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ΘΕΜΑ:

HANDLING DANGEROUS GOODS EMERGENCY RESPONSE

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Contents

Abstract

In the current essay we will discuss about which substances can be called dangerous goods, how they are segregated and identified and why they are dangerous. We will also discuss the correct practise and precautions when handling these goods and the allocation of the responsibilities. Also, this paper takes into consideration and mentions the bad consequences and hazards of mishandling dangerous goods. In addition, it presents some of the major accidents caused by dangerous goods onboard the ship. Finally, this essay points out all necessary action that must be taken in a emergency response situation.

Key words:

Dangerous goods

Emergency response

Hazmat

Maritime danger

IMDG CODE

Responsibilities

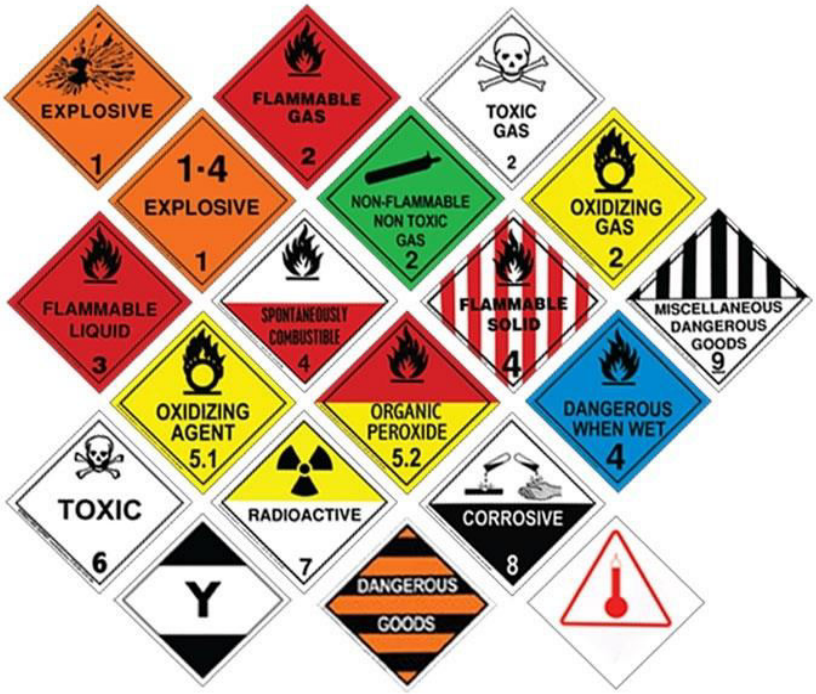

Illustration 1: Dangerous goods labels

1. Introduction:

1.1 General Information about dangerous goods.

Dangerous goods are solids, liquids, or gases that can harm people, other living organisms, property, or the environment. Dangerous goods are more commonly known as hazardous materials (abbreviated as HAZMAT or hazmat). Many products which we encounter on a daily basis can be hazardous to our health if we come into contact with them too often or for too long. Substances and materials which are dangerous for transport range from those which present obvious risks, such as explosives and fuming acids, through to more frequently encountered products such as paints, solvents and pesticides. The UN Model Regulations use a classification system in which each dangerous substance or article is assigned to a class, depending on the nature of the danger it presents. There are nine classes in which dangerous goods are sub divided: Class 1- Explosives, Class 2- Gases, Class 3- Flammable liquids, Class 4- Flammable solids and other flammable substances, Class 5- Oxidizing substances and organic peroxides, Class 6- Toxic and infectious substances, Class 7- Radioactive material, Class 8- Corrosive substances, Class 9- Miscellaneous dangerous substances and articles.

Class 1 consists of substances and articles which have a mass explosion hazard, substances and articles which have a projection hazard but not a mass explosion hazard, substances and articles which have fire hazard and either a minor blast hazard or a minor projection hazard or both, substances and articles which present no significant hazard; only a small hazard in the event of ignition or initiation during transport with any effects largely confined to the package, very insensitive substances which have a mass explosion hazard and extremely insensitive articles which do not have a mass explosion hazard.

Illustration 2: Class 1 label

Some examples of class 1 dangerous goods are ammunition/cartridges ,fireworks/pyrotechnics, flares, blasting caps / detonators, fuse, primers, explosive charges, detonating cord, air bag inflators, igniters, rockets, TNT / TNT compositions, RDX / RDX compositions, PETN / PETN compositions

Class 2 covers compressed gases, liquefied gases, dissolved gases, refrigerated liquefied gases, mixtures of gases and aerosol dispensers/articles containing flammable gases, non-flammable- non-toxic gases, toxic gases. Gases are capable of posing serious hazards due to their flammability, potential as asphyxiants, ability to oxidize and/or their toxicity or corrosiveness to humans. Commonly Transported Gases are aerosols, compressed air, hydrocarbon gas-powered devices, fire extinguishers, gas cartridges, fertilizer ammoniating solution, insecticide gases , refrigerant gases, lighters, acetylene / oxyacetylene,carbon dioxide, helium / helium compounds, hydrogen / hydrogen compounds, oxygen / oxygen compounds, nitrogen / nitrogen compounds, natural gas, oil gas, petroleum gases, butane, propane, ethane, methane, dimethyl ether, propene / propylene, ethylene.

Illustration 3: flammable gases

Illustration 4: Non flammable - non toxic gases

Illustration 5: Toxic gases

Illustration 6: Class 3 label

Class 3 dangerous goods are flammable liquids with flash points no more than 60 celcius degrees. It covers liquid substances, molten solid substances with a flash point above 60 celcius degrees and liquid desensitized explosives. Flammable liquids are capable of posing serious hazards due to their volatility, combustibility and potential in causing or propagating severe conflagrations. Commonly Transported Flammable Liquids are acetone / acetone oils, adhesives, paints / lacquers / varnishes, alcohols, perfumery products, gasoline / petrol, diesel fuel, aviation fuel, liquid bio-fuels, coal tar / coal tar distillates, petroleum crude oil, petroleum distillates, gas oil, shale oil, heating oil, kerosene, resins, tars, turpentine, carbamate insecticides, organochlorine pesticides, organophosphorus pesticides, copper based pesticides, esters, ethers, ethanol, benzene, butanols, dichloropropenes, diethyl ether, isobutanols, isopropyls, methanol, octanes.

