amount of oxygen** must be also in present. The suitable concentration of vapour and oxygen is called the **”flammable range”** (ISGOTT, 1996).

Lower limit of that range means that there is an insufficient amount of hydrocarbon gas in the air to support and propagate combustion (ISGOTT, 1996).

An upper flammable limit means that hydrocarbon gas in the air is above the flammable limit and there is not enough oxygen to support the fire.

Flammable limits vary for different chemicals and physical conditions such as pressure, temperature and mixture (Bond, 1991). In practice gas mixtures’ lower and upper limits of oil cargoes are between 1% and 10% by volume of atmosphere (ISGOTT, 1996).

Table 1. Flammable range of different type of oils.

Substance	Lower limit	Upper limit
Crude oil	2.2%	9.5%
Aviation gasoline	1.9%	8.5%
Natural gasoline	1.5%	7.8%

Source: ISGOTT 1996

### 2.3.2 Vapours

Vapours are not dangerous only from the point of safety. Volatile organic compounds (VOC) vapours, which originate from the manufacture, storage and distribution of products like gasoline and solvents are also pollutants. They cause environment contamination and danger to lives and vegetation. Volatile organic compounds although react with sunlight and form photochemical smog, which causes global warming. Even more, vapours containing individual toxic products like benzene (UN no. 1114) are the key substances of causing cancer in human beings.

**Volatility** (the tendency of oil and its products to produce vapours) is characterised by the vapour pressure, which depends on temperature, constituents and the volume of the vapour space. The higher the pressure the bigger the evaporation.

All liquids have a natural tendency to achieve equilibrium within surroundings. For liquid stored in a tank this means that evaporation occurs until a certain concentration of gas has been established in the vapour space. The equilibrium-saturated concentration depends on the vapour pressure of the liquid. The higher the vapour's pressure the bigger the evaporation. The emission of vapours to the atmosphere during the handling of large quantities of oil is possible in three ways:

- Displacement losses of vapour when filling the tanks

After filling a tank, a small proportion of the liquid will evaporate in attempting to achieve certain equilibrium concentration of vapour in the tank vapour space. The evaporation is smaller when the tank already contains any liquid because then the vapour already exists in the tank.

- Losses through tank vents during the storage

Air temperature influences the emission of vapours in tanks. When the temperature rises during the daytime the vapour pressure increases and results in the emission of vapours to the atmosphere. At night, the pressure decreases and air is drawn into the tank. This creates a driving force for new evaporation until the vapour equilibrium concentration is re-established. The amounts of losses of vapours can be significant depending upon the liquid volatility and temperature change.

- Losses from opening hatches on transport units

These amounts are not big but can still contribute losses. This happens when the hatch is opened to enter or withdraw the loading arm or the hose.

The hazard of vapours depends on their density and toxicity. If the **vapour density** is less than 1.0, the vapour rises high and disperses soon (ISGOTT, 1996). In case of density more than 1.0, hydrocarbons' vapours spread near the ground or deck and may travel down stairs (ISGOTT, 1996). These vapours do not disperse quickly and may affect human lives very seriously. For instance, the density of vapour of petrol is greater than the density of air. Therefore layering effect must be taken into consideration in handling this type of cargo.

Table 2. Different densities of oil and its products relative to air

	DENSITY	DENSITY
SUBSTANCE	Pure hydrocarbon	50 % by hydrocarbon / 50% air
Crude oil	1.55	1.25
Aviation gasoline	2.0	1.5
Natural gasoline	2.5	1.8

Source: ISGOTT 1996

The toxic hazard of chemicals depend on various kinds of hydrocarbon constituents of vapour. Toxicity can be influenced by the presence of aromatic hydrocarbons (benzene, toluene, xylene) and hydrogen sulphide (ISGOTT, 1996). For instance, already small quantities of petroleum vapour cause symptoms similar to drunkenness with headache and irritation of eyes. In high concentrations it leads to paralyses, insensibility and death. The smell of petroleum vapour is variable and sometimes it can be even without smell. This happens when the vapour contains hydrogen sulphide. Therefore the absence of smell cannot be an indicator of the absence of vapours.



### 2.3.3 Oxygen consumption

The oxygen content in enclosed spaces (like holds or tanks) may be low because it is removed by chemical reactions. This causes a danger to human life. There are special symptoms which indicate a lack of oxygen but most people cannot recognise them until they are too weak to escape without help. The danger is extremely big when escape needs climbing out of the cargo holes or tank. If the amount of available oxygen decreases below 21% of the volume of atmosphere breathing becomes faster and deeper (ISGOTT, 1996). An atmosphere containing less than 10% oxygen content by volume causes unconsciousness and leads to death of person unless the victim is removed quickly to the open air (ISGOTT, 1996). Oxygen level falling under 5% by volume of atmosphere causes immediate unconsciousness and brain damage even if life is restored later (ISGOTT, 1996).

## **2.4 Possible impacts of dangerous chemicals**

The wrong handling of dangerous chemical substances may cause accidents which impacts may be very serious. They can pollute water, kill living people and organisms, destroy property and affect the economy. In the following part of the text potential consequences are under view.

### 2.4.1 Pollution of water and mortality of fauna and flora.

Chemicals discharged into the water can affect the aquatic ecosystem in many ways (Pardo, 1999).

- Impact on the exchange of gases spilled into the water start biological processes which consume the oxygen in the water.
- Energy release cause water temperature increase
- Toxic properties on the surface and in the water affect negatively marine life.

Chemical pollution can be a direct or a long term. When the direct impact affects the environment immediately, then the long-term influences the flora and fauna even after the disappearing of the pollution. The reason is that some chemicals can enter into the organic food cycle and affect fish' and mammals' fecundity and

growth, physical disturb feeding or cause tainting and accumulation of substances into the organisms.

#### 2.4.2 Destruction of property

Explosions and fires of hazardous chemicals are the main reasons of the damage of vessel and port structure. Especially dangerous are substances belonging to UN classes 1, 2, 3 and 4.

To show the impact of an explosion, the “Fort Strikene” example is described.

The cargo vessel “Fort Strikene” was moored alongside Victoria dock in Bombay in 1944. There were 1,260 tonnes of dynamite and 1,648 tonnes of bales of cotton loaded in the same hold. The cotton ignited itself and caused dynamite explosion. The “Fort Strikene” exploded with such a force that nine ships sank and the port was completely destroyed. More worse, extremely high waves killed 1,376 people and damaged hundreds of houses (Compton, 1999).

The incident shows that when large quantities of explosives or flammable chemicals are transported extreme safety measures must be taken into consideration.

#### 2.4.3 Death and serious injuries to human life

Explosions, fires and toxic vapours of different chemicals are the main dangers affecting people. As the results of explosions and fires have been already described in part 2.3.2 then now the main concentration is dedicated to the impact of vapours.

To show the seriousness of vapour release, the Bhopal gas cloud disaster is described.

The pesticide factory situated in Bhopal, a city with a population of 670,000 in central India. On the 3 of December in 1984, 15 tonnes of the highly toxic and irritant gas methyl isocyanate (UN no 2480) leaked from the tank. The gas cloud covered a 30- mile long and 1.5- mile wide area. It was estimated that 200,000 people breathed the vapour, 2,500 of whom died due to the flooding of their lungs. 125,000 people required hospital treatment, of whom 20,000 were seriously sick. (HCB, 1985).

#### 2.4.4 Negative impact to the economy of the area where the accident occurred

Pollution's negative affect the economy basis on its high cost which is can be divided into two groups. When direct costs are related to the recovery of physical damage, reconstruction work, and also clean up operations them indirect costs can be associated with the closure of affected areas for navigation, sea use and customers trust (tourists number decreases, fish products are boycotted by consumers). Although international funds (today the International Oil Pollution Fund, which covers crude oil pollution and in the future the HNS Fund, which covers pollution of hazardous substances) cover expenses, there are very often occasions when their financing is not sufficient or the pollution claims are not accepted by the fund. In this case the money must be taken from the government budget which causes poor financing of some other area.

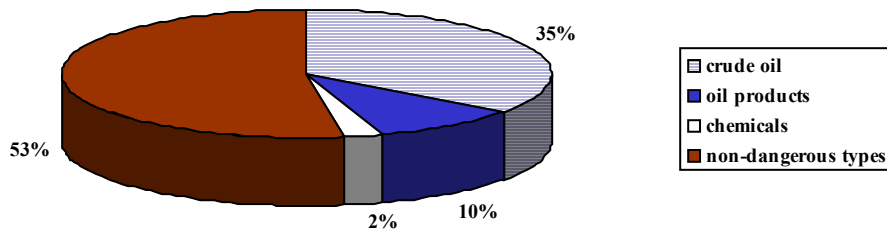
**CHAPTER 3**  
**THE OVERVIEW OF THE TRANSPORTATION OF DANGEROUS**  
**CARGOES IN THE DIFFERENT PART OF THE WORLD**

As the world becomes more industrialised the list of chemicals developed and produced increases year to year. Because of the main principle of logistics and the role of multimodal transport more and more dangerous cargo is transported from one area to another. According to the IMO materials, at the end of the 20th century more than 50% of bulk and 10-15% of containerized or packed cargoes transported by sea all over the world are classified as dangerous. The main objective of the chapter is to emphasize the importance of the transportation of dangerous cargo in the world. The author introduces main countries and ports which have leading role in handling of dangerous cargo in the world. More detailed overview of transportation of dangerous cargo in the Baltic Sea is given. Finally, overview of development of movement of harmful substances through Estonian ports in recent years is given.

**3.1 World statistics**

The main States of handling bulk and containerised dangerous cargo in the world are the United States, Japan, Germany and United Kingdom. Although large quantities of substances are transported mainly on land, sea transport has not lost its importance, especially as a main carrier of liquid dangerous substances. In 1997 the volume of the world seaborne trade of crude oil was 1,477.8 million tonnes (35% of world seaborne trade), oil products 422.2 million tonnes (10% of world seaborne trade) and chemicals 100.3 million tonnes (2.4 % of world seaborne trade) (Intertanko, Drewry Shipping Consultants, 1999).

Chart 2. The division of world seaborne trade in 1997



Source: Intertanko, Drewry Shipping Consultants, 1999

According to the Drewry Shipping Consultants, the US is the biggest importer of Latin-American and northern European oil. The state imports from the Middle-East, Africa, Asia and Mediterranean areas are stagnant. Japan's crude oil is mainly supplied by the Middle-East. Europe uses mainly local oil. On the basis of the research of the Drewry Shipping Consultants, a similar trend is in oil products seaborne trade. The USA is the main consumer of Latin-American and northern European petrol. Europe itself is concentrated to use its own interregional sources and decreases import from non- European states.

### *The United States*

The United States is the biggest handler of dangerous substances. Inside the state 4 billion tonnes of hazardous cargo are transported annually, involving 500,000 movements per day, mainly by road and rail (Compton, 1994). The state imported 425.8 million tonnes of crude oil and 87.6 million tonnes of oil products in 1998. At the same time 8 million tonnes of crude oil and 15.7 millions tonnes of oil products moved out of the country (BP Amoco Statistical Review of World Energy, 1999). The main ports handling dangerous liquid substances are Philadelphia, Houston and Tampa (table 1). The United States is also the leader in the trading of containerised dangerous cargo. The biggest international trade of hazardous substances in the world is between the USA and northern Europe. It is estimated that 10% of imported containers to the US and 17% of exported from the US carry dangerous substances

(Lyons, 1999). Between January and July 1999, 7,200,000 TEU-s containing dangerous goods were moved between western coast of the US and Europe (Lyons, 1999). Eastbound coast trade was 600,000 TEU-s (Lyons, 1999). The biggest ports, which handle containerized harmful substances in the USA are Long Beach, Los Angeles and New York .

Table 3. Main oil ports in the US and their throughput in 1998

Port	Oil throughput
Philadelphia	41million tonnes
Houston	40 million tonnes
Tampa	13 million tonnes
Seattle	13 million tonnes
Los Angeles	3 million tonnes

Source: Institute of Shipping Economics and Logistics

### *Canada*

In Canada, 230 million tonnes of packed dangerous goods are transported per year, involving 75,000 movements per day, mainly by road. Statistics show that 56% of Canada's total cargo is moved by trucks.

Table 4. Approximate annual numbers of dangerous cargo movements in Canada

Mode	Shipments	Quantity (tonnes)
Marine	10,000	71,300,000
Rail	510,000	29,900,000
Road	24,990,000	128,708,000
Air	1,490,000	92,000

Source: Transport Canada

The biggest oil port in Canada is Saint John N.B., with a throughput of 15 million tonnes of oil and its products in 1997. It was followed by Quebec (8.7 million

tonnes) and Halifax (4.2 million tonnes) (Institute of Shipping Economics and Logistics, 1998).

#### *Asia*

The Asian biggest oil port is Kaohsiung in Taiwan. In 1997, operators handled 36.5 million tonnes of oil and its products. The Japanese ports of Yokohama and Nagoya, with a throughput of 15.3 million and 14.4 million tonnes of oil keep second and third place in Asia (Institute of Shipping Economics and Logistics, 1998).

#### *Europe*

According to Mr. Endlicher, Head of Central Logistics of Bayer AG (1997), inside Europe 88% of the movement of chemicals are done by road and 7% by rail. In 1990, 1.3 billion tonnes of hazardous substances were moved by road and 90 million tonnes by train inside EU countries. Inside Germany several hundreds millions of tonnes of chemicals are moved. Another 50 million tonnes are carried out of the country by land (Lambrecht, 1992).

255 million tonnes of liquid dangerous cargoes, from which 10.3 million tonnes were chemicals moved through UK ports in 1991 (James, 1992). Research based two years early statistics showed that 3.6 million tonnes of packed hazardous cargoes were handled by British terminals.

Rotterdam is the main European port for the transport of dangerous cargoes. It is followed by Marseille (France), Milford Haven and Forth Port (UK) and Wilhelmshaven (Germany) (table 5).

On the basis of the statistics published in the homepage of the Port of Rotterdam (2000), in 1998, a totally of 101 million tonnes of crude oil were handled in Rotterdam. In addition, Rotterdam handles more than a half of the total amount of oil products and chemicals in the North- Western part of Europe. In 1998, 20 million tonnes of oil products and chemicals were transhipped through the port. Chemicals are brought mainly from Germany, the USA, the UK, and countries in the Middle East such as Saudi Arabia.

Table 5. Biggest oil ports in Europe and their throughput in 1998

Port	Oil and its product throughput
Rotterdam (The Netherlands)	120 million tonnes
Marseille (France)	45 million tonnes
Wilhelmshaven (Germany)	36 million tonnes
Forth Ports (UK)	33 million tonnes
Milford Haven (UK)	33 million tonnes
Le Havre (France)	28.8 million tonnes
Ventspils (Latvia)	25 million tonnes
London (UK)	18 million tonnes
Genoa (Italy)	17 million tonnes

Source: Institute of Shipping Economics and Logistics

### 3.2 Baltic Sea statistics

Approximately 143,000 tonnes of packaged dangerous cargo is carried in 4000 shipments in the Baltic Sea every month. A totally of 795 different substances are transported, half of them are carried only once or twice a month and only a hundred of different substances are carried more than 20 times. Summary of the substances is in annex 1.

The main dangerous goods transported in packed form in the Baltic Sea are inflammable gases (class 3 according to IMDG Code), followed by corrosives (class 8) and oxidizing substances (class 5).

130 shipping routes carrying dangerous goods in the Baltic Sea. Only in 80 of them monthly quantities are bigger than 100 tonnes. (List of these routes is shown in annex 2). The length of the shipping routes varies from a large number of short distance shipments to 48 hour long shipments from the North-sea inlets to the ports of southern Finland and eastern- Sweden. It is estimated that 35 ships with dangerous goods on board are continuously at sea. The highest traffic density is in the southern part of the Baltic Sea, near the Kiel Canal approach and its surrounding waters. A medium traffic density is found in Danish waters, the Kattegat, along the Swedish



east coast and in the Gulf of Finland. Transport activity is quite low in the Gulf of Bothnia.