Illustration 7: Class 4 label

Class 4 dangerous goods include flammable solids, substances liable to spontaneous combustion and substances which, in contact with water, emit flammable gases. Commonly transported class 4 dangerous goods alkali metals, metal powders, aluminium phosphide, sodium batteries, sodium cells, firelighters, matches, calcium carbide, camphor, carbon, activated carbon, celluloid, cerium, copra, seed cake, oily cotton waste, desensitized explosives, oily fabrics, oily fibres, ferrocerium, iron oxide (spent), iron sponge/direct-reduced iron (spent), metaldehyde, naphthalene, nitrocellulose, phosphorus, sulphur.

Class 5 dangerous goods are oxidizing substances and organic peroxides. Oxidizers, although not necessarily combustible in themselves, can yield oxygen and in so doing cause or contribute to the combustion of other materials. Organic peroxides are thermally unstable and may exude heat whilst undergoing exothermic autocatalytic decomposition. Additionally, organic peroxides may be liable to explosive decomposition, burn rapidly, be sensitive to impact or friction, react dangerously with other substances or cause damage to eyes. Commonly Transported Oxidizers and Organic Peroxides are chemical oxygen generators, ammonium nitrate

fertilizers, chlorates, nitrates, nitrites, perchlorates, permanganates, persulphates, aluminium nitrate, ammonium dichromate, ammonium nitrate, ammonium persulphate, calcium hypochlorite, calcium nitrate, calcium peroxide, hydrogen peroxide, magnesium peroxide, lead nitrate, lithium hypochlorite, potassium chlorate, potassium nitrate, potassium chlorate, potassium perchlorate, potassium permanganate, sodium nitrate, sodium persulphate.

Class 6 dangerous goods are toxic substances and infectious substances. Toxic and infectious substances can pose significant risks to human and animal health upon contact. Commonly transported toxic substances and infectious substances are medical/biomedical waste, clinical waste, biological cultures / samples / specimens, medical cultures / samples / specimens, tear gas substances, motor fuel anti-knock mixture, dyes, carbamate pesticides, alkaloids, allyls, acids, arsenates, arsenites, cyanides, thiols/mercaptans, cresols, barium compounds, arsenics / arsenic compounds, beryllium/ beryllium compounds, lead compounds, mercury compounds, nicotine / nicotine compounds, selenium compounds, antimony, ammonium metavanadate, adiponitrile, chloroform, dichloromethane, hexachlorophene, phenol, resorcinol.

Illustration 8: Class 8

Illustration 9: Class 6: Infectious

Class 7 dangerous goods are radioactive materials. There is no sub-division. However, there are different labels for radioactive materials which depend on the content and activity of such materials. Commonly Transported Radioactive Material are radioactive ores, medical isotopes, yellowcake, density gauges, mixed fission products, surface contaminated objects, caesium radionuclides / isotopes, iridium radionuclides / isotopes, americium radionuclides / isotopes,plutonium radionuclides / isotopes, radium radionuclides / isotopes, thorium radionuclides / isotopes, uranium radionuclides / isotopes, depleted uranium / depleted uranium products, uranium hexafluoride, enriched Uranium.

Class 8 dangerous goods are corrosive substances. Corrosive substances may cause severe damage when in contact with living tissue such as skin or damage or destroy surrounding materials in case of leakage. Chemicals which are classified as skin corrosive category 1 under GHS usually belong to class 8 dangerous goods. Commonly Transported Corrosives are, acids/acid solutions, batteries, battery fluid, fuel cell cartridges, dyes, fire extinguisher charges, formaldehyde, flux, paints, alkylphenols, amines, polyamines, sulphides, polysulphides, chlorides, chlorosilanes, bromine, cyclohexylamine, phenol / carbolic acid, hydrofluoric acid, hydrochloric acid, sulfuric acid, nitric acid, sludge acid, hydrogen fluoride, iodine, morpholine.

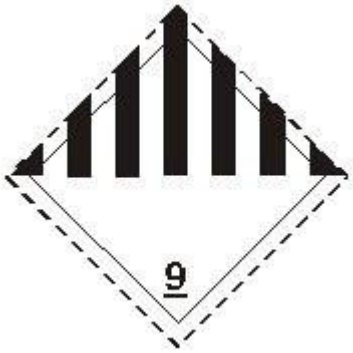

Illustration 10: Class 9

Class 9 Miscellaneous Dangerous Goods are substances and articles which during transport present a danger or hazard not covered by other 8 classes. This class encompasses, but is not limited to, environmentally hazardous substances, substances that are transported at elevated temperatures, miscellaneous articles and substances, genetically modified organisms and micro-organisms and (depending on the method of transport) magnetized materials and aviation regulated substances. Miscellaneous dangerous goods present a wide array of potential hazards to human health and safety, infrastructure and/ or their means of transport. Commonly Transported Miscellaneous Dangerous Goods are dry ice / cardice / solid carbon dioxide, expandable polymeric beads / polystyrene beads, ammonium nitrate fertilizers, blue asbestos / crocidolite, lithium ion batteries, lithium metal batteries, battery powered equipment, battery powered vehicles, fuel cell engines, internal combustion engines, vehicles, magnetized material, dangerous goods in apparatus, dangerous goods in machinery, genetically modified organisms, genetically modified micro-organisms, chemical kits, first aid kits, life saving appliances, air bag modules, seatbelt pretensioners, plastics moulding compound, castor bean plant products, polychlorinated biphenyls, polychlorinated terphenyls, dibromodifluoromethane, benzaldehyde.

To ensure the safe carriage of dangerous goods by sea the International Maritime Dangerous Goods (IMDG) Code was created. The key objectives of IMDG is to protect human life, prevent maritime pollution and facilitate the free movement of dangerous goods. The IMDG Code is produced by the International Maritime Organization (IMO), a specialist United Nations (UN) agency responsible for developing and maintaining regulatory frameworks for sea transport. The Code's provisions are based on recommendations developed by the UN. These are published in the UN 'Recommendations on the Transport of Dangerous Goods', known as the 'Model Regulations' because the document provides a framework of rules for the safe transport of dangerous goods by all modes air, road and rail as well as sea. The UN Model Regulations provide a uniform set of safety procedures covering consignment and transport issues such as classification, identification, packing, marking and labelling, documentation, security and training.

2. Transport of dangerous goods on a global scale.

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. At the end of the 20th century more than 50% of bulk and 10-15% of conteinerized or packed cargoes transported by sea all over the world are classified as dangerous.

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.

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. The main ports handling dangerous

liquid substances are Philadelphia, Houston and Tampa. 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.

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 Willhelmshaven (Germany).

The Asian biggest oil port is Kaohsiung in Taiwan. The Japanese ports of Yokohama and Nagoya, keep second and third place.

3. Precautions and important stages of handling dangerous goods and cargoes.

3.1 The IMDG CODE

All dangerous goods and cargoes delivered to or from the port area shall be packaged, marked, labelled and placarded in accordance with the IMDG Code. IMDG Code or International Maritime Dangerous Goods Code is accepted as an international guideline to the safe transportation or shipment of dangerous goods or hazardous materials by water on vessel. IMDG Code is intended to protect crew members and to prevent marine pollution in the safe transportation of hazardous materials by vessel. It is recommended to governments for adoption or for use as the basis for national regulations.

The implementation of the Code is mandatory in conjunction with the obligations of the members of united nation government under the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78). It is intended for use not only by the mariner but also by all those involved in industries and services connected with shipping. Contains advice on terminology, packaging, labeling, placarding, markings, stowage, segregation, handling, and emergency response. The HNS Convention covers hazardous and noxious substances that are included in the IMDG code.

The code is updated and maintained by the CCC (formerly DSC) Sub-Committee of the International Maritime Organization every 2 years.

Where the dangerous goods or cargoes are to be loaded on to a ship, their packaging shall comply with the IMDG Code. All documentation must comply with the requirements of the IMDG code. Notification must be submitted on the applicable DPC Dangerous Goods and Cargoes Forms in Annexes B, C and D as applicable.

Dangerous goods and cargoes whilst within the port area, ships or containers must be segregated as follows:

3.2 Precautions whilst loaded on a ship in accordance with the IMDG Code.

All personnel should know the classification of dangerous cargo. The dangerous cargoes are segregated in to various sub-categories so as to plan the carriage as per the requirements of the cargo. This avoids mistakes and proper preventive actions that can be taken in case of any incidence or accident. Furthermore, they should check the cargo for correct packaging: If the IMDG cargo is loaded in a package, it has to be ensured that absorbing or cushioning material is used with the package containing liquid cargo, which must be competent of absorbing the liquid in case of leakage. The package is kept with sufficient ullage if liquid cargo is carried. All cylinders carrying IMDG cargo are pressure tested and certified ok for use.

Also cargo groups should be identified by the ship's personnel. IMDG cargoes are divided in to three main groups and each has a specific plan to store, transport and

handling in case of accident or spill. Those groups are: cargo which are extremely dangerous, cargo with moderate danger and cargo with less danger.

It must be ensured that all the labels on the packages are visible and clearly indicate the type and characteristics of cargo.Appropriate labels indicating the hazard (Flammable, toxic, Corrosive etc.) are also pasted over the package.The label must be water resistant such that even in case of immersion, it should be readable for at least 3 months.

Ensure that before loading any IMDG cargo, the agent or shipper has handed over all documents concerning the cargo, such as the technical name of the cargo carried and the declaration certificate saying cargo has been packed as per the IMDG code.

Before cargo operation, have a check on port regulation on IMDG cargo. While loading the IMDG cargo, following things must be checked:

- The stowage plan and storage of the package as per IMDG.
- No bunkering is going on or stopped during the time of loading.
- The radar is put off.
- The packaging is weather tight.
- There is no damage or leakage found during loading.

If the IMDG cargo is with explosive label, the personnel should check if:

- The package is stored over a wooden pallet.
- All the electrical fittings in that region are disconnected from the source.
- All electrical wirings are sheathed properly.
- The cargo is stowed away from accommodation and hot bulkhead.

It is very important for the OOW to prepare himself for any kind of accidents while handling such dangerous cargo. The deck officer must read and understand all emergency procedures for ships carrying IMDG cargo, MFAG-Medical First Aid Guide for accidents involving IMDG cargo, risk associated with cargo by understanding the labels.

These are some of the important points that must be considered while handling dangerous cargoes on board ships. However, special attention must also be given to the instructions that are provided by the manufacturers and the company.

3.3 Precautions for dangerous goods in harbour areas.

The Dangerous Goods in Harbour Areas Regulations on 1 October 2016. They contain a set of safety provisions aimed at safeguarding ports against major accidents involving dangerous goods when they transit through ports, harbours and harbour areas. The purpose of the regulations is to put in place certain specific measures to reduce the risk of a serious incident occurring.