Table 6. Total quantity and number of parcels per class transported in the Baltic Sea

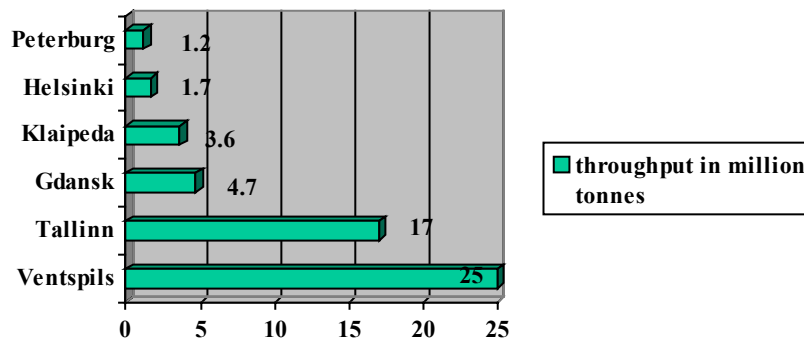
Class and property	Quantity, tonnes	Number of parcels
1 Explosives	2,700	370
2 Gases	10,900	1,100
3 Inflammable liquids	32,450	4,700
4 Inflammable solids	18,500	540
5 Oxidizing substances	25,000	510
6 Poisonous substances	12,800	1,100
7 Radioactive materials	1,300	30
8 Corrosives	29,600	2,400
9 Others	9,500	640
<b>Total</b>	<b>142,750</b>	<b>11,390</b>

Source: Helsinki Commission

The ferry lines' part in transportation of dangerous cargo is significant. 76,000 tonnes which make 53% of the total amount of the dangerous cargo, are shipped with ferries sailing in 34 different routes. (List of these routes is shown in annex 3).

Approximately 52 million tonnes of oil and its products, 5.8 million tonnes of liquid chemicals and 2.9 million tonnes of gases were carried in 1999 in the Baltic Sea. It is estimated that 12 loaded chemical tankers and 3-4 loaded gas carriers continuously sail at sea. The main ports handling oil and its products in the Baltic Sea are Ventspils in Latvia and Tallinn in Estonia.

Chart 3. Biggest oil ports in the Baltic Sea



Source: Institute of Shipping Economics and Logistics

### 3.3 Estonian statistics

As any research covering dangerous cargo movement in all Estonian ports around the country have not been done and the official annual statistics do not exist, it is difficult to find out accurate figures. The only official survey available were done in 1995 by the Helsinki Port Authority in Finland (covered transport of dangerous cargo by ferries between Tallinn and Helsinki) and in 1997 by Estonian Maritime Board's Hazardous Cargo Division (covered dangerous cargo movement through Estonian three main ports during 10 days). To get more updated information the statistics of handled cargo by main stevedore companies is used.

The direction of traffic flow of dangerous goods in Estonian ports depends very much of the type of the cargo. Bulk cargo moves usually through ports out of the country. According to the port statistics, ammonium nitrate (UN no. 1942 and 2067), which can be qualified as dry bulk, moves 100 % from Russian factories to Estonian ports by rail with aim to export to the world market by ships.

Similar situation is in the liquid bulk trade. Approximately 95% of oil products move from Russia to Estonian ports by railway and later shipped to the world. The remaining 5 % (mainly gasoline) is transported to Estonian ports from the Neste refinery in Finland by ships and is consumed in the country or sent out to the other Baltic States or Russia.

Opposite to the liquid and dry bulk cargo movement trend, 90% of containerised dangerous cargo is imported to Estonia by ships and moved later to Russia by rail or Latvia and Lithuania by road.

A similar trend is in ferry transport. Most of the trucks and trailers carrying hazardous substances come from Finland and Sweden. Some of them continue their trip to other Baltic States.

Dangerous cargo usually moves through the ports, which are in Tallinn. Most oil products, containers, dry bulk and some trailers are shipped through the biggest Estonian port known as the “Port of Muuga”. Some containers and most of the trailers move through the Old Harbour. Only trucks using ferry route between Paldiski (Estonia)- Kappelskär (Sweden) travel through the Port of Paldiski, which is in the NW part of the country.

The quantities of packed dangerous cargo transported through Estonian ports are not significant. Research done by the Estonian Maritime Board in 1997 showed that during 10 days 811 tonnes of packed dangerous goods were imported through the three ports (table 5).

Table 7. Main chemicals in packed form imported to Estonia

Substance	UN no	IMDG class
Ethanol	1170	3.1
Acetone	1090	3.2
Aerosol disperses	1950	2
Chromic acid	1463	5.1
Paints	1263	3.1

Source: Estonian Maritime Administration

At the same time only 63 tonnes of packed dangerous goods were exported. The main substances are marked in the table 8.

Table 8. Main chemicals exported from Estonia

Substance	UN no	IMDG class	Quantity
Chromic acid	1463	5.1	42.0 tonnes
Chlorine	1017	2	2.5 tonnes
Dichlorosodifluoro methane	1028	2	17.0 tonnes

Source: Estonian Maritime Administration

According to 10 days statistics it is possible to estimate that approximately 30,000 tonnes of packaged dangerous cargo moved through Estonian ports in 1997 (Hurbas, 1997). Although this limited time period may be too short for producing statistically reliable data, it is still useful information, previously not available at all. As the cargo amount has increased between 1997 and 2000, so the number is probably bigger now.

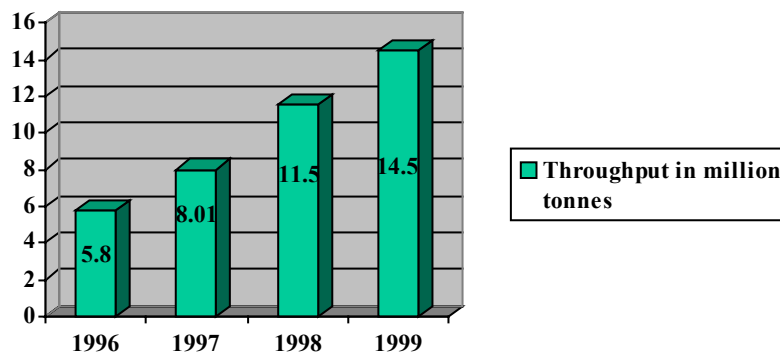
Another research related to truck movements between Estonia and Finland was done in 1995 by Helsinki Port Authority. During the period between 1 January and 30 June, 5,562 tonnes of dangerous cargo in 864 trailers sailed across the Gulf of Finland (Arro, 1996). 4481 tonnes (81% of the total quantity) were liquid chemicals like paints, 461 tonnes (8.3%) of corrosives (class 8) and 233 tonnes (4.2%) of gases (class 2). The research showed that 140 trucks with dangerous cargo moved monthly between Tallinn and Helsinki in 1995. According to the statistics published in the magazine "Cruise & Ferry Info" approximately 5,500 lorries were transported per month between these two towns in 1995. A simple calculation shows that 140 lorries from 5,500 are 2.6%. If to use the same ratio in 1999 when 7,800 tracks sailed between Tallinn and Helsinki per month, then 2.6% is 203 lorries.

If the containerised or packed dangerous cargo quantities transported through Estonia is not significant and sudden rise can not be seen, then the importance of transportation of oil related substances increase year to year. Estonia has risen to the second biggest oil transshipment country after Latvia (25 million tonnes in 1999) in the Baltic Sea region. (Look chart 3). According to Mr. R. Vare (2000), **the Director-**

**General** of the Pakterminal, the main advantage why Russian oil exporters prefer Estonian ports to others at the same region is the vicinity to the Russian border. When the “Port of Muuga” situates 210 km from the border then the main competitors Klaipeda in Lithuania and Ventspils in Latvia stays 400 km from Russia. In addition, the Klaipeda port’s oil transit route goes through Belorussia, which automatically adds two extra border crossings and significantly decreases their competitive position in the market.

In 1999, 17.1 million tonnes of oil and its products were handled in four Estonian ports. The biggest throughput (14.5 million tonnes) was in the “Port of Muuga”, followed by the “Port of Vene- Balti” (1.8 million tonnes) and the “Port of Miiduranna” (0.8 million tonnes).

Chart 4. Historical overview of liquid bulk cargo transport development in the ports of “Port of Tallinn”

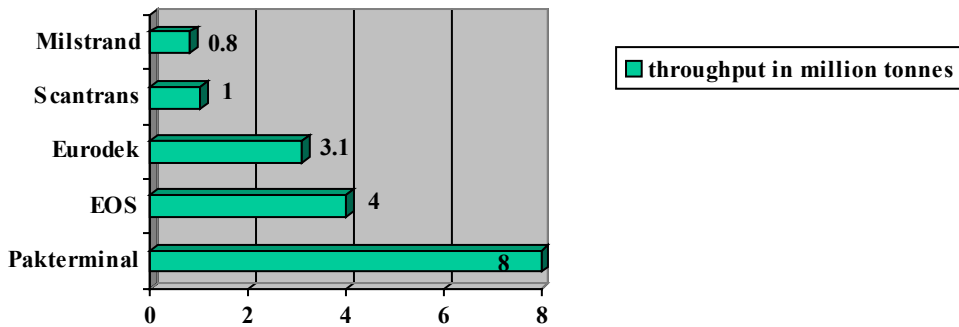


Source: Statistics of “Port of Tallinn”

### *Port of Muuga*

In 1999, 611 tankers with a total dwt 5,000,000 visited the port. They loaded 13,317,400 tonnes and discharged 611,400 tonnes of oil and its products (**source**). 14.5 million tonnes of oil handled in the “Port of Muuga” put the harbour on the list of the biggest European oil ports into the 10<sup>th</sup> position (Institute of Shipping Economics and Logistics, 1998).

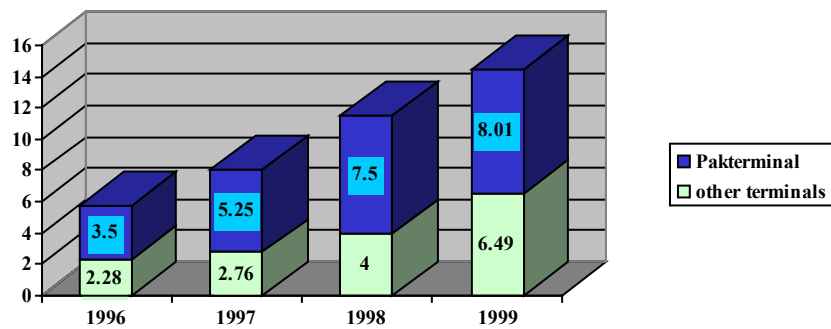
Chart 5. Different oil terminals and their throughput in the “Port of Tallinn”



*Pakterminal*

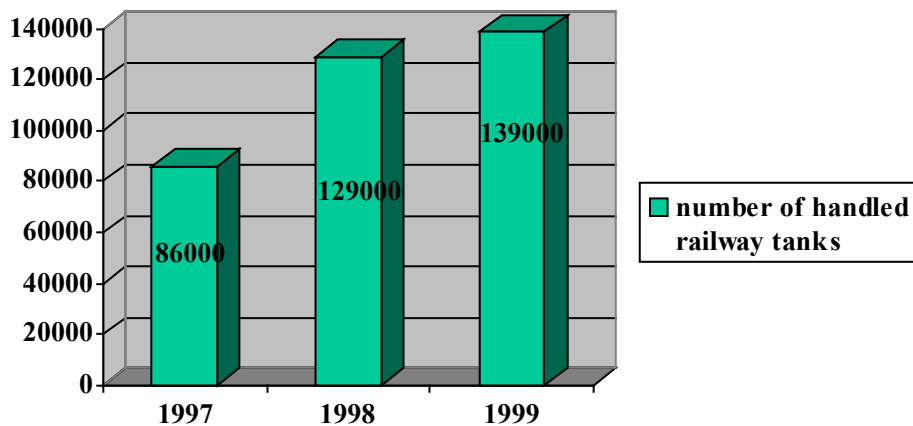
To emphasise the importance and activities related to oil transportation in Estonia the main oil terminal is introduced. Pakterminal a 50%- 50 % joint venture of Estonian investors and Netherlands’s Ovpak company is the largest of seven existing oil terminals in Estonia. It is also the biggest in the Baltic States. When in 1995 its throughput was 2.24 million tonnes of oil, then in 1999 the number was already 8.04 million (47% of total 1999 year Estonian oil transshipment).

Chart 6. Throughput of oil in the Pakterminal in million tonnes



The number of discharged railway tanks in the terminal increase year by year. In 1997 the terminal handled 86,000 and in 1998 already 129,000 railway tanks. In the year of 1999 the number reached to 139,000. The total storage capacity of the terminal is 206,000 m<sup>3</sup>. Three rail tanks discharge installations can handle 84 wagons simultaneously. The traffic in the terminal is very active, statistics show that 400 rail tanks carrying 20,000-23,000 tonnes of fuel, are discharged per day, and at least one tanker is moored to load oil in the quay every day. 95% of the cargo comes from Russia and is transhipped by tankers to the world market. 5% of cargo comes by sea and is sent mainly to Russia by rail tanks.

Chart 7. Number of railway tanks handled in the Pakterminal



The rough division of operating cargo in the terminal is the following:

- 40% of cargo is classified as heavy oil
- 40% gasoline (UN no.1203, IMDG class 5.1)
- 20% kerosene (UN no.1223, IMDG class 3.3)

**CHAPTER 4**  
**THE ROLE OF STATISTICS IN THE TRANSPORTATION**  
**OF DANGEROUS CARGOES**

The detail survey about the movement of dangerous cargo may look unimportant to persons who are not involved in handling of harmful substances. In reality the accurate statistics play a significant role in many fields. In the chapter different possibilities how to use the statistics have been analysed.

**4.1 The importance of the statistics**

Statistics plays an important role in modern industry. It is useful both operator companies and legislative bodies. The developments of companies, service supply level and amount of production, also safety and precaution measures depends on the analysis of statistics. Similar principles are in the business of dangerous goods transportation. Collecting, updating and analysing statistics related to the movement and handling of harmful substances is the key issue which helps to:

- establish state transport policy and local legislation.

On the basis of statistics authorities must analyse all pro- and con-arguments of the transportation of dangerous cargoes. All of the advantages (encourage state's economy) and disadvantages (danger to people and the environment) must be taken into consideration. For instance, in the UK and Germany the government encourages coastal shipping instead of using land transport to move dangerous cargo. Germany has established regulations that, since 1991, containers with highly flammable goods transported farther than 200 km from starting point must be shipped by railway or waterway. Inflammable liquids with flashpoints of less



than 21°C must be treated in a similar way when they are shipped more than 100 km. All dangerous goods transported more than 400 km have to be moved by combined transport. This is of course in case when ports and railway nets exist. The main reason to establish that regulation is the tank container explosion in the centre of the city of Herborn in 1988. Baltic States, opposite, are interested in cargo movement from Western Europe to Finland using “Via Baltic” road through their countries.

- define main traffic routes and increase safety

Statistics are the basis for develop contingency plan (Sampson, 2000). The authorities have an overview of the amount of dangerous cargo transported through the area. This information gives responsible authorities chance to define possible dangers and impacts and to take measures to avoid accidents or decrease their impacts (local response service officers are trained to deal with possible hazards and specific response equipment is stored in the area).

- restrict dangerous cargo movements in sensitive areas

In case statistics show that large quantities or extremely dangerous substances go through the highly populated or environmentally sensitive areas, local authorities can close some areas for transport. For instance, in Finland it is prohibited to transport chemicals except class 2 in some build up areas. In Norway it is prohibited to transport dangerous substances belonging to UN classes 1, 2 and 3 through long underground tunnels (HCB, 1998).

- make marketing research and develop economy

The development of economy basis on marketing research. When the environment is suitable and attractive for business, investments will be done. It can be economically beneficial to establish a container-cleaning yard to an area where tank containers are loaded or discharged.

## **4.2 “A crisis management map”**

“A crisis management map” is not a new invention, which is used already many years in France. Despite of that fact it needs introducing as in many countries the idea is new.

The mapping of transport routes is the easiest way to find out possible dangerous areas on the chemical cargo transport route. The map must also show the places to get some help in case of emergency. In addition, it can help to educate people in how to act in the case of an accident.