The main provisions are:

- anyone bringing dangerous goods into a harbour must pre-notify the arrival of the goods to the harbour master and/or berth operator
- the harbour master is given powers to regulate the movement of dangerous goods within the harbour area when they create risks to health and safety
- the master of a vessel carrying defined quantities of specified dangerous goods must display appropriate flags and lights
- harbour authorities must produce emergency plans to deal with potential consequences of an emergency involving dangerous goods in the harbour area, and any ‘untoward incidents’ (incidents involving or threatening the containment of dangerous goods) must be reported to the harbour master
- berth operators must provide certain information on emergency arrangements

to masters of vessels
- harbour authorities must provide a designated parking area for road vehicles carrying dangerous goods
- harbour areas where explosives are to be brought in or handled must be licensed by HSE or, in certain cases, the Office for Nuclear Regulation (ONR). This also applies to any loading or unloading of explosives on the coast of Great Britain or in territorial waters
- associated safety and security requirements for explosives in harbour areas
- statutory harbour authorities are given powers to make byelaws on dangerous goods in their harbour area.

3.4 Precautions for dangerous goods while stored in containers.

Before packing dangerous goods into container the interior and exterior of the container must be thoroughly examined. Every package of dangerous goods, drums, jerricans, boxes, bags etc. must be visually inspected for any damage. Packages leaking or damaged must not be loaded into the container. Packer must check whether the packages are marked, labelled and are having UN Performance marking on them.

Rules for securing cargo inside container is same for dangerous goods and non-dangerous goods. Improperly secured goods are prone to damage due to movement inside when exposed to acceleration. Rolling and pitching of vessel and hard braking of vehicles may cause goods to move inside the container, stacks collapsing, heavy goods to even break through the container walls.

When oversized machinery or vehicles are secured on container the dangerous goods in the machinery or vehicle must not leak or spill.

Whenever possible liquid dangerous goods must be loaded below dry dangerous goods. Similarly, while loading dangerous and non-dangerous into same container dangerous goods should be kept towards the door end when possible. The marks and labels of dangerous goods packages should face the door end.

Packages with vents, drums, and those having orientation marks must always be kept upright. IMDG Code prohibits drums on roll. If the packages are not designed for stacking the tiers must be separated with dunnage. Some shipping lines have a policy to get a letter signed by shipper stating dunnage is used while shipping liquid dangerous goods in plastic drums. This is to ensure the top tier wont crush the bottom tier and cause leakage.

Goods must be properly blocked, braced or secured or empty space between goods filled with dunnage bags or air bags. While using air bags to fill the space one must take into consideration the force on the bag from cargo. If the pressure of the air bag is low then there is possibility of bag becoming loose and if the pressure is too high there is possibility of bag breaking due to temperature variance.

When different dangerous goods are to be loaded into the container segregation rules of IMDG Code shall be met with.

Steps for checking segregation according to 37th amendment of IMDG Code

I. Identify the UN No., Proper Shipping Name, class or division, subsidiary hazard class or division, if any, and where assigned packing group for each substance
II. Are the dangerous goods exempted from the general segregation provisions example; Limited Quantities, Excepted Quantities, Special Provisions of segregation, Acids and Alkalis in class 8? If yes, follow same

III. If no, check segregation requirement of column 16b in dangerous goods and any segregation applicable as per dangerous goods declaration
IV. If no segregation applicable as per above, use segregation table in accordance with general segregation provisions
V. If segregation is applicable according to above, Use the segregation table taking into account any specific or general segregation provisions and determine the specific segregation provisions for each substance (e.g., segregation groups), Ensure the most stringent requirements are taken.

Responsibility of packer: Those who pack a dangerous goods container is responsible to issue a Container Packing Certificate, CPC is not required for tanks. The declaration of this certificate must read "I hereby declare that the goods described above have been packed/ loaded into the container/vehicle identified above in accordance with the applicable provisions" and must be signed. This certifies that;

- The container/vehicle was clean, dry and apparently fit to receive the goods.
- If the consignments include goods of class 1, other than division 1.4, the container is structurally serviceable.
- No incompatible goods have been packed into the container/vehicle unless specially authorised by the Competent Authority.
- All packages have been externally inspected for damage and only sound packages packed.
- Drums have been stowed in an upright position, unless otherwise authorised by the Competent Authority.
- All packages have been properly packed and secured in the container/vehicle.
- When materials are transported in bulk packagings the cargo has been evenly distributed in the container/vehicle.
- The packages and the container/vehicle have been properly marked, labelled and placarded. Any irrelevant mark, labels and placards have been removed.
- When solid carbon dioxide (CO2 – dry ice) is used for cooling purposes, the vehicle or freight container is externally marked or labelled in a conspicuous place.

A poorly packed container exposes transport workers and ship staff to risk additionally they pose risk to other cargo, equipment and environment.

4. RESPONSIBILITIES

All parties within the dangerous goods transportation activities are obliged to take all necessary measures to transport safely, securely and environmentally friendly, to avoid accidents and to reduce the damage as little as possible, if an accident occurs.

4.1. Responsibilities of the relevant person of the goods

The relevant person of the goods has to prepare all necessary documents, information and certificates relating to dangerous goods and provide availability of these documents with the cargo during the transport activities.

Moreover, he has to ensure the proper classification, identification, packing, marking and plating of the dangerous goods in accordance with the legislation. Also, ensure safe loading, stowage, transport and unloading of dangerous goods in approved and proper package, container and cargo units and the training of all relevant personnel on marine risks of dangerous cargo, safety precautions, safe operation, emergency measures, safety and so on and keep training records.

Necessary safety measures for improper, unsafe or risk-posing hazardous substances and necessary support and information in case of emergency or accident should be provided. One more responsibility is to inform the administration on

dangerous goods accidents occurred in the area of responsibility.

Finally he should present the requested information and document in the inspections carried out by the Authorities and provide the necessary cooperation.