“The crisis management map” is developed on the basis of dangerous transportation statistics. It illustrates the major dangerous goods’ transport routes (including rail, road and sea) and pipelines for gas, oil and chemicals in the region. Ports handling oil products and other chemicals should be marked on the map. It is also important to define the position of oil refineries, chemical or petrochemical complexes and nuclear power plants which are designated “liable to be affected by a major accident” as defined by the European Council directive 96/82 “Seveso II”. In Estonia, twenty-one enterprises fall under the directive’s criteria. The list of these enterprises is in annex 4. In case of accident to get a quick response, the location of rescue services and hospitals should also be marked. To make the map more useful, additional information (placards, UN numeration) of how to understand road tankers identification plates, should be printed on it. The most effective scale of the map is 1:200 000 (“Mapping dangerous goods”, 1993). The map should be available to everybody who is directly related to transportation and rescue or response operations (police stations, rescue and fire fighting centres, local authorities) or whose work is related to driving around the area and who can be eye- witnesses to accidents (post and transport companies). For instance, a postman is out on his rounds and he is an eyewitness of road tank fire. The driver is immobilised and the tank load is spilling out. A local farmer is trying to extinguish the burning load with water. By simply viewing the tanker’s information plate and the consulting map, the postman understands that the farmer’s good intentions are not appropriate and increase the risk to aggravating the situation (Gagnier, 1993). France has a more ambitious plan. Their aim is to introduce to their country every citizens possible hazards and teach

them to act in the critical situation. More than 4000 maps are distributed to local schools and companies. Mr. Daniel Gagnier from the Ministry of the Environment's industrial risk prevention directorate explained it as a way to increase non-experts' knowledge to act or not to act in case of accident. There is a need to educate people as surveys showed that general awareness of hazardous substances is zero, the understanding of placards are poor and sometimes lead to wrong conclusions (Maynard, 1986). About survey read in the annex 5 People must know about dangers they can meet. "A crisis management map" gives good change to study the dangers.

## **CHAPTER 5**

### **ACCIDENTS AND THEIR AVOIDANCE**

Transport and handling of dangerous substances are activities with the high risk. In this chapter historical overview of biggest accidents is given. The chapter also points out most common violations in container transportation. Finally, establishment of management system, use of safe technology and continuous training of workers as main areas to avoid accidents happen are analyzed.

#### **5.1 Accidents with dangerous substances, statistics of 1999**

Disasters have followed the transport and storage of dangerous cargo through history. The earliest registered gunpowder explosion happened in Boston in 1645. The accident killed three people and destroyed half of the city (Marshall, 1987). The first explosion involving a new generation of explosives took place in Heleneburg, Sweden in 1864. An interesting fact is that the accident killed five persons including Emil Nobel, brother of the inventor of dynamite (Marshall, 1987). The earliest chemical fire was recorded in 1759. It was the result of spillage of bottle of nitric acid (Marshall, 1987). The first ammonium nitrate explosion happened in Kingston, London in 1896 (Marshall, 1987). It is recorded that the intentional release of toxic gas was used already in 429 BC during the siege of Plata and in 1915 during the attack at Ypres which killed 5000 soldiers. The first non-military release of chlorine was recorded in the State of Michigan, USA in 1917 (Marshall, 1987).

Ships loaded with dangerous cargo have been involved with many serious accidents. Here are some remarkable examples.

1917 -Halifax harbor.

An overloaded ship, “Mont Blanc”, lost maneuverability and collided with other vessel. 2,600 tons of dynamite on board exploded. 3000 people died, 6000 were injured and 6,000 buildings were destroyed. The accident is defined as the biggest man- made explosion until the advent of the atomic bomb.

1947 -Brest harbor

21 people lost their lives when the ammonium nitrate on board of the cargo ship “Ocean Liberty” exploded.

1987 – the north- west coast of Spain

The cargo vessel “Cason” grounded. Seawater entered into holds and caused a strong reaction with sodium. The result was the explosion of the cargo. 23 crewmembers died and 20,000 residents of the nearest town were evacuated.

1999 – the south- east coast of UK

The violation of traffic rules caused the collision of the cruise ship “Norwegian Dream” and the containership “Ever Decent”. Containers with dangerous substances started to burn and evaporate toxic fumes. Moreover, some of them fell on the board of the cruise ship and some into the sea. The accident had the potential to turn into a major pollution incident with very bad consequence for the UK’s coastline but due to the quick work of the response team the catastrophe was avoided (Garner, 1999).

Despite the enormous development of safety measures and the increase of cargo handlers’ knowledge during the second part of the 20th century accidents still continue to happen. Most accidents with dangerous substances happen in port areas during the loading and discharging of liquid substances. According to the statistics published in the magazine “Hazardous Cargo Bulletin”, there were 31 incidents related to the dangerous cargo handling in 1999. 24 of them happened in ports and 7 at sea. 27 incidents were related with tankers, other 4 with containerships. 17 accidents were explosions and fires, mainly caused because of the emission of vapours. 12 spills happened in the port

during discharge and loading operations. 20 people lost their lives and 45 were injured. The list of all accidents happened in 1999 is available in annex 6.

## **5.2 Violation of regulations**

When states have ratified and implemented legislation concerning dangerous goods, responsible persons from port authorities and maritime administration must concentrate to controlling the enforcement of existing rules. There is a need to do so because surveys show that occasions of the violation of regulations are not rare. Very often risks and dangers associated with transport and handling through ports are ignored. Surveys show that typical violations are related to transport of harmful substances inside containers. During the survey done in 12 ports in Belgium, the Netherlands and Germany in 1989 from 2,437 inspected freight containers 1,384 were deficient, and 497 were barred from carriage. Situation was not better with tank containers because from 473 tank containers 193 were deficient and transport of 89 units were prohibited. Although 41 trailers were inspected from which in 31 items were found some deficiencies.

Violation of container packing rules is also common in other countries. Analyses done in the southern part of the UK showed that the violation rate has reached 81%. The main violations are usually related to stowage/segregation, labelling and documentation. According to M. Compton, a survey done in the USA showed that 46% of violations are related with stowage and segregation, 24% with documentation and 21% with placards.

### *Stowage and segregation*

It is quite difficult to keep control over containers and the cargo inside it because the owner of the container is a transport company, the packing is done by the freight forwarder and stowage by the port operator. Usually the next link in the chain cannot be sure that the previous did its job properly, and often it did not. Cargo carried in cargo transport units must be packed and secured in the way to prevent damage or hazards to ships, persons on board and the marine environment. Most of these types of violations are caused by a lack of knowledge or by negligence. Workers who pack containers are

not familiar of stresses affecting containers during transportation, especially at sea in rough weather. Very often the planning of stowage is not done correctly, things are not put tightly or the centre of gravity is in the wrong place. Violation of these rules causes movement of the cargo and breakage of packages and even in some cases the lost of containers overboard. The ferry “Nordic Pride” incident is one example from the long list.

In rough weather conditions the vessel “Nordic Pride” on the route Zeebrugge-Immingham lost four tank containers loaded with triethylene tetranine (UN no 2259, class 8: corrosives) and ethyl acylate (UN no 1912, marine pollutant) overboard. The investigation found out that the main reason was a too- high centre of gravity of the transport unit (Champion, 1991).

#### *Documentation and labelling*

Correct documentation and labeling plays an important role in the transport of dangerous goods. All who are involved in the transport chain must know what they are dealing with. In case of emergency, documentation helps the crew and the response team to deal with the cargo, otherwise people’s lives can be endanger and the wrong emergency response technology is used. To emphasize the importance of documentation the vessel “Santa Clara I” incident’s one aspect is described. After the storm which damaged several packages and drums on board of vessel, workers of the shipyard were sent to clean the hold. After entering the hold 32 workers got poisoning and were sent to the hospital. The problem was that magnesium phosphate (UN no 2011) was not included into the cargo manifest and the hazard of air poisoning in the hold was not appreciated. Problems with documentation and placards normally fall within one of the following areas: unsigned or missing documents; incompetent or incorrect information in documents, wrong size, missing or wrong information giving placards.

### **5.3 Safe running of enterprises with major hazards**

According to the magazine “Hazardous Cargo Bulletin”, there were 31 accidents with dangerous cargo in the maritime industry in 1999. But this is not all, it is estimated

that for every actual accident involving a ship, there are around 10 “near misses”- events which could have resulted in an accident (Norwegian Shipowner Association, 1995). The simple calculation shows that in this case of 31 accidents there were 300 possible accidents in 1999. Moreover, there is an enormous number of violation of rules or so-called non-conformities, which could cause “near- misses” or accidents (Norwegian Shipowners Association, 1995). Accidents and nearly misses do not just happen. There is always any cause. Different sources declare that 80-90% of accidents are caused by human failure, but human errors are avoidable through the improvement of management systems, the use of environmental friendly technology and the training of employees. Of course, where dangerous goods are handled the risk of incidents can never be eliminated. However, by using good, well-planned operating procedures the risk can be minimised.

#### 5.3.1 Identification of hazards

In general, safety management is defined as a set of management activities that ensure that hazards are effectively identified, understood and minimized. The OECD (1992) recognises 21 management tasks and factors in the prevention of chemical incidents. Among them the most important are hazard identification (what can happen), hazard analyses (why it can happen), consequent assessment (what are the results and how much they cost) and assessment of information and lessons learnt from relevant major accidents.

Risk assessment process will be much more simple and many incidents will be avoided when maritime industry implements similar system as air industry already has. This is called a Safety and Improvement Reporting (SAFIR) system. The idea is very simple. Shipping and stevedore companies should keep a record of accidents and violations involving their ships and equipment. All incidents should be classified according to their description like spill, fire, explosion or poisoning. Although the impact and actual cost and time lost should be added. When during the particular time period occurrence of one type of accidents is large, all cases must be carefully analysed to identify the reasons of accidents and find out solutions of avoiding them in the future. On the basis of the results, changes in working conditions must be done. These can be a



critical review of existing management system, the improvement of technical equipment or the extra training of employees.

Even the idea of creating an accident database seems quite simple, in real life it is quite difficult to implement it. It is relatively easy to identify accidents, but “near-misses” and non-conformities cause more problems. Employees are not interested in reporting their errors as they scare to show themselves in a bad light and lose their jobs. To avoid this kind of threats, companies must establish official policies to encourage to report of errors and not to punish the workers. Employees at the same time should trust management. Only the wide co-operation of both sides helps to achieve the real aim; the safe and environmentally friendly handling of dangerous goods.

### 5.3.2 Safe and environmental friendly management

During the last ten years the importance of environmental matters has increased significantly. A large number of resolutions, recommendations, standards and codes related to environment protection have been drafted. But this is only the beginning. As Mr. P. Barnevik, president and chief executive of ABB said: “If you think today’s environmental requirements seem like a breeze, you should get ready for the storm tomorrow.” It means, companies have to establish new goals for environmentally friendly activities, otherwise in the near future they are enforced to leave the market.

Most accidents in the oil and dangerous cargo industry cause environmental damages. To avoid them, an integrated management system, which includes both safety and environmental management, should be used. Integrated management is a new way of thinking where safety and pollution prevention are not negotiable topics. In other words, profit cannot be earned on the base of pollution and the lack of safety. As the dangerous substance industry is a wide area covering handling and transporting both on shore and at sea, different standards have been worked out. For ports it means obtaining the ISO 14,000 and for ships the ISM. Even both standards have different titles the main idea is the same- improvement of organisations efficiency and internal control, minimisation of the risk of system and human error.

ISO 14,000 is a voluntary document about management system which monitors an operation's impact on the environment. The main goals of the system are related to pollution prevention and a decrease in the risk of potential accidents. For ports it means mainly the existence of environmental friendly loading technology and oily waste reception facilities. In 1995, 38,000 organisations planned to become registered to ISO 14000 (Horck, 1999). Environmental friendly management plays especially important role in the Baltic Sea area because of the unique status of the sea. The ISM Code is a mandatory document established by IMO for ship companies. It is compulsory to all tankers and gas carriers of 500 gt and upward. The Code establishes a system for the safe and environmental friendly management and operation of vessels with the aim to support and encourage a safety culture in shipping. The result is that the Code forces substandard shipowners to remove out of business and the marine environment is better protected. Even the analyse of the code is not the aim of the dissertation the author wants to emphasise the importance of one paragraph of the Code.

Chapter 5.2 says the following:

*“the master has an overriding authority and the responsibility to make decisions with respect to safety and pollution prevention.”*

This point is very important. The author of the dissertation has been witness of the situation where a master of a tanker refused to enter the port because of the bad weather. Despite the possible danger of accident the terminal management used all kinds of pressure including influencing the shipowner to force the ship berthing. The operator company needed the ship to load the cargo quickly into it and get free space as terminal tanks were full but new trains arrived continuously. In a good shipping company which has implemented a safety management system this kind of pressure is useless and does not give any effect.

### 5.3.3 Technical equipment

Technical equipment in terminals plays an important role in safety matters. Accident shows that equipment used in terminals is not necessarily the best one in the market (Horck, 1999). Accidents are mainly related to hoses and their connections, over

pressure inside pipeline systems and static electricity. At the same time external factors like faulty design and corrosion of pipelines' structures can also cause accidents (Marshall, 1987). In the following part of the section the most dangerous technical parts are under view.

#### *Hoses, loading arms and their connections*

Most of the accidents during the cargo loading/discharging are related to wrong handling of hoses. The result can be very tragic. An accident in Landskrona, Sweden shows that. On the 16<sup>th</sup> of January in 1976, a French tanker started to discharge 533 tons of anhydrous ammonia. The liquid ammonia hose ruptured, and a large cloud of liquid ammonia released. The master and the chief mate who happened to be close to the transfer died. The reason for the accident was a rude violation of existing rules. The used hose was suitable for propane and butane but not for anhydrous ammonia. The pressure was too strong and the hose broke (HCB, 1999).

Even the development of hoses has been significant during last decade, changing from metallic to thermoplastic composite, they still demand very careful handling (Barber, 1985). Hoses must be checked visually before every connection operation (ISGOTT, 1996). A pressure tests must be done after specific intervals, depends on the manufacturers recommendations (ISGOTT, 1996). In addition, as the tanker falls and rises during the loading operations, strain on the hoses must be avoided.

Nowadays the most popular hose construction material is polypropylene (thermoplastic composite hose). It is resistant to organic and inorganic acids, alkalis, hydrocarbons and all solvents (Barber, 1985). In addition, they are lighter and more flexible to pressure ratings (Barber, 1985). At the same time metallic hoses are more suitable for transporting liquid chemicals with temperature up to 60°C (Barber, 1985).

The alternative to hoses is to use more safe loading arms. They have many benefits. First, a loading arm can be used to transport many different chemicals. Second, they are more flexible to pressure. Third, chemicals cannot contaminate metal. In addition to these advantages, the cargo throughput can increase as a loading arms' diameter is bigger (Simpson, 1985). The advantages of the before mentioned factors have been lead to a situation where most of the developed ports use loading arms. For

instance, Malmö's oil port uses in most cases chocks (Horck, 1999). The disadvantage of the loading arm is their price and dimensions. As loading arms are specifically designed to the specific terminal taking into account the elevation changes (resulting from the tide, freeboard of smallest and largest tanker for which the berth is intended), the price is expensive. Although they take a lot of space. In many terminals 30-50 lines are installed side by side on quay. Tanker manifold can contain similar number of flanges. Very often some of them are used simultaneously. So the space is important.

The other area which must be under the careful attention, are connections between terminal's hoses and ship's manifolds. Spills and leakage from connections are mainly caused in three reasons which are following:

1. Flanges of ship manifolds and terminal's pipelines does not fit because of different standards.
2. Poor conditions of flanges in terminals and on vessels
3. Terminal workers negligence to close correctly bolted connections.

#### *Pressure in pipelines*

The strength of pipelines must be equal to the pump speed. When terminals want to increase their loading rate more powerful pumps are used. The increased pressure inside lines can cause broke of it. A similar danger is when during the discharging process a tanker's pumps are used (Horck, 2000). Very often vessels' equipment is more powerful than the terminals' capacity to handle the product. A shipowner who is interested in spending less time in the port wants to use the maximum potential of his equipment. To avoid dangers caused by high pressure during the loading/discharging operation an agreement must be exchanged between the terminal and tanker regarding pump speed, flow rate and the rate of valve closure.

#### *Insulation system*

Some chemicals like kerosene, natural gasoline, jet fuel, heating oil, and lubricating oil are characterised as an accumulators of static electricity. Their loading and discharging

process presents fire and explosion hazards and to avoid the danger, necessary precautions must be taken into consideration.

Static electricity generates during the discharging and loading of cargo. The tanker and berth establish galvanic element because of their potential differences. The loading arm or hose closes the electrical circuit. A spark can be created when the loading arm is connected or disconnected. To avoid a spark a bonding wire or an insulated flange in loading arm construction is used.

Research has proved that bonding wire connections between the ship and the berth have been impracticable and even dangerous. IMO suggests in its Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas (paragraph 8.3.4.1) to finish using the bonding wire. Today most big terminals do not use the bonding wire any more (Horck, 2000).

In Estonia the situation is confusing. The national law does not prefer one solution to another. Though designers of terminals use regulations of different countries, which sometimes prefer the use of bonding wire other time insulated flange. There have been situations where the designer demands the use of bonding wire even the terminal operator has bought already modern and more safe insulated flange. The mixture of different systems is the worst solution which does not increase safety.

Not only loading equipment but also any electrical equipment can be a source of spark, though safety regulations over technical equipment must be established in the territory of a terminal. Although the safety zone must be created in the vicinity of tanker and loading equipment where the use of mobile phones and portable radio stations is prohibited (ISGOTT, 1996).

#### 5.3.4 Training of personnel

The Greek shipowner P. Livanos has said:” Tankers do not carry oil safe, people do.” Awareness of the danger of harmful substances and skills to handle them in a proper way are the main clues to avoid accidents and pollution. IMO has established training regulations both to crew of tankers and terminal operators. In the following part training requirements for seafarers and terminal workers are under the view.

### *Seafarers*

STCW 95 obliges a tanker's crew to complete a tanker familiarisation course, which introduces different cargo characteristics and hazards. In addition, a shore-based fire fighting course must be attended. Later training depends on, whether the crew works on board an oil tanker or a chemical carrier (STCW 95, section A-V/1).

### *Terminal operators*

IMO recommends dividing the training concerning the handling of dangerous goods into three parts.

First, every person who is involved in the transportation and handling of harmful substances should receive general familiarisation training. Second, function-specific training to persons concerning requirements, which are applicable to the tasks he performs. Third, safety training to persons regarding risks, which can happen when he performs duties.

It is not enough than people just know regulations, they must also understand the importance of them. Lets take containerised dangerous goods as an example. The consignee who opens the container does not know in what condition is the cargo inside it. His safety depends on, whether the freight forwarder did his job properly or not. Though, the training of terminal workers is extremely essential.

The author's idea is that cargo securing training programs must also include field training where participants unload not properly secured containers with damaged cargo. Only examples from real life help workers to understand the importance of packing. This should avoid them violating the rules later.

**CHAPTER 6**  
**INTERNATIONAL REGULATIONS OF TRANSPORTING**  
**AND STORING OF DANGEROUS GOODS**

The transport and handling of dangerous cargo is regulated with different international legislative acts. The chapter describes the aims of international legislation and shows why the world needs it. In addition, the overview is given of the development of regulations and main different organisations responsible for establishing them. Finally, as the number of pages in the dissertation is limited then the chapter analyses only these codes and directives which consist significant weaknesses.

**6.1 The need for international legislation**

“Chemicals themselves do not cause any danger; wrong handling does” (J-A. Johnsson).

The main aim of the legislation concerning handling of dangerous substances is to prevent accidents to persons or property and damage to the environment. As most accidents happen during incorrect transport and handling operations legislative acts regulate mainly this area.

The importance of the existence of safety rules shows the pollution incident in the Tisza River at the end of February in 2000. The Romanian mines, run by an Australian company, used exploitation technology which was prohibited in most European countries except Romania. The result was that an extremely poisonous substance, cyanide, was spilled into the river, causing the contamination of water and the death of 130 tonnes of fish. The accident happened because Romania had not implemented environment protection rules. This situation was used by the mining

industry, which saw a possibility to increase their profit without spending money on environmental friendly technology.

The accident emphasises two aspects.

1. There will be soon or later any accidents when the State does not regulate and control handling of dangerous goods.
2. Every private company is interested in profit making. They follow safety and environmental protection rules as much as is demanded in national rules.

The regulations concerning dangerous substances must be strict to eliminate pollution possibilities but at the same time not to impede the movement of goods. The significance of that point has increased during the last decades when the nature of trade has become more international. Nowadays cargo moves through many countries crossing several borders and use different modes of transport. As the carriage of goods by sea and by land is different then each transport mode needs special regulations. The fact that freight container rolls and pitches 60,000 times during the crossing of the Atlantic shows that big stresses affect the cargo on board. Though, in maritime transport special factors like wind and sea forces, temperature changes and no shore assistance in case of emergency must be taken into consideration to ensure safety.

Today there is a situation where different states accept different standards. From the transport company's point of view it is a complicated situation. It can cause confusion or misunderstandings and finally lead to dangerous situation.

To show the complexity of international transport from Europe to Asia following example from Ms Haldis Fearn- a Director of Hazardous Material in APL is used.

A chemical cargo classified as 3.1 under IMDG Code is shipped from Hamburg to Hong Kong. As there is no direct trip to Hong Kong the cargo is reloaded in Singapore but before that the vessel makes a stop in Jedallah (Saudi Arabia). The shipper knows that the goods must be packaged according to the IMDG Code. To his surprise it is told that to move the cargo from the depot to the Hamburg port by land transport, extra ADR or RID rules (depends on the transport modules selected) must be followed. Even the IMDG Code and ADR/RID harmonise more or



less, there are still in case of some substances differences. In the worst case it means that the cargo must be packed according to ADR/RID first and later in the port repacked according to the IMDG Code. The next surprise comes in Jedallah, Saudi Arabia. Even the State recognises the IMDG Code, their local regulations must be followed. One Saudi Arabian rule is that dangerous substances moving to the country should be clarified with the port prior to arriving. There is possibility that local authorities demand additional safety measures (package, labelling, segregation). Similar situations repeat exactly in Singapore and in the final destination, Hong Kong, where permission to unload the cargo must be given by local authorities. And again, Hong- Kong land transport safety rules should be followed to move the cargo from the port to the consignee.

To minimise this kind of complexity of trading as much as possible, but at the same time increase the safety of transportation, all countries must work towards the harmonisation of their legislation. Today this is possible through the implementation of international regulations. International Conventions and Codes are like guidelines, which equalise different countries' legislation. At the same time, from the transport company's point of view, they make cargo movement easier because no need to repack or label in border of different states.

In the maritime transportation a harmonisation is achieved through the IMDG Code. In Europe the ADR/RID regulates land transport. The next aim must be harmonisation between land and sea transport modes.

## **6.2 History of legislation**

Legislation has regulated the transport of dangerous substances since the beginning of the development of industry. The first piece of legislation of dangerous goods in the world were the British Merchant Shipping Act of 1894. It covered substances as gunpowder, aqua fortis, naphta, nitroglycerine and lucifer matches (James, ). The act was more related to the preservation of ships and lives onboard than the protection of the environment. Many years later, a British Standing Advisory Committee was formed to advise the President of the Board of Trade on the carriage of dangerous goods. The report the committee published in 1933 came to

be known as UK Blue Book. It was a publication which contained several hundreds of chemical substances and instructions on how to handle them.

In the USA the first regulation “Explosives and Combustible Act “was drawn up in 1908 (Corkhill, 1991). The rule was addressed to explosives and highly flammable liquids. Later new classes were added.

The destiny of two countries’ legislative acts have been different. In the UK the Blue Book was unvalued in 1990 (Rawson, 1994). USA’s regulations are still based on their local standards.

The first international regulation attempting to govern the carriage of dangerous cargoes were SOLAS 1914 (Henry, 1985). The Convention prohibited the carriage of goods which of their nature, quantity or mode of stowage endangered lives of the passenger and the safety of ship. This Convention was never entered into force. A second attempt to revive the earlier regulation was SOLAS 1929. In the convention life saving appliances and dangerous goods were put under the same rubric (Henry, 1985). Both SOLAS 1914 and SOLAS 1929 left to each administration to determine which goods were dangerous and what were precaution measures (Henry, 1985). The Convention entered into force in 1933. In the 1940-s the traffic of dangerous substances by sea increased significantly to satisfy the post-war industry’s needs. Ships started to face problems they never had before. The new SOLAS 1948 represented already new way of thinking. The convention included a chapter covering dangerous goods which said that dangerous substances should be identified on the basis of their characteristics. The Convention also recognized the need for international uniformity in safety precautions and recommended that labels must be developed to indicating the kind of danger presented by each class of goods (Henry, 1985).

### **6.3 Different international organisations and their legislation**

There are many organisations in the industry which deal with dangerous goods. The UN, IMO, ILO, CMI, and UNCTAD are the international organisations which have dealt with the regulation of world shipping, establishing international conventions for half a century. In addition to international regulations, the number

and the importance of regulations based on regional agreements or unilateral implementation has increased significantly in recent years. The European Union is playing a bigger role than ever in that field. The legislation of the Community of the most powerful European states affects more countries than belonging to that region. Refusing to follow EU rules means that this huge market is closed to outsiders. Similar situation is in the USA, where very strict pollution control measures have been established and ship does not follow them are not allowed to enter the country's territorial water. In addition, Australia has implemented unilaterally regulations of restriction of ballast water discharge and Baltic Sea coastal states have their own rules for transporting trailers loaded with dangerous goods on board of ro-ro ships. This kind of situation is caused because of IMO's slowness in environment protection areas which makes some developed states unsatisfied. The previous statement is proved by the following quotation found from the EU directive 94/63 concerning volatile organic compound emissions:

*“ Standards must be drawn up at IMO level for vapour control and recovery systems to apply to both loading installations and ships. Whereas the MARPOL Convention is not so revised, the Community, after discussion with its major trading partners, should propose appropriate measures to apply to ships and port installations servicing ships.*

Unilateral and regional measures have caused stresses between the IMO on one side and the EU or the United States on the other side. The IMO supporters' point of view is that the US and the EU decisions basis on political decisions which are the result of the pressure of pollution affected areas (Farthing & Brownrigg, 1997). The contra argument heard at the IMO MEPC meeting after the “Erika “ accident, said by the representative of the European Commission was that nobody has right to stop the EU as an independent institution to protect its environment.

It is impossible to say that regional regulations are good or bad. It depends on the way they are drafted and how they affect the maritime industry. Generally, when regulations have been established there is a need for them. The author's point of view is that economically developed large countries such as the USA and the European Union can establish local measures without any negative impact to their economy.

They are big markets and shipowners cannot ignore them. For instance, unlimited liability introduced in the Oil Pollution Act of 1990 in the USA, has not caused the boycott of the US ports by tanker owners even that kind of speculations were expressed. Moreover, after some time, similar rules are proved by IMO (tanker double hull is an example) and made mandatory all over the world.

This dissertation concentrates mainly on conventions, codes and directives established by United Nations and its specialised agency the International Maritime Organisation, also the European Union and Helsinki Commission. In addition, the Baltic MOU of ro-ro transport of dangerous goods is under view.

### 6.3.1 United Nations and its legislation

The United Nations has a leading role in international regulation for the transport of chemicals. The organisation has published several legislative acts. In 1956, “ Recommendations for the Transportation of Dangerous Goods”, which is known as the “Orange book” were published by the Committee of experts of the Economic and Social Council. The ultimate aim of the publication was to unify world- wide all modes of transport. The ”Orange Book” covers classification and numeration of dangerous chemicals, also packaging and labelling requirements to transport hazardous substances. The “Orange book” is addressed primarily to international regulatory authorities in order to promote harmonisation of regulations of different transport modes. The book is renewed every two years.

Today the “Orange book” is the basis of the most countries’ legislation related to dangerous goods. An exceptions are the United States which legislation basis the local standards grown up from the 1908 year “Explosive and Combustible Act” and in some way the European Union.

A second Convention adopted by the UN in the Conference on the Carriage of Goods by Sea in 1978 was the Hamburg Rules. The Convention deals with private law matters and its provisions are commercial. Article 13 still concerns dangerous goods as it orders the shipper to mark or label these packages. The weakness of the Convention is that the Hamburg Rules do not define dangerous goods (Henry, 1985).

A third UN legislative act was the Convention on International Multimodal Transport of Goods. It also makes reference to the carriage of dangerous cargo. Article 23 is exactly the same as in the Hamburg Rules' article 13, only instead of the term "shipper" "consignee" is used.

### 6.3.2 IMO, strengths and weaknesses

A UN specialised agency International Maritime Organization is a main legislative body which deals mainly with maritime matters on the international level. 157 member states are represented in the organisation. The legislation worked out by the IMO is extremely relevant and fairly good. This has achieved by two reasons:

- 1.Regulations have been worked out by the experts of the field. Politicians' role and influence on the working groups are not significant.
2. Every member states' opinion and suggestion has been taken into consideration during the regulation drafting process.

At the same time, from the environmental protection point of view, it seems to the author that the organisation is one step back from real needs. This is caused because of the complexity of the IMO procedures to update the legislation. Usually it takes so long time and when it is finally done the world already needs something else.

From the author's point of view the following list includes the main weaknesses of the IMO. These are following:

- "Highest practicable standards"

Different member states have different political and economical interests. IMO's wish that its legislation must satisfy everybody has caused a situation where the pollution prevention legislation basis on not very high standards. Generally taking into consideration everybody's opinion is acceptable but not in case of environment protection. "Highest practicable standards" is an attitude which shows the old manner of thought and is in contradiction with manners of thinking where the environment is not a negotiable topic.

- Complicated requirements of adoption of legislation

IMO treaties enter into force after a specific number of member states who own the majority of world tonnage (usually 50%) have ratified them. For

instance, when main flag states like Liberia and Panama, who own 17% and 13% of the world fleet decide to boycott some convention then there is a real possibility that it never enter into force (The Torremolinos International Convention for the Safety of Fishing Vessels) or the ratification period takes years. The best example is MARPOL Convention. The treaty was adopted already in 1973. It required ratification by 15 States with a combined fleet of 50 % of the world's gross tonnage. By 1976 only three States with less than 1% of the world tonnage had ratified MARPOL. Only in 1983 the first annex from fifth of this really important convention entered into force.

- Most of the treaties related to dangerous cargo transport and handling are codes or recommendations which roles are to be only a guidelines for governments.
- Although IMO Conventions do not cover vessels in the cabotage trade.

### 6.3.3 The European Union, its strengths and weaknesses

The European Union is a community of 15 of the most developed European countries. The European Commission, seated in Brussels, is the policy- making body. It formulates the proposals for legislation and monitors the implementation of regulations in the member states. The commission consists of 23 directorates covering different areas like transport, environment etc.

European Commission laws can take three following forms:

**Regulations** are the most stringent type of legislative measures. They enter into force with immediate effect and require compliance with the overall objectives and describe procedures on how the objectives should be achieved. (Examples of regulations are the ruling of cabotage and the elimination of boarder control).

**Directives** have a binding effect with respect to objectives. The procedures to achieve the result depends on individual member states. Directives usually include

deadlines by which they must be implemented. All regulations dealing with dangerous cargo are directives.

**A decisions'** aim is to impose requirements of an individual nature, usually they may be issued against a specific company.

The European Commission is political body, it means that their decisions are also political. This fact sometimes makes following their rules quite complicated.

The European Commission's intention is to see the end of substandard ships operating in Community waters. A big concern of safety and environmental protection matters have efforted the European Union to establish their own extra legislation. The biggest difference between the IMO and the European Union's regulations is obligation. The strength of the EU law is that, when IMO regulations are not mandatory to member states, then the European Commission does not allow this kind of attitude at all. Everything decided in Brussels is binding in every member state. The second advantage is that the EU legislation establishes high standards. The EU policy is that environment protection is not a negotiable topic. As the European Commission is a political body, its decisions are affected by political pressure resulting that sometimes technical aspects are not taken into consideration. Almost every directive concerning dangerous substances includes some weaknesses. One reason is that the number of experts whose opinion is taken into consideration during the drafting of regulation is not so big as in the IMO. This can cause a situation where some significant aspects can be forgotten and not added to the regulations.