4.2. Responsibilities of the port facility operator

The port facility operator should ensure appropriate, secured, safe land connection and safe entrance-exit system between the ship and shore. He should provide training for personnel working in loading, unloading and handling operations of the dangerous goods. Also he has to ensure proper and safe transport, handling, separation, stowing, temporary stock and inspection of the dangerous goods in the operation field by qualified, trained personnel who has taken the job security measures. All necessary documents relating to dangerous goods must be requested from the relevant person of the cargo and the availability with the cargo should be ensured. Additionally, it is his responsibility to keep an updated list of all dangerous goods in the business field and provide training for all personnel on the risk of handled dangerous goods, safety measures, safe operation, emergency measures, safety and keep training records. He should check the documents regarding to appropriate identification of hazardous substances delivered to the facility, correct use of shipping names of dangerous cargo, certification, packaging, labeling and declaration, inspection on loading and transport of dangerous goods in the certified and proper package, container or cargo unit in a safety way and reporting of inspection results. He has to provide necessary safety measures for improper, unsafe or risk-posing hazardous substances , as well as, emergency arrangements, necessary support and cooperation for the inspections made by the authorities. and notify the port authority. The activities related to hazardous substances in the docks, wharves, warehouses which are established for this purpose should be executed by the port facility operator. Moreover, he should provide proper installation and equipping for the docks and wharves separated for ships and marine vessels which load and unload petroleum and petroleum products. He should not allow the products out of the port facility without waiting and the ships and vessels carrying hazardous goods to edge in with the dock and pier without permission from the port authority. Additionally, he should provide a storage area proper to separation and stowage requirements and take necessary fire, environmental and other safety measures. Load and unload the dangerous good to ships and vessels, to take necessary actions against heat and other hazard especially in warmer seasons by relevant person. Keep combustible materials away from sparks and avoid usage of sparkling tools and equipment in the dangerous goods handling area. Finally, he should prepare emergency evacuation plan for the evacuation of the ships and boats from the port facilities in case of emergency.

4.3. Responsibilities of the ship's master

The ship's master has to ensure that the ship, equipment and devices are in good condition for dangerous good transport. Firstly, he should demand all necessary documents, information and certification relating to dangerous goods and ensure their availability with the goods. Secondly, he has to ensure that the safety measures related to loading, stowing, separating, handling, transport and unloading of the dangerous goods in his ship and take necessary inspection and controls. He should also check the compliance of identification, classification, certification, pack aging, marking, declaration, loading and transport of the approved and proper package, container and cargo unit in a safety means. It must be ensured that the crew is trained and informed on the risks, safety precautions, safe operation, emergency measures and similar issues of the loaded and unloaded dangerous goods. In addition, the persons, who are qualified and have necessary training on the loading, transport, unloading and handling of the dangerous goods, should work by taking job safety measures. He

should follow the rules given to him by the port authority, not cross the boards assigned to himself, not anchor, not edge with the pier and docking without permission. He must apply all rules and measures during sailing, maneuvering, mooring, berthing and leaving for the safe transport of dangerous goods and ensure safe entry and exit between the ship and the dock. The crew must be informed on the applications, security procedures, emergency measures and intervention methods related to dangerous goods in the ship. He should take the necessary safety measures for illegitimate, improper, unsafe, risk-posing for ship, persons or environment. Finally, he must report the dangerous goods accident in the ship to the port authority, if there is any.

4.4. Responsibilities of the Dangerous Goods Safety Consultant

The safety consultant should follow the compliance with the requirement to the transport of the dangerous goods and provide recommendations with regard to the transportation of hazardous materials to the port facility. Also, he should prepare an annual report on the dangerous goods transportation activities of the facility operator to the port facility.(Annual reports are kept for years and submitted to the authorities upon request.). Moreover, he should check the procedures regarding to appropriate identification of hazardous substances delivered to the facility, correct use of shipping names of dangerous cargo, certification, packaging, labeling and declaration, inspection on loading and transport of dangerous goods in the certified and proper package, container or cargo unit in a safety way and reporting of inspection results. Loading / unloading evacuation procedure related to handled and temporary dangerous goods, check that if the port facility considers the special requirements relating to dangerous goods while purchasing means of conveyance regarding to the handled dangerous goods. He must control methods of transport equipment used in loading and unloading of hazardous substances. Including the amendments to the legislation, he is responsible to check that whether the port facility personnel has necessary training and whether the records of this training is available. He should make easy the emergency methods to be applied in case of occurrence of an accident or incident that may effect the safety during the transport, loading or unloading of the dangerous goods. He should prepare reports on the serious accidents, incidents or serious infringements occurring during the transport, loading and unloading of the dangerous substances and determine the necessary precautions for the possibility of the re-occurrence of the accidents, incidents or serious violations and evaluation of the practices. Additionally, he should check what extent the requirements of the transport of the dangerous good are considered among the selection of the sub-contractor, determine whether the personnel has detailed knowledge on operational procedures and instructions for the transportation, handling, storage and shipment / discharge of hazardous substances. He must have all the necessary procedures on the identification of all necessary documents, information and certifications relating to hazardous materials. He has to give procedures on berthing, loading / unloading, sheltering or anchoring of ships carrying dangerous substances to the port facility day and night safely. Also, procedures on the additional measures to be taken for loading and unloading of the dangerous goods according to the seasonal conditions, procedures on fumigation, gas metering and degasification operations and procedures on keeping records and statistics of hazardous materials.Finally he should know procedures on handling and disposal of damaged dangerous goods and wastes contaminated with dangerous goods, information for the personal protective clothing and procedures among their use.

4.5 Responsibilities of 3rd party, cargo / ship broker etc. operating in the port facility

The 3rd party, cargo / ship broker etc. operating in the port facility should ensure that their personnel participating in the port facility has necessary training. He shall comply with the requirements set out in the IMDG Code and with the procedures for Hazardous Goods Guide and Hazardous substances formed by the port facility. Handling, transport and storage of hazardous substances in the port facility is his responsibility and he must report any violation to the relevant authority. He must also submit the (SDS) Form, which constitutes an integral part of the operations for the elimination of the Occupational Health and Safety risks that may occur during the use and storage of dangerous substances and prepared to inform the users accurately and adequately, to the port facility and Port Authority.