#### 6.3.4 Helsinki Commission

The wish to protect the unique marine life of the Baltic Sea and growing awareness that national measures alone are not sufficient to protect the environment nine coastal states Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden adopted the Helsinki Convention. The first Convention was signed in 1974 and second version in 1992. These Acts cover all sources of pollution

both from land and from ships. A Helsinki Commission- Baltic Marine Environment Protection Commission- known as HELCOM is the governing body of the Convention. It meets usually annually, but from time to time meetings are held at ministerial level. Decisions taken by the Commission are regarded as Recommendations and must be incorporated into national legislation of the member states (source). Some Recommendations are related to transport of dangerous cargoes. The HELCOM has chosen a different way to regulate dangerous cargo transport with the aim to protect marine pollution. Instead of establishing new regulations, the organisation has taken some relevant acts from the IMO and the EU and obliges member states to implement them.

#### **6.4 IMO legislation, its weaknesses**

The IMO's work has been significant to change the maritime transportation of dangerous goods more safe. The organization has established SOLAS and MARPOL Conventions, BC and IMDG Codes, and also "Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas. In this paragraph only the IMDG Code is under the view as the code has fallen under some critics.

##### 6.4.1 IMDG Code

Resolution 65, adopted at the 1960 SOLAS Conference, recommended that Governments adopt a uniform code for the carriage of dangerous goods by sea which must supplement the SOLAS chapter VII. By 1965 IMO's Maritime Safety Committee's working group on the carriage of dangerous cargo prepared the document known as the **IMDG Code**. It covered such matters as packaging, stowage, and labelling. All information based on the UN's "Orange book". One of the main reasons for the development of the Code was the trend towards containerisation (Henry, 1985). The use of freight containers reduced the physical hazards. However, dangers related to careless or improper packing of TEU-s stayed. As the SOLAS, so the IMDG Code has undergone many changes, both in appearance and content to keep pace with chemical industry. The IMDG Code has been



successful through its existence. This is proved by the fact that few incidents have occurred with properly stowed cargo.

#### *Weaknesses of the IMDG Code*

Even if the IMDG Code has been successful it is not perfect. The publication's four volumes are not designed to be user friendly. The code also needs continuous renewing because of the development of new substances by the chemical industry. Existing IMDG Code design is not very comprehensible. Four books are very heavy and very uncomfortable to carry. The code also differs from the UN model regulations and other transport modes rules. However, amendment 30 will reformat the code radically. The code which will come into force on January 1, 2001, consists of two A4 bound volumes which makes it similar to the UN's "Orange book" and other transport modal codes. The new problem is that bound version will not be capable of being updated as previous one. Thus, users are forced to buy new books after every amendment. This makes the cost of the code very expensive.

The Code is amended 29 times already during its existence and the process continues. Incident on board of the vessel "Wealthy River" in 1995 confirms the need of renewing. The container, which contained thiourea dioxide overheated and combusted itself. The chemical emitted dense fumes of sulphurous gases. Four people on board became ill and one was hospitalised. The sad side of the incident was that the crew and freight forwarder who packed the container did not do anything wrong; all safety stowage and segregation rules were followed. The only thing was that the thiourea dioxide was considered as non-hazardous and was not regulated by IMDG Code (Compton,1996).

The second issue is, whether the IMDG Code must be mandatory or not. Of course, after being familiar with the facts about the incident on board of the vessel "Asian Freighter" every reader feels anger and wishes that the IMO will take proper steps to avoid this kind of accident in the future. The incident itself was the following. On a voyage across the North Atlantic, four seafarers were sent to the holds to check the lashing. In one of the holds they were all overcome by fumes of arsine gas to such a degree that they had to be sent immediately to the hospital. The fumes came from a container which was not labelled and the arsine gas cylinders

inside it were not declared. The ship, therefore, did not know that they were there. The punch line of the story is that no one of these affected men died. The accident happened in 1974 but in 1992 two of them were still on life support machines (Compton, 1999).

The main advantage of a mandatory IMDG Code is that when rules are compulsory, companies have to follow them and the vast majority of enterprise does. The risk of accidents decreases. In case of the code will stay on recommendations level there is always a chance that companies will not follow suggestions. IMO has planned to make the IMDG Code mandatory and the suggested date will be 1<sup>st</sup> of January 2002 (Compton, 1999). There will be similar question in many readers' heads of why the IMO did not make the Code already mandatory when it was adopted? The basic reason in 1965 was that the Code was not intended to remain static as new substances were increasingly carried by the sea (Henry, 1985). The status of the Code gives possibility to make changes quickly and easily without asking agreement with parties. Supporters of the not mandatory IMDG Code say that when the Code will be transformed into a Convention or by making it a part of some other treaty (like SOLAS and ISM Code) then the process of making amendments gets longer but the IMDG Code needs very operate changes. This is not exactly true. IMDG Code amendments are not so operative at all. Usually it is amended every two years. Proposals go through the DSC Committee which meets once per year and the Maritime Safety Committee (after that it takes up to a year to prepare them for publication). In addition, the transitional period is 6 months before they enter into force. In case the IMDG Code is a Convention, the "tacit acceptance" procedure is sufficiently quick (6 months) to make amendments to the Code at the same speed as they have done now.

The real problem is that the IMDG Code is divided into two parts. The ship side regulates vessels and their operations, shore side port work and packing technology. At the same time the IMO is set up to regulate only the sea- side. It means that the organisation is not able to make the shore side part obligatory and cargo originators who are situated on shore are excluded. The result is that containers

and trailers on board can be properly stored but what is inside it depends on the freight forwarder's conscience. Though the danger of accident remains.

A solution is when IMO cannot legally change the IMDG Code mandatory, some other alternative organisation must be found. The UN specialised agency International Labour Organisation (ILO) is a theoretical possibility. One possibility is that the IMDG Code should be added into the ILO convention 152 dealing with the health and safety of dockworkers. Unfortunately, in practice, ILO does not have the same status and effect as IMO. This is proved by the fact that only 18 states have ratified ILO 152 Convention during 20 year (Compton, 1999).

There is also another side of the coin. A mandatory IMDG Code causes a big mess in the tank and packing industry. When the IMDG Code bases on the UN "Orange book" then the USA and some EU legislative acts are related to local standards, which are quite different from the UN's (numeration, constructional requirements for tanks, containers). Compulsory IMDG Code changes in cargo packing and transport impossible in these countries. The only solution is that these countries must harmonise their legislation to UN standards. This is a very long term process. The EU is working towards it, changing differences between the IMDG Code and the ADR/RID. The USA, even if they are interested in it, it is quite impossible because of the opposition of local shippers.

In conclusion, it seems that it is not possible to make the all IMDG Code compulsory at the international level using the IMO machinery. But there is also more bright side. Approximately 47 States owning more than 86 % of world fleet have declared to the IMO that the IMDG Code is part of their national law. It obliges countries which have not implemented the IMDG Code to follow the regulations; otherwise, their ships are detained in these 47 states' ports.

## **6.5 European Union's legislation**

The European Commission has established since the beginning of its existence six directives related to dangerous cargo. All of them have been criticised. In this paragraph they are looked at more closely.

## **Council Directive 93/75**

### **“Minimum requirements for vessels bound for or leaving Community ports and carrying dangerous or polluting goods.”**

The legislative act covers vessels bound for or leaving a Community port carrying dangerous or polluting goods onboard. The directive requires the ship operators to give a full list of cargo either to the competent authority of the Community port of departure or the first port of arrival if coming from a port outside the European Union. In case of accident the authorities of the affected area must find out the ship's departure port and contact the competent authorities who own relevant data related to the cargo.

#### *Weaknesses of the directive:*

The main weaknesses of the directive are high implementation cost and the content of irrelevant paragraphs. Maritime administrations and port authorities wish to implement to the Hazmat directive means that they have to develop computer systems, which connect all ports inside the state and is linked to other countries' similar systems.

The directive also includes unimportant articles which are not related to transport of dangerous goods. For instance, article 8 states:

*The master of the vessel shall complete truly and accurately a check list as reproduced in annex II to this directive and make it available to the pilot for his information and competent authority, if it so requests.*

The check list is a three page long document, including questions about the vessel, technical equipment and certificates of the crew.

The second paragraph of the same article says:

*Pilots engaged in berthing, unberthing, or manoeuvring vessel shall immediately inform competent authority whenever they learn there are deficiencies which may prejudice the safe navigation of the vessel.*

From the author's point of view the article is irrelevant for the following reasons:

1. It is not related to the transportation of dangerous goods.
2. Safety suffers as the master cannot concentrate on navigation but has to write papers. A similar thing is with the pilot. Instead of doing his work he must

control the check list and his main work, to navigate ship safely to the port, suffer.

3. Control of certificates and ship's technical condition is port state control's job, not pilots'.

### **Council Directive 94/63**

#### **“Control of volatile organic compound (VOC) emissions resulting from the storage of petrol and its distribution from terminals to service stations.”**

The directive demands member states to establish extra safety requirements for storage installations at terminals to reduce emissions of environmentally harmful hydrocarbon vapours. The provisions of the law are designed to reduce the total annual loss of petroleum resulting from loading and storage of installed tanks below the target reference value of 0.01 weight by weight % of the annual throughput. The loss of petrol during the loading and unloading mobile containers at terminal must be below the value of 0.005 weight by weight % of the annual throughput.

#### *Strength and weakness of vapour recovery systems*

From the environmental protection and safety point of view the requirements in the directive are very useful as they decrease the air pollution and danger of explosion. Floating roof with primary seal around it reduces evaporation to 1 tonne per 10,000 tonne and vapour recovery unit 1 ton per 20,000 tonnes. From the operational point of view terminal operators do not get any benefit. Despite the claims of equipment manufacturers there is no profit in vapour recovery. This idea was also presented by Mr Nils Bergander from the Port of Gothenburg and Ms Kai Ingman from Neste Engineering (HCB, February 1996). The reason is that vapour recovery systems require heavy investments and only some terminals which handle high value products in huge quantities may realise more attractive economics for vapour recovery (Warshaw, 1995). To build up a recovery systems additional pipelines, pumps and other protection devices will be needed. The other problem is land area. Based on Mr B. Warshaw's (1995) calculations, a total land area for recovery systems would be 275m<sup>2</sup> for a single berth. Although one type of recovery equipment cannot keep control over emissions from all VOC-s. Different chemicals

need different technology. There is a danger when European Commission will establish similar requirements for crude oil and other chemicals as petrol lots of terminals lose flexibility and are forced to handle only one type of cargo (Hartless, 1996).

### **Council Directive 96/35**

**“The appointment and vocational qualification of safety advisers for the transport of dangerous goods by road, rail and inland water.”**

The directive requires member states to introduce regulations mandating the training and employment of safety advisers by all those involved in the transport of dangerous goods. Even the title does not mention maritime transport the port sector is included as the meeting point of land and sea transport.

#### *Weaknesses of the directive:*

It is self-evident that companies involved in the handling of dangerous goods should have somebody on the payroll who is familiar with existing rules. Despite that the directive has found negative impact from the industry. The main reason is that the act is based on a decision to increase safety and protect the environment but, technical and logical aspects on how to achieve it have not taken into consideration. The document establishes very strict requirements to transport companies, but at the same time does not cover storing terminals at all.

The article 1 states that, *since 31 December 1999, any transport company engaged in the transport of dangerous goods must hire a safety advisor.*

In some cases transport companies are not engaged in the loading and discharging process at all, as they move packed cargo only from one point to another. In this case there is no need to hire a safety advisor. The same article says *that companies dealing with loading and unloading must appoint a safety advisor.*

The clause is very general and changes situation ridiculous. According to the law a chemist's shop which sells aerosols must also hire a safety advisor when the shop assistant helps to unload the cargo from the delivery van.

When the directive covers all possible and impossible transporting and loading cases, it does not mention storing companies, which can be the main sources of danger, at all.

The second unclear part of the directive is related to the examination and certification of safety advisers (article 5 and annex II of the directive). The document demands *that the examination must include all kind of modes of transportation, different types of cargo and classes of chemicals*. This is too much. The safety advisor of a bulk terminal does not need packaging skills and the safety advisor of a company which deals with one or two types of chemical substances does not need to know anything about all different classes of chemicals.

The only ones who can benefit from the directive are training organisations. It is estimated that only in UK there are already 12,000 persons who need safety advisor training. The fact that the safety advisor must renew his certificate after every five year, taking a refresh course (article 6) only proves that fact. It seems that the European Commission has given a training organisations wonderful possibility not to worry about their future.

#### **Council Directive 96/82**

**“The control of major accident hazards involving dangerous substances.”  
(Seveso II)**

The directive was established as a result of Flixborough and Seveso accident. The act was renewed in 1996 after the fire in a warehouse in Basel, Switzerland. The directive specifies certain substances and minimum quantities of any of these chemicals stored in plants (lower and top tier). Minimum amounts vary from two tonnes to up to thousands of tonnes.

Examples of substances covered by the directive and the two tier levels are the following:

- |  |                   |
|--|-------------------|
| 1. Automotive petrol and other petroleum spirits:      | 5000/50000 tonnes |
| 2. Ammonium nitrate (contains nitrogen more than 28%): | 350/2500 tonnes   |
| 3. Phosphorus trihydride (phosphine)                   | 0.2/1 tonnes      |
| 4. Arsenic trihydride (arsine)                         | 0.2/1 tonnes      |

On the basis of the amount of substances the directive divides enterprises into categories where different safety measures are required. In the lower tier the operator must take specific measures as prepare major accident prevention policy to prevent

major accidents. The policy includes organisational structure, responsibilities and procedures for implementing safety management system.

In the top tier, the operator must submit the safety report before the construction work of the terminal or plant starts.

#### *Weaknesses of the directive*

The directive distinguishes long term and intermediate temporary storage. According to article 4 the intermediate storage is excluded. The actual words used to describe the exclusion are following:

*The transport of dangerous substances and intermediate temporary storage by road, rail, internal waterways, sea or air, outside the establishments covered by this Directive, including loading and unloading and transport to and from another means of transport at docks, wharves or marshalling yards;*

Long term storage in the port area is covered when amounts trigger lower or higher tier quantities.

It is difficult to understand the difference between intermediate and long time storage and the need to divide it. The European Commission also realised this problem and carried out an investigation to find out what kind of legal provisions exist concerning the safe transport and temporary storage in a port. They found that only existing rule was the IMO's "Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas". The Commission decided that this was enough and there was no need to change the directive (Compton, 1999). From the author's point of view, distinguishing these two definitions is wrong because of two reasons.

Firstly, five of ten largest accidental man-made explosions happened in ports (Compton, 1999). From the point of safety a substance is also dangerous if it is stored in an area for a short time.

Secondly, IMO's "Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas" are only guidelines and implemented into local legislation by small number of IMO member states.



The following two directives must be looked together as from the maritime safety point of view they have similar weaknesses.

**Council Directive 94/55**

**“Approximation of the laws of the member states with regard to the transport of dangerous goods by road.”**

Obligates member states to implement the rules of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) established by the UN Agency Economic Commission in order to harmonise traffic inside the community.

**Council Directive 96/49**

**“Approximation of the laws of the member states with regard to the transport of dangerous goods by rail.”**

The directive lays down uniform safety rules for the transport of dangerous goods basis on Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID) established by the Intergovernmental Organisation for International Carriage by Rail (OTIF).

*The weakness: lack of harmonisation between the IMDG Code and the ADR/RID.*

The biggest weakness of the ADR/RID agreements from the maritime industry’s point of view, is the lack of smooth transition from land transport to maritime transport. Today, when multimodal transport plays a significant role in cargo movement, it can be a crucial factor.

The differences start from the point that the ADR/RID technical requirements for trucks, wagons, tanks and packages are designed for stresses experienced in land transport which are absolutely different from stresses encountered at sea. The IMDG Code section 17 of General Introduction divides portable tanks and tank containers into different classes according to the types of goods they contain. IMO types 1, 2 and 5 are permitted to transport on board the vessel. Type 4, which is approved to transport of dangerous goods by the ADR regulations and used widely in land transport, is prohibited to loaded on ro-ro vessels, or when loaded, then transported only on short voyages.

Because of the different construction requirements of the tanks certain substances are not permitted to be carried on ro-ro vessels. IMO type 1 and 2 portable tanks apply to liquids and type 5 is for the carriage of non-refrigerated pressure liquefiable gases. According to that powdery substances, deeply refrigerated gases or gases liquefied under pressure cannot be transported on ro-ro vessels. (Busch, 1986). Although, the ADR/RID requirements for marking and labelling cargo units are different. According to the ADR/RID no need to put placards on every side of the transport unit, the IMDG Code still demands that. Finally, the ADR/RID do not require that small quantities of dangerous substances inside the trailer or container must be declared and marked. In contrast, at sea any exceptions are not available.

#### **6.6 Helsinki Commission's regulations**

Member states of the Helsinki Commission have established large number of Recommendations, five of which are related to the transport of dangerous cargo. As most of them recommend to adopt and implement the IMO and EU legislation, then the author does not concentrate on their analyse. List of recommendations can be found in annex 7.

#### **6.7 Memorandum of Understanding for the Transportation of Dangerous Goods in the Baltic Sea**

Ro-ro ferries have found an important role in the cargo transport chain. The Baltic Sea states regard ferry transport as being a continuation of road and rail journey. Unfortunately, different requirements for land transport (ADR/RID) and for sea transport (IMDG Code) described in the previous paragraph, makes transition from one mode of transport to another difficult.

For that reason the Baltic Sea States of Denmark, Estonia, Finland, Germany, Poland and Sweden have signed the "Memorandum of Understanding for the Transportation of Dangerous Goods in the Baltic Sea" which establishes rules on how to move road tank vehicles, wagons and containers designed to land transport by sea. The

memorandum divides voyages on the Baltic into short and long. According to the section 6 of the agreement short voyages are:

*“trade between ports south of a line Scaw-Lysekil and within sheltered area of the western part of the Baltic west of the longitude 15°E, or east of longitude 15°E on those routes agreed by competent authorities”.*

In long voyages freight containers, swap bodies, vehicles and railway wagons must be classified, packed, labelled, documented, towed and segregated either in accordance with the IMDG Code or labelled according to the ADR/RID but classified, packed, documented, towed and segregated according to the IMDG Code (section 5). In short voyages, small amounts of dangerous goods inside packages or large amounts in tanks can be classified, labelled, packed, and mixed according to ADR/RID regulations. Actually this means that without any preparations in the port, vehicles may be loaded directly onto ro-ro ships. This rule gives transport companies a good possibility to save money from extra labelling and packing. There is no need to mark all four sides of the trailer and fill out extra documents. Though, the MOU gives the possibility to avoid complexity which is caused of the lack of harmonization between international maritime and land transport agreements.

## CHAPTER 7

### TRANSPORTATION OF DANGEROUS GOODS IN ESTONIA

Through Estonian ports a significant amount of liquid dangerous goods is transhipped which careless handling can cause disasters with severe consequences. The wish to avoid danger to the local population and the environment has forced the Government of Estonia to ratify international agreements and establish local regulations covering transport and storing of harmful substances. The chapter describes what Estonia has done to change the handling of chemicals more safe and how successful its efforts have been. The author gives an overview of main organisations dealing with transport of hazardous materials, analyses the weaknesses of existing legislative acts and describes how these regulations work in reality. Finally, the main aim which should be achieved in the near future is added to the chapter.

#### **7.1 Accidents with dangerous goods in Estonia**

Accidents with dangerous goods have also happened in Estonia. During the year 1999 there were two incidents related to the transport and storage of dangerous cargo in Estonia. Both of them were caused because of the violation of safety rules. In May, 19 a fire was discovered on the car deck of the Viking Line's passenger ferry "Cinderella" sailing from Tallinn to Helsinki. 5.5 tonnes of charcoal (UN no. 1361, class 4.2) and 50 kg of matches (class 4.1) loaded on to the Estonian trailer burned. It took the crew an hour to get the fire under control. The incident was caused because

the freight forwarder company violated the following IMDG Code rules:

1. The charcoal and matches were not declared as dangerous cargo
2. The trailer was not labelled according to the IMDG Code rules
3. Segregation rules were not followed as matches and charcoal were stored closer to each other than 3 metres inside the trailer.

The fire on board of the “Cinderella” was not the first incident with charcoal. Two other similar cargoes had burned down in the Paldiski harbour waiting loading into the ro-ro vessel.

The second accident happened in September, when a large amount of cacao ignited in a storehouse in Paljassaare harbour belonging to the organisation “Port of Tallinn”. The fire extinguishing operation took several days. Cacao is not directly mentioned in the IMDG Code but it goes under the definition of seedcake, containing more than 10% of oil (UN no 1386, class 4.2). For that class special precaution measures like good ventilation and control of air temperature must be taken into account. In this case these safety rules were violated.

Violations of safety regulations are quite common in Estonia. If to add contradictions inside Estonian national law, the lack of knowledge and the negligence of people working in that field it is possible to predict similar accidents also continue in the future.

## **7.2 Estonia and international organisations and agreements**

First steps Estonia did to make the transportation and handling of dangerous goods safer in the state’s territory, was the participation in different international organisations’ work and ratification of their conventions and agreements.

Firstly, since 1991 when Estonia got the official status of the International Maritime Organization’s member state, the country has ratified all organization’s regulations related to the transport and storing of dangerous goods. Secondly, as a member of the Helsinki Convention, Estonian has converted the organization’s recommendations to its national law. Thirdly, as Estonian official policy is to achieve a status of Member State of the European Union as soon as possible, a great emphasise is put on the implementation of European Commission directives.

In addition to these organizations, Estonia is also a member of “The memorandum of Understanding for the Transportation of Dangerous Goods in the Baltic Sea”, which gives the right to transport railway wagons, road trailers and trucks on Helsinki-Tallinn route using the ADR/RID regulations instead of the IMDG Code. In addition, the mutual obligations between the terminal and the tanker, and the use of checklist printed in the ISGOTT publication have been made obligatory through the Estonian local port rules.

### **7.3 Legislative and controlling organisations in Estonia**

The Maritime Department of the Ministry of Transportation and Communication and the Hazardous Cargo Division of the Estonian Maritime Board are the main organisations which deal with legislating and controlling of handling of dangerous cargoes. Personal selection and lack of qualified specialists obstruct the effective work of these institutions.

The Maritime Department is the legislative body which objectives are developing of a merchant shipping policy, establishing regulations increasing maritime safety including transport of dangerous cargoes by all modes and the handling of hazardous substances in port areas. Implementation of these objectives demand special maritime knowledge, especially when the country’s official policy is a creation of a business friendly environment. Legislation drafters must be very careful not to decrease the safety part for the benefit of business activity. Unfortunately, there is not any seafaring background person left in the Ministry and only one clerk has a maritime education as a WMU Master’s Degree. This is the result of a new trend in the government’s politics where middle- aged persons with maritime background and experience have replaced with young generation of general legal or economical knowledge. From the author’s point of view shipping and maritime economics are areas where are very difficult to manage without specific experience and knowledge. Otherwise, it will lead soon or later to a decrease in the quality of decisions and legislative acts.

The main task of the Hazardous Cargo Division in the Maritime Administration is to keep control over the implementation of regulations concerning

the handling of dangerous cargo in ports and transport at sea. The task contains the following objectives:

- control over implementation of national legislation in ports
- control dangerous cargo securing on board of vessels
- inspection of ships, issue certificates
- information collection, keeping statistics database
- establishing regulations
- 

Although the list of tasks is long, only two officers are employed by the administration. Physically they are not able to carry out most of these duties. Another problem is related to education of officers. A chemical engineering background without any maritime knowledge or seafaring experience can not be sufficient to control cargo securing on board and inspection of ships. They do not have any knowledge about ship's construction and seafaring.

The only solution for how to improve the effectiveness of the Maritime Department and the Hazardous Cargo Division is to increase the number of employees with maritime backgrounds and seafaring experience. Their knowledge will help draft effective legislative acts and find out violations of regulations on vessels and in ports.

#### **7.4 Existing regulations concerning dangerous goods**

Three years ago the main way to escape from the liability was to emphasise the lack of regulations. In the year 2000 this excuse does not help any more because the area is covered with different acts. The list of regulations is included to annex 8.

#### **7.5 Non-conformity in Estonian regulations**

As the transport and handling of dangerous goods contain different aspects, specialists from four different ministries were used to draft legislation. Unfortunately this has caused the situation where the texts of two legislative acts contain contradictions.

On the bases of article 11 in the Chemical Act and paragraph 14 in the Port Act the Ministry of Transportation and Communication is obliged to establish requirements for the handling of dangerous goods in port areas. The regulation of the Ministry of Transportation and Communication bases on the IMO's recommendations and is titled "**The requirements for receipt, processing and storage of dangerous goods in ports**". At the same time the Ministry of Social Affairs worked out the legislative act "**The requirements for recording dangerous chemicals in enterprises liable to be affected by a major accident**", bases on chapter 10 of the Chemical Act. This document also covers ports because, according to the regulation of the Ministry of Internal Affairs, the "Port of Tallinn" and all port operator companies are defined as enterprises liable to be affected by major accidents. Therefore, two ministries have worked out recording requirements for the same enterprises.

The contradictions between these two legislative acts can be found in paragraphs dealing with recording harmful substances in port areas. Paragraph 3.3 of the "**Requirements for receipt, processing and storage of dangerous goods in ports**" states that:

*All dangerous goods must be recorded in the port territory. The record of the dangerous goods must include:*

- 1. Quantity*
- 2. Correct technical name*
- 3. UN number*
- 4. Location in the port*
- 5. Details of arrival and departure*

The Clerks from the Ministry of Social Affairs are not familiar with IMO documentation and do not know about existing national law. Their final draft is different and states following:

*The operator must keep the record of dangerous goods when they are stored more than 24 hours. The record must include following information:*



### *1. Quantity*

### *2. Correct technical name*

*3. EINECS (European Inventory of Existing Commercial Chemical Substance), ELINICS (European List of Notified Chemical Substance) or CAS (Chemical Abstract Service) number.*

Compare of these documents shows three differences. These are difference in time limitation for storage of dangerous cargo, obligation to record the location of dangerous cargo in the territory and use of different numeration of harmful substances.

### *Time limitation*

Because of the liner shipping schedule and the high cost of time, cargo moves to the port territory shortly before the ship's departure and leaves soon after the vessel's arrival. A 24- hour limitation separates ferry terminals out of list of enterprises, which must record chemicals' movements even when the amount is big. It does not mean that dangerous substances are less dangerous. Even short period can be enough to cause an accident. Exactly this happened in the Paldiski harbour where two trailers carrying charcoal burned down just waiting loading on board of ro-ro ship.

### *Location of cargo*

When the operator does not have an overview of where substances are stored in the territory, they can be stored too close to each other causing the violation of segregation rules. Furthermore, in case of fire or explosion, there is no possibility to define the burning substances as the packages can be damaged and the response team has no idea what kind of response or precaution measures they must take into account.

### *Numeration*

An UN number of chemical is established by the international organisation and is used world wide in transport business. The IMDG Code, the main tool in every port and ship, bases on UN numeration. Although all cargo manifests and safety documents related to harmful substances contains UN numbers. The idea to demand Estonian port operators to keep records of chemicals using different

numeration is pure bureaucracy which causes extra time losses. Moreover, use of different numerations' affects safety, when some documents use CAS, others EINECS and third ELINICS numerations, in the case of emergency it is very difficult to define possible hazards very quickly.

### Solution

From the author's point of view, the regulation established by the Ministry of Transport and Communication is more beneficial than the Ministry of Social Affairs' as it avoids bureaucracy of using different numeration, obliges to keep control over cargo stored in port territory and does not exclude any terminal.

With aim to stop non-conformity between two legislative acts following changes should be done in the regulation 6 of the Ministry of Social Affairs.

Firstly, cancel 24 hour limitation to storage.

Secondly, the use of the UN numeration must be compulsory, other numeration system can be used on voluntary bases.

Thirdly, dangerous substances storage location in the port area must be immediately recorded after arrival to the territory and deleted after leave the area.

Finally, the record list must be accessible 24 hours.

In addition to the contradiction, both legislative acts have other weakness. They do not regulate the form of the record document. According to the regulation of the Ministry of Internal Affairs, both the "Port of Tallinn" and every port operator company working on the territory of the "Port of Tallinn" must keep a record of dangerous substances stored in its territory. As the form of the document is not regulated, every operator company uses their own form. It makes the Port of Tallinn Authority's task to maintain a dangerous cargo database, bases on the information received from operators, very complicated and time consuming as they have to rewrite all collected information.

In annex 7 there are examples of three record lists by three port operators sent to the port authority. They all use different forms. For instance, one operator follows the standards of the Ministry of Transport and Communication, other standards of Ministry of Social Affairs and the third does not follow any standards at all.

## 7.6 Violation of the existing regulations

Violations of existing regulations are common in Estonian ports concerning both cargo transportation and storing. The main reason is that persons responsible for safety in port are not employed or do not do their work properly.

### 7.6.1 Violations of regulations related to transport of dangerous cargo to/from ports by sea and by land

#### 7.6.1.1 Containers

The paragraph 3.5.1 of the **requirements for receipt, processing and storage of dangerous goods in ports** states:

*“Placards must be taken off after discharging cargo units.”*

A short visit to the container terminal in the “Port of Muuga” showed that placards were not removed every time. The author saw two empty containers carrying placards. The terminal safety adviser’s comment was that these containers would be used to transport the same cargo and there was no need to remove old markings. The explanation has been accepted by the Maritime Administration.

From the author’s point of view this kind of situation must be avoided as it can cause accidents, confusion and waste of time.

- Firstly, if containers are labelled they must be stored on board according to the IMDG Code segregation rules. This makes cargo-storing operation more complicated as crew must draw up the cargo loading plan taking into consideration empty but marked containers.
- Secondly, in case of accident the response team observes labels on containers and acts on the bases of them. It means that they waste time and resources to protect labelled but empty containers.
- Thirdly, if some labelled containers contain dangerous goods and some not, then it is very easy to mix them up. There is a risk that loaded containers are handled without taking caution measures written in the IMDG Code into account. The result can be disaster.

### Solutions

The only way to avoid violations of labelling is to increase the control over containers in port terminals. Although, the extra training of workers can be done. In case violations continue operator company must be punished.

#### 7.6.1.2 Railway tanks

Transport of dangerous goods by rail is regulated by the Agreement on International Railway Trade. Despite the existing legislation violations still exist.

Incorrect labelling of railway tank wagons carrying oil products is the main violation. The problem is significant with wagons loaded on the Estonian side. Trains arriving from Russian oil refineries are marked properly. These wagons which are loaded with chemicals at Estonian port terminals do not carry often any labels. The interesting fact is that terminals are aware of violations. Moreover, the violation of labelling rule is intentional and done because of security reasons. Wagons are parked often in remote areas where it is very difficult to keep an eye on them. Wagons loaded with petrol are very valuable. Correctly marked tank wagons will rise the interests of criminals and increase the risk of theft.

The terminal employers' opinion was that labels did not increase safety significantly. According to them the alternative way was to keep all relevant documents related to every wagon and its cargo in the cabin of the locomotive. In case of any incident the response team can find them there. This attitude is wrong. Many accidents happen because of two trains' collision. In these cases railway-engines are completely damaged and it is impossible to find any documents inside them.

### Solution

The freight forwarders' threat to lose valuable cargo in Estonia is understandable as the risk of theft is high. It still does not give right to violate safety regulations and put human life and environment in danger. There are three ways to increase wagons' security.

1. Wagons' stop-cocks and hatches must be locked well. Unfortunately, there is a danger. Thieves are ready to use force to break any locking system. This can

cause a situation where, after opening, it is impossible to close stop-cocks. The result will be pollution of the environment or even disaster.

2. Wagons must be parked in protected areas surrounded with fence and secured by respected security company.
3. During establishing cargo movement's logistic plan long stops in theft sensitive areas must be avoided.

It is clear that all precaution measures cannot avoid theft attempts 100% and always it is not possible to follow these rules but generally the number of losses decrease.

#### 7.6.2 Violations related regulations related to advanced notices

Paragraph 2.6 of the "The requirements for receipt, processing and storage of dangerous goods in ports" says:

*Harbour Master's office must be notified of the arrival of dangerous goods both by land and sea at least 24 hours in advance.*

Paragraph 2.8 says

*Copies of advanced notices must be kept 10 year.*

In addition, Paragraph 2.9 states

*Harbour master must be informed about the time the cargo leaves the territory.*

This information is needed to give the port authorities overview of cargo transported through the port territory and to prepare safety measures in case of accidents. A survey done in March 1997 showed that advanced notice system did not work in some ports and the harbour master was not informed about the cargo in the port territory. Otherwise, how to explain the situation when harbour's transport control officer from the harbour master office had no idea about the containers containing dangerous goods laying on the quay and the stevedore company which handled them (Arro, 1999). In developed countries it causes a scandal when list of dangerous cargo on port areas is not accessible for one hour. In Estonia nobody cares even when the list does not exist at all. This information must be in the harbour master office, it is not enough when only the operator owns data. For instance, let's assume that as accident with a transport unit happens at night, response team need quickly

information but it is impossible to find the employee of the stevedore company who has relevant information about the cargo inside it.