5. Accidents involving dangerous goods.

The rise in major incidents involving hazardous ocean cargo and growing concerns about danger to ships and their crews from dangerous goods – especially improperly declared shipments – is a major concern for operators and the transport industry overall. According to the UK P&I Club, 27% of incidents on cargo ships in 2013 and 2014 were attributable to mis-declared hazardous cargo, second only to poor packaging. The UK P&I Club says around 10% of all container cargo is made up of dangerous goods, which means these issues affect virtually all containership services.

J.M. Häkkinen & A.I. Posti mention in their paper "Overview of Maritime Accidents Involving Chemicals Worldwide and in the Baltic Sea" an analysis of chemical incidents and accidents in the EU waters and elsewhere, and stated that 23 incidents had information written down on related facts, such as accident places and causes, chemical products involved, response actions and environmental impacts. The study categorized the accidents into five groups according to how the substance involved behaved after being spilled at sea: products as packaged form; dissolvers in bulk; floaters in bulk; sinkers in bulk; and gases and evaporators in bulk. Most of the accidents happened in the transit phase at sea, that is, while the vessel was moving.

Only four accidents happened in ports or in nearby zones. Most of the accidents happened with bulk carriers (62 per cent of all the incidents), and less often with vessels transporting chemicals in packaged form (38 %). Bad weather conditions and the resulting consequences were the main cause of the accidents (in 62 per cent of all the cases). They also highlighted several issues concerning human health risks in the case of maritime chemical accidents. In most accident cases the risks affecting human health come usually from reactive substances (reactivity with air, water or other products) and toxic substances. Certain substances such as chlorine, epichlorohydrine, acrylonitrile, styrene, acids and vinyl acetate are transported in large quantities and may pose a very serious threat to human health being highly reactive, flammable and toxic. Consequences and hazards to the environment have varied a lot, considering chemical tanker accidents. Studies stated that, in light of accidents, pesticide products are one of the biggest threats for the marine environment. If pesticides enter the marine environment, consequences for the near-shore biota, and simultaneously for the people dependent on these resources could be severe.

The list of chemicals that were involved in the accidents more than one time included sulphuric acid, acrylonitrile, ammonium nitrate, and styrene. Only 10 of the 47 accidents occurred in ports or in nearby zones. Moreover, 66 per cent of the accidents involved chemicals transported in bulk, whereas 34 per cent involved hazardous materials in packaged form. Improper maneuver was most frequently the reason for the accident (in 22 per cent of all the cases), shipwreck came second (20 %), and collision was third (13 %), closely followed by grounding and fire (11 % each).

Packaged chemicals can also be extremely dangerous to humans. This could be seen when fumes of epichlorohydrine leaking from the damaged drums on the

Oostzee (Germany 1989) seriously affected the ship´s crew and caused several cancer cases that were diagnosed years after. However, these types of accidents involving packaged chemicals have only a localized short-term impact on marine life.

As to accidents caused by fire, there are difficulties in responding to the situation if the vessel is transporting a wide variety of toxic products. It is important yet difficult to have a fully detailed list of the transported products for the use of assessing possible dangers for rescue personnel and public. The highest risk for human health comes mainly from reactive substances (reactivity with air, water or other products). Many chemicals are not only carcinogenic and marine pollutants, but can form a moderately toxic gas cloud which is often capable of producing a flammable and/or explosive mix in the air. Acrylonitrile is a toxic, flammable and explosive chemical, and if it is exposed to heat, a highly toxic gas for humans (phosgene) is formed. Vinyl acetate, in turn, is a flammable and polymerizable product that in the case of Multi Tank Ascania incident (in United Kingdom, in 1999) caused a huge explosion.

Little is known about the actual marine pollution effects of most of these substances. If hazardous chemicals and oil are compared, it can be said that the danger of coastline pollution is a far greater concern for oil spills than it is for chemical spills.

United States over 5 year-span (1992–1995) listed 423 spills of hazardous substances from ships or port installations, giving an average of 85 spills each year. The 9 most frequently spilled products were sulfuric acid (86 spill cases), toluene (42), caustic soda (35), benzene (23), styrene (20), acrylonitrile (18), xylenes (18), vinyl acetate (17) and phosphoric acid (12). Over half of the spills were from ships (mainly carrier barges), and the rest from facilities (where the spill comes from the facility itself or from a ship in dock). A complementary study made over a period of 13 years (1981–1994) on the 10 most important port zones reported 288 spills of hazardous substances, representing on average, 22 incidents each year (US Coast Guard 1999).

Small spillages in Europe were not recorded with a similar care because they were not detected and/or there was a lack of communication between environmental organizations and competent authorities. Cedre and Transport Canada (2012) analyzed a total of 196 accidents that occurred across the world´s seas between 1917 and 2010. The substances that were most frequently spilled and that had the greatest quantities were sulphuric acid, vegetable oils, sodium hydroxide solutions and naphtha. Quite surprisingly, the study showed that structural damage (18 %) was the main cause of accidents involving hazardous materials, followed by severe weather conditions (16 %), collision (13 %), and grounding (11 %). Loading/unloading was the cause for only 7 per cent of the accidents.

6. Known incidents caused by dangerous goods

6.1 Charlotte Maersk accident

On 7 July 2010,CHARLOTTE MAERSK was en route from Port Klang, Malaysia bound for Salalah, Oman. At 2119 on 7 July 2010 approximately three hours after departure crew members on the bridge observed smoke rising from the forward part of the ship. It was soon apparent that there was a rapidly developing fire on deck. The fire alarm was activated and the crew mustered according to the muster plan and started the fire fighting efforts. After approximately 24 hours of fire fighting by the crew members, support ships and a fire fighting aeroplane,the fire was considered to be under control. From the evening of 9 July 2010, the fire fighting effort was organised by a salvage master and fire fighters from ashore assisted by the ship's crew. On 18 July 2010, CHARLOTTE MAERSK sailed under own power to the Port

of Tan-jung Pelepas, Malaysia to discharge the cargo. The fire fighters from ashore were de-mobilized on 22 July 2010. There were only minor damages to the hull and deck and some deformation due to heat on two hatches of cargo hold no. 6. Approximately 160 containers were damaged. One crew member subsequently suffered respiratory problems from inhaling smoke from the fire. The fire probably originated from the container containing methyl ethyl ketone peroxide (MEKP) in stowage position 230682. The response time of the crew was decisive for the containment of the fire. A wide variety of safety considerations and decisions were made and actions taken within a short timeframe and under critical circumstances. Furthermore, that the shipboard organisation was able to function effectively even when its main structure was changed in response to the unfolding events. These elements were decisive for the development and outcome of the accident which resulted in relatively minor damages to the ship and crew members.

6.2 MSC Flaminia

On 14 July 2012, a fire in hold 4 caused an explosion aboard MSC Flaminia while the ship was underway from Charleston, United States, to Antwerp, Belgium, forcing the crew to abandon the ship some 1,000 nautical miles (1,900 km; 1,200 mi) from nearest land in the middle of the Atlantic Ocean. Her Majesty's Coastguard received a distress signal at 10:07 (UTC (GMT)) and broadcast an alert to all vessels in the area. DS Crown, a German-owned, Bahamas-flagged oil tanker en route from Halifax, Nova Scotia, Canada to Falmouth, Cornwall, United Kingdom, was the first to arrive at the scene and rescue 22 crew members and two passengers from a lifeboat and a liferaft. One crewman remains missing and is presumed dead. The ship's First Officer died on DS Crown shortly after being taken aboard from burns he had sustained while fighting the fire. On 8 October, another seriously injured crew member of MSC Flaminia died in a specialist hospital for burn wounds in Portugal. A number of containers were also lost overboard.

After the crew and passengers had abandoned the ship, MSC Flaminia was left drifting in mid-Atlantic. Dutch salvage company Smit International signed a salvage contract for the stricken vessel, but the extent of the fire was not known until the first salvage tug, Fairmount Expedition, arrived at the scene on 17 July. According to the first reports, the fire was still burning in holds 4, 5 and 6, and the ship had developed a list of about 8.5 degrees as a result of the firefighting operations, but the engine room, superstructure and aftship were not seriously damaged. A second explosion occurred on the ship on 18 July, but the salvage efforts soon continued. The ship's own firefighting system was also started and the salvage personnel attempted to find the missing crewman. On 20 July, Fairmount Expedition began to tow MSC Flaminia towards Europe while Anglian Sovereign, another salvage tug with specialized firefighting equipment, continued to cool down the fire. On 24 July, it was announced that the fire on board MSC Flaminia was under control and an aerial high definition video, recorded by a helicopter on 26 July, showed the damage to the ship and its containers. By 29 July, the ship had arrived within 100 nautical miles (190 km; 120 mi) of the British coast. However, the deteriorating weather prevented the salvage crew from entering the ship, then listing at 10 degrees, on 31 July and she was moved away from the coast. Although the fires had been put out in holds 4, 5 and 6, temperatures in hold 7 were still rising. On 13 August, the salvage efforts restarted but, as no European country had given the ship a permission to enter its coastal waters, MSC Flaminia remained at her waiting position approximately 240 nautical miles (440 km; 280 mi) offshore. In addition to extinguishing individual containers, the salvage crew had pumped water from the cargo holds to stabilize the vessel, reducing the list to around 2.5 degrees.

The fire onboard MSC Flaminia has again raised concerns about misdeclared

cargo. Containers containing explosive or flammable materials are normally carried on the decks for safety, but if the cargo manifest is incorrect or falsified, they might be stowed inside the cargo holds where they create a potential hazard. The shipping company has confirmed that, according to the cargo manifest, the ship was not carrying calcium hypochlorite, a chemical compound responsible for several container ship fires in the 1990s, in any of the 2,876 containers on board the ship. Furthermore, the reluctance of any country to give permission for the ship to enter its coastal areas raised concerns about the vessel sinking or being intentionally scuttled in deep water.

6.3 Hanjin Pennsylvania

Hanjin Pennsylvania was a large box ship that was launched in March 2002 and, although small by today's standards, was designed to carry 4,500 containers. These were stacked eight high in the holds (of which the ship had several) and six high on deck and. In the early hours of 11th November 2002, the ship blew up off Colombo in the Indian Ocean, due to a box of fireworks that contained calcium hypocloride, which reacts violently when exposed to moisture. The result was an explosion that was so huge as almost to empty one of the holds and to clear the deck above (remember that the containers were piled 14 high), reducing a significant section of the ship to a tangled mass of metal. The explosion caused the tragic death of two crew members who were on deck at the time.

6.4 Sea-Land Mariner

Sea-Land Mariner suffered sever containers' explosion in two cargo holds aft of the accommodations. The extinguishing of the fire, that was caused by the explosion, lasted a couple of days and finally the vessel was towed to port of Piraeus for Vessel Inspection.The Vessel Inspection was carried-out by a number of eminent European shipyards amongst them also shipyard Viktor Lenac from Rijeka, Croatia. The ship was then towed from port of Piraeus to Rijeka and to VLS for repairs. At VLS,, the complete aft two holds with hatch covers were restored, including topsides partial steel renewal of hull, also the steering gear room & 'miles' of electric cabling towards Engine Room. This restoration project at the time 1998 was worth 3,3 mil USD.

It was explosion on aft part due to positioning of wrong manifested containers into the hold instead on the deck. There were two containers loaded with expandable polystiren that blast took 2 seamen's lifes. Accident has happened near port of Piraeus.

6.5 Hyundai Fortune

On March 21, 2006, Hyundai Fortune was en route from ports in China and Singapore through the Gulf of Aden about 60 miles (97km) south of the coast of Yemen. She was sailing west towards the Suez Canal on the way to ports in Europe. Around 12:35 UTC, an explosion of unknown origin occurred below deck, aft of the accommodation, causing 60 to 90 containers to fall into the ocean. The explosion caused a fire that spread through the stern of the ship, including the accommodation and the container stacks in front of the accommodation. Secondary explosions followed as seven containers full of fireworks also ignited above deck on the stern. A large section of the hull had been blown out below deck but above the waterline on the port side.