Other possibility, the office of operator company where the data is kept is usually situated in the territory of the storing area. In case of fire or explosion the access to it is eliminated.

To avoid loss of time in case of accident the data must be duplicated and kept in different places. The harbour master's office is the best place as it works 24 hours annually and usually situated far from storing area.

#### *Storing cargo in the port territory*

The obligations related to the storage of dangerous goods in the port is regulated by two acts: "The requirements for receipt, processing and storage of dangerous goods in ports" and "Requirements for the recording of dangerous chemicals in enterprises liable to be affected by a major accident". The contradiction between them related to recording data was already in a previous chapter. In this part the right to access to the data is under the view.

The aim of collecting data is to find out the quantities of cargo stored and transported through the area. On the bases of the data possible dangers can be defined and contingency plans established. Analyse is done by governmental authorities. Therefore, representatives of the authority must have access to private companies' databases. The right is written in the paragraph 4.2.2 of "The requirements for receipt, processing and storage of dangerous goods in ports" which says following:

*Overview of movement of dangerous goods must be available in case of request of auditors or supervisor officers.*

"The requirements for the recording of dangerous chemicals in enterprises liable to be affected by a major accident" from the Ministry of Social Affairs demands even more. According to it:

*After the 1<sup>st</sup> February every year the annual summary of stored dangerous goods must be available to the supervision officer.*

Unfortunately these clauses do not work in any Estonian ports. The landlord port system which has proved to be successful in increasing ports' turn- round is an

obstructive factor of information exchange. Private companies do not give records of harmful substances to the port authorities even port regulations demand it. The following is a fragment from the port regulation:

*Operator companies must submit a quarterly report concerning the movement of dangerous goods through the port area to the Harbour Master by the 10<sup>th</sup> day of the following month of the quarter.*

A survey done in February 1999 by the Estonian Maritime Administration showed that in three ports out of four under the control of the “Port of Tallinn” the authorities did not have statistics of dangerous cargo movements. Thus, supervisor officers cannot get information even if they want it.

### 7.6.3 Violations related regulations concerning Safety adviser

According to Estonian regulations port companies must hire a person who is responsible for the handling of dangerous goods.

Chapter 4 paragraph 4.1.1 and 4.1.2 in the “The requirements for receipt, processing and storage of dangerous goods in ports” states:

*“port authorities and terminal operators must hire employee who is responsible of handling of dangerous cargoes.”*

His duties are defined in the paragraph 4.2

- organising transport and handling of dangerous cargoes in the port territory
- controlling documentation related to dangerous substances (advanced notices, record of substances).
- keeping record of dangerous goods stored in the territory of the port.

The importance of safety adviser increases as the number and amount of dangerous substances handled in ports increase year by year. Though, the companies cannot guarantee safe operations without hire somebody with specific skills and knowledge. Still it seems that port authorities do not take their obligations related to safety and environmental protection very seriously yet. They officially have a person in every port office who should deal with these matters. Unfortunately, according to the survey done in February 1999 by the Maritime Administration very often the responsible persons have not adequate knowledge about existing regulations and do

not know what is going on in the port territory. Though, they are not able to implement their duties. It seems that persons hired to that jobs are useless to the port authority. Instead of get rid of them the jobs related to safety is offered to them with the aim to let them nicely spend time until the official retirement. In private terminals, the person who is responsible for dangerous goods has many other tasks. Safety is just one which is very often marked only on paper.

### Solution

To make responsible person work more effective, the Maritime Administration must take the following steps and change the regulations:

- The responsible person must deal with duties directly related to dangerous goods.
- The responsible person qualification and compulsory training courses must be clearly defined.
- The responsible person must be examined from time to time by the Maritime Administration.

As all these requirements are defined already in the EC Directive 96/35 (safety adviser), probably the situation will change when the directive 96/35 is implemented in Estonia.

### **7.7 Main targets**

As Estonia wants to join the European Union it must implement all existing directives. Unfortunately the existing situation concerning recording hazardous cargo movement makes implementation of the EC Directive 93/75 (Hazmat) impossible. The first step the state must do is to establish computer based network which connects all ports and the maritime administration. The idea is that all ships arriving at the country's port give relevant information concerning cargo (correct technical name, UN number, IMO hazard class, the quantity, location on board) to the harbour master office. The port is also obliged to keep data about the cargo stored in the territory. Usually it is kept in a computer. The port database is directly linked to the Maritime Administration's server. They are informed at all times about any hazardous cargo passing ports. The system gives many advantages. Firstly, in the case of accident, response service officers can get information about the cargo on



board of the ship and their following steps depend on that. Secondly, hazardous cargo inspectors working for the Maritime Administration have a good overview of arriving ships and their cargo. They can plan their inspections when they know that some cargo is entering the port. This kind of systems already exist in many countries. For example, Finland has established their “Port@net” and it has proved to be very effective. A similar system works in Hamburg, Germany under the name “Dakosy”. The establishment of an effectively working net demands not only on technical development but also changes in existing legislation. The national law, in the case of Estonia must be “The requirements for receipt, processing and storage of dangerous goods in ports”, must oblige to record all dangerous cargoes in the maritime administration. In addition, the law must demand that all dangerous cargoes are electronically registered in ports.

## CHAPTER 8

### CONCLUSION

The term “dangerous cargo” includes hundreds of substances both solid, liquid and bulk forms. These chemicals can be very harmful to human health and the environment. The damaging effect of these substances vary considerably, mostly depends on their type, amount and toxic content. People whose work is related harmful cargo must be familiar with physical and chemical criteria of different substances. They must understand the danger which chemicals can cause when safety regulations are violated.

Keeping of safety of dangerous cargo needs cooperation between the transportation industry and governmental institutions. The first step is that responsible persons must get exact statistics of cargo moves through ports. After that possible dangers can be identified and contingency plan established. In this field Estonia has to do a big work as today responsible organisations have not accurate overview of dangerous cargo movement.

It is known fact that accidents with dangerous cargo never disappear as long the cargo is transported. There are still possibilities to decrease the risk of incidents. Implementing of environmental friendly management, encouraging use of modern technology and training of people are the key issues which help to change handling of dangerous goods significantly safe.

International organizations play an important role in regulating to transport and handling of harmful cargo. Even they have done good job, there is no reason to be satisfied. Firstly, the biggest problem is the lack of harmonisation of regulations of different modes of transportation. The importance of multimodal transport has

increased quicker than development of legislation. The UN, its specialized organizations, European Commission and the US responsible institutions must increase their efforts to harmonise different requirements. Otherwise, existing requirements start to obstruct world trade.

Secondly, the IMO should find a way to make IMDG Code obligatory. In addition, speed of updating the legislation must be increased and the environmental protection can not be a negotiable topic where “highest practicable standars” are permitted. The European Commission, opposite, is quick and effective. The environmental protection is not negotiable topic and rules are compulsory to everybody. The weakness of the EU legislation is that directives very often bases on political decisions which makes them sometimes too strict. It seems to the author that really good regulations will be established when the IMO and the European Commission study from each other and take over their strengths side.

Estonia is doing first steps towards safety of transportation and storing of dangerous cargo. As most of the legislation already exists then the state must dedicate its efforts to implementing and enforcement simultaneous work in all three fields guarantee that transport of dangerous goods is not so dangerous any more.

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## Annex 1

### Summary of chemicals transported in the Baltic Sea

TABLE 2 SUMMARY OF CHEMICALS SUBSTANCE	TRANSPORTED IN THE BALTIC SEA UN-NO CATEGORY	QUANTITY TONS
LISTING BY CATEGORY		
CATEGORY A	A	<b>198171</b>
coal tar	1999 A	153957
Creosote	1334 A	22797
alpha-methyl styrene	2303 A	9592
acetone cyanohydrme	1541 A	3590
Naphtalene	2304 A	2646
TML/TEI-	1649 A	1554
butyl toluene	266 A	1400
butyl benzyl phfialate	A	1299
vinyl toluene	2618 A	475
solvents, cat A	A	466
ethyl aaylate	191 A	200
dibutyl phtalate	A	195
CATEGORY B	B	<b>707024</b>
styrene monomer	2055 B	110472
ethylene dichloride	1184 B	92768
coal tar naphta solvent	2553 B	87313
phew	2312 B	78700
acrylonitrile	1093 B	69221
tall oil	B	69118
white spirit	1300 B	63831
buthylaldehyde	1129 B	33811
carbon tetrachloride	1846 B	19000
solvents, cat B	B	17614
chlorobenzene	1134 B	12953

SUMMARY OF CHEMICALS <i>SUBSTANCE</i>	TRANSPORTED IN THE BALTIC SEA		<i>QUANTITY</i> <i>TONS</i>
	<i>UN-NO</i>	<i>CATEGORY</i>	
<b>LISTING BY CATEGORY</b>			
isopropylbenzene	1918	B	12060
turpentine	1299	B	9534
trichloroethylene	1710	B	5774
lub oil additives		(B)	5347
nonene	1257	B	4700
trimethylbenzene	2325	B	3964
butyl acrylate	2348	B	2540
isodecyl alcohol		(B)	2440
trichloroethane	28318		1350
tetrachloroethane	1702	B	1036
crotonaldehyde	1143	B	1030
pinene	2368	B	898
propylene dichloride	12798		850
tetrachloroethylene	1897	(8)	700
<b>CATEGORY C</b>	—	C	<b>2226483</b>
pyrolysis gasoline		(C)	477376
sulphuric acid	1830	C	472164
xylene	130	C	409695
benzene/toluene/xylene mixtures		(C)	345243
benzene	1114	C	90130
nitric acid	2031	C	74510
ethyl hexanol		(C)	63782
Huosilicic acid	1778	(C)	43844
pyrolysis waste mixtures		(C)	39537
toluene	1294	C	37382
aniline	1574	C	31039
benzine, aromat	1115	(C)	22799
potassium hydroxide solution	1814	C	20282
vinyl acetate	1301	C	16019
tall oil fatty acid		C	10979
solvents, cat C		C	10801
hexane	1208	C	8425
butyl acetate	1123	C	8101
ethylbenzene	1175	C	7910
octanol	1986	C	7120
cyclohexane	1145	C	6573
toluene diisocyanate	2078	C	4180
dipentene	2052	C	3112
heptane	1206	C	2890
ethylenediamine	1604	C	2656
ammonia aqueous	2672	C	2485
2-ethoxyethyl acetate	1172	C	1666
1,3-pentadiene		C	1206
sodium borohydride		C	1198
formaldehyde	1198	C	1000
propylamine	1277	C	1000
nonyl alcohol		C	679
amyl acetate	1104	C	436
methylamyl alcohol	2053	C	264
<b>CATEGORY D</b>		D	<b>1696271</b>
sodium hydroxide solution	182A	D	703957
phosphoric acid	1805	D	4279
vegetable oils		D	172538
methyl tert-butyl ether	2398	D	98490
ethylene glycol		D	43743

SUMMARY OF CHEMICALS SUBSTANCE	TRANSPORTED IN THE BALTIC SEA	
	UN-NO CATEGORY	QUANTITY TONS
LISTING BY CATEGORY		
Latex	D	39413
Acetic acid	2789 D	32676
methyl ethyl ketone	1193 D	26540
Achloromeihane	1593 D	24223
formic acid	1779 D	20804
calcium chloride solution	(D)	18165
ethyl acetate	1173 D	17983
cyclohexanone	1915 D	10980
urea, ammonium nitrate solution	D	10100
fatty acids	D	9935
methyl pro pyl ketone	1249 D	7408
2-ethoxyemanol	1171 D	7235
fish oil	D	5822
sodium hydroxide solution, spent	D	3926
methyl methacrylate	1247 D	2260
propionic acid	1848 D	2189
diisodecyl phtalate	D	1704
ethyl propionate	1195 D	1651
pyridine	1282 D	1100
ethylene glycol acetate	D	931
diethyleneglycol iso-butyl ether	D	915
methyl iso6utyl ketone	1245 D	571
ethylene glycol methyl ether	1188 D	525
aminoethylethanolamine	D	510
2-ethylhexanoic acid	D	444
acetic anhydride	1715 D	397
amyl alcohol	1105 D	382
ethanolomine	2491 D	284
hexanol	2282 D	209
propylene glycol methyl ether	D	180
butylene glycol	D	104
<b>APPENDIX III SUBSTANCES</b>		<b>1045218</b>
methyl alcohol	1230 App III	747545
ethyl alcohol	1170 App III	96924
butyl alcohol	1120 App III	54695
acetone	1090 App III	54307
iso64 alcohol	1212 App III	27960
isopropyl alcohol	1219 App III	23188
glycerine	App III	16946
dioctyl phtalate	App III	14026
propylene glycol	App III	7259
paraffin wax	App III	875
vegetable protein solution	App III	750
diethylene glycol	App III	639
sthylene glycol butyl ether	2369 App III	104
<b>GASES</b>	<b>Gas</b>	<b>2845921</b>
ammonia	1005 Gas	1427274
propane	1978 gas.	703630
butane	1011 Gas	243232
propylene	1077 Gas	210329
vinyl chloride	1086 Gas	110071
butadiene	1010 Gas	90772
ethylene	1038 Gas	56883
LPG	1075 Gas	2570
eth chloride	1037	1160

## Annex 2

### Overview of packed dangerous cargo transported in the Baltic Sea

#### I TRANSPORTATION OF PACKAGED DANGEROUS GOODS, SUMMARY

Approximate values for one month, routes with more than 100 tons

Between ports	Per month Tons	Number	Major classes	Between ports	Per month Tons	Number	Major classes
North Sea and Aalborg	150	120	3,1	TravemOnde and Malm6	3300	600	3,8,6
North Sea and Copenhagen	150	20	8	TravemOnde and Rauma	160	40	8
North Sea and Gothenburg	13300	1100	8,5,3	TravemOnde and Trelleborg	3200	560	3,8,5
North Sea and Hanko	350	10	5,1	TravemOnde and Turku	100	50	3
North Sea and Helsingborg	600	50	8,3	Kiel/canal and Aalborg	100	S	4,8
North Sea and Helsinki	60	10	8	Kiel/canal and Gdansk/Gdy	16200	60	4,5,8
North Sea and Kiel	1000	120	3,8	Kiel/canal and GAVle	160	5	5
North Sea and Kotka	400	30	5,8	Kiel/canal and Halmstad	130	5	3
North Sea and Leningrad	3900	1	9	Kiel/canal and Hamina	450	25	3
North Sea and Rostock	750	50	6,3	Kiel/canal and, Helsingborg	950	75	3,8
North Sea and Uddevalla	240	25	1,4	Kiel/canal and Helsinki	6000	950	3,6,8,9
North Sea and Varberg	600	1 S	1	Kiel/canal and Kotka	140	S	5
North Sea and Wallhamn	700	40	8,3	Kiel/canal and Leningrad	2900	5	8,6
Gothenburg and Copenhagen	100	15	3	Kiel/canal and MALaren	500	20	5
Gothenburg and Fredrikshav	1200	150	3,2	Kiel/canal and Pori	1100	80	6,8
Gothenburg and Hanko	600	15	5,1	Kiel/canal and Rauma	130	20	8
Gothenburg and Helsinki	750	40	5,8	Kiel/canal and Riga	720	5	4,5
Gothenburg and Kiel	500	120	3,8	Kiel/canal and Stockholm	600	20	5,3
Gothenburg and Kotka	200	5	5	Kiel/canal and Sundsvall	750	1	5
Gothenburg and Travem(Inde	4200	420	3,2,5,8	Kiel/canal and Szczecin	5000	30	5,8
Copenhagen and Helsingborg	6300	320	3,6,8,4	Kiel/canal and Turku	700	120	8,6
Copenhagen and Helsinki	170	220	3	Kiel/canal and Ventspils	710	1	6
Copenhagen and Malmd	370	90	8,9	Rostock and Riga	220	5	6
Aarhus and GdanskWGdy	300	1	5	Sassnitz and Trelleborg	9400	470	2,3,4,8
Aarhus and Kalundborg	350	20	8	Swinoujscie and Ystad	1500	30	2,3
Aarhus and Uddevalla	200	1	4	Klaipeda and Mukran	2000	35	4,8
Aalborg and Oskarshamn	120	5	4,8	Nyniishamn and Visby	100	5	3,8
Ebeltoft and Zealand	230	30	8	Oskarshamn and Visby	400	170	3,4
Grenaa and Hundestedt	700	50	3,4	Forsmark and Ringhals	200	1	7
Halsskov and Knudahoved	3800	250	8,3,4	Gdansk/Gdy and Helsinki	1000	15	5,6
Kors6r and Nyborg	12000	1500	3,8,2,4	Gdansk and MBlaren	900	1	5
Helsingborg and Helsing6r	5100	790	3,8,9	Gdansk/Gdy and Norrkdping	1000	S	5
Helsingborg and Helsinki	280	20	3,8	GdanskWGdy and Stockholm	350	1	5
Helsingborg and Kotka	290	5	5	Gdansk and Uddevalia	500	1	8
Helsingborg and Turku	120	10	3	Hargshamn and Uusikaupunki	1600	200	9,3,5
Gedser and WarnemOnde	800	60	3,8	Stockholm and Helsinki	1800	230	3,9,8
Puttgarden and Rddby	5500	400	3,6,2,8	Stockholm and Turku	3000	330	8,3
TravemOnde and Gedser	250	70	3	KapellskAr and Turku	120	25	3
TravemOnde and Hanko	1500	75	2,3	Holmsund and Vaasa	240	15	8
TravemOnde and Helsinki	4600	1000	3 5 8	Sundsvall and Vaasa	200	15	9

### Annex 3

#### Overview of Packed dangerous goods transported in the Baltic Sea on ferry lines

Between	Ports	Quantity per month In tons	Number parcels per month	Quantity per trip, Average tons
Fredrikshavn	and Gothenburg	1200	160	4
Grenaa	and Halmstad	5 0	1 5	0
Grenaa	and Varberg	30	15	0
Gothenburg	and Travemunde	4500	500	75
Gothenburg	and Kiel	500	100	8
Aarhus	and Kalundborg	350	20	2
Ebeltoft	and Zealand	500	30	1
Grenaa	and Hundestedt	750	50	3
Halsskov	and Knudshoved	3900	250	6
Korsör	and Nyborg	12000	1500	13
Copenhagen	and Malmö	400	100	1
Copenhagen	and Helsingborg	6300	330	10
Helsingör	and Helsingborg	5100	800	1
Malmö	and Travemunde	3300	600	28
Copenhagen	and Rønne	80	40	5
Gedser	and Travemunde	300	70	2
Gedser	and Warnemunde	800	70	7
Puttgarden	and Rödby	5500	400	9
Trelleborg	and Travemunde	3200	600	21
Rostock	and Trelleborg	30	1	0
Hanko	and Travemunde	1500	80	25
Helsinki	and Travemunde	4600	1000	77
Sassnitz	and Trelleborg	9400	480	31
Swinoujście	and Ystad	1500	30	5
Klaipėda	and Mukran	2000	40	67
Nynäshamn	and Visby	200	10	2
Oskarshamn	and Visby	400	160	7
Hargshamn	and Uusikaupunki	1700	200	14
Helsinki	and Stockholm	1800	230	15
Kapellskar	and Turku	100	30	1
Stockholm	and Turku	3000	350	12
Stockholm	and Tallinn	90	3	10
Holmsund	and Vaasa	240	20	1
Sundsvall	and Vaasa	200	20	3
	total	75520	8304	6

## **Annex 4**

### **List of Estonian enterprises defined as “liable to be affected by a major accident” according to the European Council Directive 96/82.**

- Propaan AS
- Tallinna Vesi AS
- Port of Tallinn
- Milstrand AS
- Dry Bulk Terminal AS
- Refetra AS
- Ferry Terminal AS
- Reola Gaas AS
- Nitrofert AS
- Silmet AS
- Petkam AS
- Euredeck AS
- Nybit AS
- Sonmarin AS
- Pakterminal AS
- Tartu Terminaal AS
- Narva Vesi AS
- OÜ Tarkoil Rakvere Terminaal
- Kunda Nordic Cement AS
- Rakvere Lihakombinaat AS

## ANNEX 5

### Survey how “people in the streets” recognise dangerous cargo placards

The idea of the survey was to find out how many “people in the street” know the meaning of hazardous substances placards. Twenty of selected people were not directly involved in the transport business. Seven were females, thirteen males and one for each sex was a child aged about ten year old. Four of the people were possible regular users of hazardous materials as motor engineers and construction builders. One was a retired fireman and the others were ordinary people. The contestants of the survey were told that they were the first on the scene of a road accident and they had to recognise the placards and give information about the cargo to the rescue centre by phone. The research showed the general public has very little awareness of the hazards that may be present during transport. The individual findings were following:

#### No 1- explosives

- Seven got right answer, saying it is the dynamite.
- Four thought it was tar or oil
- One thought it is beetles or spiders
- One thought it is petrol
- One thought it is splashes of dangerous substances as caustic soda
- One thought it is cattle droppings
- Five had no idea

#### No 3- inflammable liquids

- Eleven thought it represented inflammable materials or goods (nobody made difference between liquids and solids).
- Five said fire hazards
- Two said petrol



- One said highly inflammable material
- One had no idea (fireman)

#### No 5- oxidising materials

This label caused more misunderstanding than others. Nobody got the right answer. Participants had no real idea of the properties and reactions of oxidisers. Some people associated the label with fire hazards. The results were the following:

- Two thought it is inflammable chemicals
- Two said tyres burning
- One said grain fire
- One said flammable when dry
- One said inflammable solid
- One said less flammable than class 3
- One said not a fire hazard
- One said inflammable materials
- One said cannons
- One said gas
- One said explosives
- Seven had no idea

#### No 6- poisons

This label was most recognisable.

- 16 said it is poison
- One said it is dead bodies in the vehicle
- One said acid
- One had no idea
- One said very dangerous substance

#### No 6.1- harmful

The label proved to be very confusing. Most of the answers were related to wheat.

- Six said it was a wheat lorry or empty wheat lorry
- Three said do not eat wheat
- Two said danger of grain fire
- Two said do not load foodstuff onto the lorry
- One said do not open the lorry
- One said not fit the consumption
- One said nuclear energy
- One said fertiliser
- Three had no idea

#### No 8- corrosives

- Seven said corrosives
- Five said acids
- Three said do not touch substances
- Two said liquids that burns
- One said do not drink
- One said detergents or abrasives
- One said non-dangerous chemicals

## **Annex 6**

### **List of accidents happen during handling and transport of dangerous chemicals in different ports in 1999 (Hazardous Cargo Bulletin, 1999).**

#### **5 January, off Gibraltar**

During the preparation for tank cleaning of the LPG carrier “Jessie Maersk” the cloud of ammonia gas was discharged which drifted over Gibraltar.

#### **5 January, off Khor Fakkan, United Arab Emirates**

The tanker “Athenian Pride” had explosion and fire after transfer of oil to another tanker.

#### **11 January, Puerto Rico**

Vapour explosion in the cargo tank of the tanker “Athenian Fidelity” when the ship was enroute to Venezuela in ballast. Five crewmembers were killed.

#### **22 January, off Armutulu, Turkey**

Explosion on board of the tanker “Marmara”, 2 crewmembers killed. Vessel had just discharged 1000 tonnes of gasoline. Gas pressure was the main reason of the accident.

#### **7 February, Klaipeda, Lithuania**

The tanker “Shuya” split unspecified amount of diesel oil to the harbour during the loading operation.

#### **9 February, Balanga Bataan, Philippines**

The tanker “Bocae” was struck by another tanker at Petro Refinery pier. Thousands of tonnes of gasoline split into the water.

#### **20 February, Gdansk, Poland**

Explosion aboard the tanker “Panormos” during the tank cleaning. 11 dock workers injured, it took 5 hours to extinguish the fire.

**26 March, off Abidjan, Cote d Ivoire**

Explosion aboard the tanker “Cam Etinde” during hot work while the ship was anchored waiting to enter port to load. Three cargo tanks damaged, four crewmembers injured.

**4 April, North Sea**

The production/ storage tanker “Uisge Gorm” reported of pressure in the tank no 4. Half of the crew was evacuated. To avoid the explosion vapours were let into the atmosphere.

**7 April, Jebel Ali, United Arabic Emirates**

Flash fire in the cargo tank of the tanker “Affinity” during repairs, 3 workers killed. Vessel was certified to be gas free after the discharge of cargo of carbon black.

**13 April, Port Newark, New Jersey; USA**

The cargo inspector was killed after falling into cargo tank fulfilled with acid aboard chemical tanker “Stolt Innovation” Authorities suspect that he was overcome by fumes or lack of oxygen and collapsed.

**16 April, Salvador; Brazil**

The tanker “Bage” discharging of oil cargo at Temadre terminal lost three mooring lines, one 8-inch discharge line was connected and the result was the spill of 65 m3 of oil at sea.

**24 April, Izmit Bay, Turkey**

Two crewmembers died while cleaning cargo tanks of the chemical tanker “Sapphire” after discharge of chemical cargo.

**26 April, Auckland; New Zealand**

The ro-ro vessel “Union Rotioti” lost 12 containers overboard, others broke on the deck causing the leakage of chemicals. Possible reason: poor stowage.

**7 May, Köln; Germany**

Rhine barge “Avanti” caught in fire and exploded while loading naphtha at the terminal. 300 tonnes of burning materials split to the river, fire spread to the empty chemical barge moored next to it.

**13 May, Baja California, Mexico**

Spillage during the fuel transfer process between the tanker and the offshore facility, 400m<sup>3</sup> fuel oil was spilled

**25 May, Rotterdam, the Netherland**

Explosion aboard the tank barge “Aphrodite” during the loading benzene at the terminal. The deck of the barge was damaged.

**27 June, Puget Sound, Washington USA**

Loading arm broke as tanker discharged oil to Tosco refinery, about 4000 tonnes of oil split to the dock.

**28 June, Port Stanvac, Australia**

Faulty connection of floating hose used for discharge of oil to Mobil refinery blamed for spillage of 270m<sup>3</sup> crude oil to sea

**10 July, eastern Mediterranean Sea**

The containership “Jakarta” enroute Dalian to the North Africa had fire in one container. Fire spread and other 100 other containers ignited. The crew abandoned the ship.

**12 August, Sydney, Australia**

12 crewmembers were hospitalised after the report of chemical leak aboard the containership “Direct Kookaburra”.

**13 August, Amsterdam, the Netherland**

The product tanker “Captain X Kyriakou” spilled 400 litres of gasoline while loading at the terminal.

**22 August, Berbera, Somalia**

The tanker “Hodo II” caught fire while discharging fuel at oil terminal. Fire spread quickly to the accommodation area. The investigation showed that the cargo pump caused the fire.

**23 August, off Kent, UK**

The containership “Ever Decent” had fire in containers containing hazardous materials after collision with the passenger ship “Norwegian Dream”.

**26 August, Point Fortin, Trinidad**

During loading at berth the tanker “Senang Spirit” shifted away from the jetty, bursting two 12-inches hoses and ripping 40- inch undersea line. 50 barrels oil lost at sea.

**24 September, off Dampier, Australia**

60m<sup>3</sup> of fuel oil split from the storage tank aboard Goodwyn- Aproduction platform during transfer operation.

**27 September, Port Dickson, Malaysia**

Fire on board the tanker “Petro Stella” loading gasoline at Esso refinery jetty killed one, injured another person. The explosion in forepeak tank blew 10- metre hole in deck.

**4 October, Zambales, Philippines**

Explosion in the cargo tank of LPG tanker “Mundogas Europe” when it was prepared for undocking after bottom hull repairs. Five workers killed, six injured.

**27 October, Delaware River, Delaware; USA**

15m<sup>3</sup> of oil overflowed from the barge during loading at Motiva refinery dock.

**5 November, Ravenna, Italy**

Explosion on board of the oil/chemical tanker “Vincenzia” during repairs at Cantieri Ravenna Dock, nine workers injured.

**25 November, off Acruha, Dutch Antiles**

Five crewmembers poisoned, two of them died because of oil vapours after discharging of sulphur rich crude oil on the tanker “Volga”.

## **Annex 7**

### **List of Helsinki Commission's recommendations concerning dangerous cargoes**

#### **Recommendation 1/3**

##### **“Concerning the adoption by the Baltic Sea states of the IMDG Code”**

Recommends contracting parties to adopt IMDG Code to harmonise national regulations in the Baltic Sea area.

#### **Recommendation 1/13**

##### **“Requirements in respect of loading and unloading of harmful substances in packed form”.**

Emphasise dangers related to loading of dangerous goods,

#### **Recommendation 12/7**

##### **“Special co-operation in case of chemical tanker accident in the Baltic Sea.”**

Recommends to nominate a contact point through which the competent authorities in other contracting parties can, in emergency situations, get information about the chemicals carried by tankers bound for or leaving a port of the contracting party. Suggests also help other contracting parties in case of pollution accidents.

#### **Recommendation 19/15**

##### **“Minimum requirements for vessel bound for or leaving ports of the Baltic Sea states and carrying dangerous or polluting goods.”**

Make the European Directive 93/75 “HAZMAT” obligatory in the Baltic Sea area no later than 1 January 2001. Weaknesses described in the previous paragraph.

#### **Recommendation 19/18**

##### **“Reporting of incidents involving harmful substances on emergency dumping.”**

Make the IMO resolution A. 648(16) obligatory in the Baltic Sea area.

## Annex 8

### List of existing Estonian regulations concerning dangerous cargoes

1. The **Port Act** entered into force on the 1<sup>st</sup> of January 1998 and was drafted by the Ministry of Transport and Communications. It is a basic document which regulates port work and establishes rights to keep control over it.
2. Regulation no of 26 January 1998 of the Ministry of Transport and Communication **The requirements for receipt, processing and storage of dangerous goods in ports**. The document bases on IMO's "Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas" The act makes the IMDG Code, BC Code, IBC Code and IGC Code compulsory in Estonia.
3. The **Chemicals Act**, adopted on the 6<sup>th</sup> of January 1998, is a document which regulates the handling and transporting of dangerous substances in the territory of Estonia.
4. Regulation no. 3 of 29 September 1998 of the Government of the Republic of Estonia the **Requirements for Petrol Transporting and Storing in Terminals and Petrol Stations**. The document bases on EU directive 94/63. It establishes limitations of petrol vapour emissions into the atmosphere from port terminals.
5. Regulation no 15 of the Ministry of Economic Affairs **Categories of Hazards for Dangerous Enterprises and Instructions for the Calculations of the Minimum Combined Hazard Levels of Chemicals, and the Threshold and Maximum Quantities of Dangerous Chemicals for Enterprises Liable to be Affected by a Major Accident**. The document bases on the EU Directive 96/82 known as a Seveso II Directive.



6. **Regulation no 60 of 26 May 1999 of the Ministry of Internal Affairs** List of Enterprises Liable to be Affected by Major Accident.
7. Regulation no 6 of 11 December 1998 of the Ministry of Social Affairs **Requirements for Recording Dangerous Chemicals In Enterprises Liable to be Affected By a Major Accident.** The regulation entered into force on the 1 January, 1999. The act obliges enterprises to keep records of dangerous substances stored in the territory of the company. It also gives controlling authorities rights to access that data.
8. Regulation no 3 of the Ministry of Transport and Communication **Requirements for Vehicles Carrying Dangerous Goods in Estonian Roads.** The act makes  
the ADR regulations compulsory.
9. The Act of Agreement on International Railway Trade **ratified on the 5<sup>th</sup> of June, 1992. It covers all previous Soviet Union territory and establishes safety rules for the transportation of dangerous substances for the railway.**
10. Memorandum of Understanding for the Transportation of Dangerous Goods **in the Baltic Sea** ratified on the 15 June 1998 and its special addition **Agreement on sea transport between Tallinn /Muuga and Helsinki** ratified in 29 June 1999. The act gives the right to follow ADR regulations instead of the IMDG Code on the board of some ro-ro vessels sailing between Tallinn and Helsinki. This document is added to annex 10.