After efforts to contain the fire failed, all 27 crew members abandoned ship and were rescued by the Dutch frigate HNLMS De Zeven Provinciën, which was performing maritime security operations in the area as part of Operation Enduring Freedom. One sailor was evacuated to the French aircraft carrier Charles de Gaulle with injuries that were not life-threatening.

On March 23, firefighting tugs began to arrive on the scene. With her engine room burned and completely flooded, the listing Hyundai Fortune continued to burn for several days.

General average was declared and at least one third of the containers were damaged by the blaze. Every container aft of the superstructure was either incinerated or lost overboard. Most of the containers forward of the superstructure were left intact, although after the ship lost power, any cargo in the refrigerated containers would have spoiled. An estimated ten per cent of the cargo was uninsured.

According to a statement to the US House of Representatives Homeland Security Appropriations Committee, "The cause of the fire is believed to have been a container loaded with petroleum-based cleaning fluids stowed near the engine room. The shipper failed to indicate the hazardous nature of this shipment to Hyundai Fortune, undoubtedly to avoid the special handling fees associated with transporting hazardous materials.

7. Dangerous goods hazards

Some hazardous substances produce toxic effects in humans or the environment after a single, episodic release. These toxic effects are referred to as the acute toxicity. Other hazardous substances produce toxic effects in humans or the environment after prolonged exposure to the substance, which is called chronic toxicity.

Chronic toxicity is the development of adverse effects as the result of long term exposure to a toxicant or other stressor. It can manifest as direct lethality but more commonly refers to sublethal endpoints such as decreased growth, reduced reproduction, or behavioral changes such as impacted swimming performance.

Acute toxicity describes the adverse effects of a substance that result either from a single exposure or from multiple exposures in a short period of time (usually less than 24 hours). To be described as acute toxicity, the adverse effects should occur within 14 days of the administration of the substance.

Dangerous goods hazards (DGH) are inherent properties of dangerous substances, materials and articles including physical, chemical, biological, and radioactive hazards. In case of a marine event, packaged dangerous goods may get involved and realise their hazards by exposing one or a combination of the risk receptors. The extent or magnitude of effects due to DGH depends on the type, physical state, and quantity of dangerous goods and a wide range of other factors and conditions. Many substances and materials possess more than one hazard, while others share similar hazards. DGH that have usually been considered in the risk analysis are:

• Acute toxicity - due to toxic clouds

• Flammability - flame impingement in flash fires due to flammable clouds. It can cause great damage to living organisms, damage the ship and cargo and endanger every other ship or person in the vicinity.

• Thermal radiation - due to jet and pool fires and fireballs.From the extreme heat exposure that materials experience, combustion of most substances occurs. Damage as a result of thermal radiation is much more severe towards humans. The very intense heating from the fireball causes "flash burns," where the more thermal radiation absorbed, the worse the burn becomes. Interestingly, anyone within 10 miles of the blast will become blind whether their eyes are open, or shut.

• Blast wave - from Vapour Cloud Explosions (VCEs), Boiling Liquid Expanding Vapour Explosions (BLEVEs), detonations, confined explosions. It can create injuries non-threatening to human life but also lethal injuries and even immediate death.

• Missile damage - from flying pieces of metals or other objects due to

blast waves.

7.1 Dangerous goods impact on human life.

A large number of people might be at risk from the transport of dangerous goods. Catastrophic events involving dangerous goods have caused thousands of fatalities. Individuals at risk in maritime transport of dangerous goods include: workers (employees), crew members or onboard ship personnel, port workers, other employees of the company, members of the public, passengers onboard ships, other ship personnel and passengers, people ashore other than the company generating risks, people living adjacent to a particular port area or waterways.

Emergency response efforts must consider the health and ecological hazards of a hazardous substance release. These hazards impact emergency responders and effected communities. In some cases, hazardous substances may irritate the skin or eyes, make it difficult to breathe, cause headaches and nausea, or result in other types of illness. Some hazardous substances can cause far more severe health effects, including:behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (e.g., reproductive impairment, kidney failure, etc.), physical deformations, and birth defects.

7.2 Dangerous goods impact on the environment.

Impacts on the environment can be just as devastating: killing organisms in a lake or river, destroying animals and plants in a contaminated area, causing major reproductive complications in animals, or otherwise limit the ability of an ecosystem to survive. Certain hazardous substances also have the potential to explode or cause a fire, threatening both animals and human populations.

Assessments of the marine environment risks have been confined to major spills of a limited number of dangerous substances and materials carried in large quantities in bulk by sea, in particular oil, oil products and a few chemicals. Knowledge about the environmental risks from a wide range of different types of PDG carriage water is underdeveloped.

For the purpose of reporting marine casualties, Greenpeace International has suggested the following categories of information to be provided by countries and inserted into the IMO Casualty Database for assessing environmental risks of marine events: natural resource damages, loss of wildlife (birds, marine mammals, non-commercial fish, other marine life), loss of fisheries (fin fish, shellfish, fish farming), habitat degradation (soft habitats, marshes, mangroves, shorelines, beaches, rocky coastal/reefs, coral reefs), geological and archaeological resources damages, terrestrial habitats, damages to tourism and recreation.

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.

7.3 Dangerous goods economical impact

Chemical marine pollution can cause many disturbances which, in the shorter or

longer term, can have a negative impact on the economy. These effects may be related to living organisms, ecosystems as well as humans and their activities.The methods used to assess economic impact distinguish all that is of commercial value from all that is not. An example of this is a professional fishing ban due to intoxication of fish flesh or due to a decrease in tourism in the incident area caused by chemical spill or oil spill. Large amounts of chemicals or oil that spilled in the sea or land demand time and money to minimize the catastrophe that was caused by them. Fishing industry will have to stop for the time of the cleaning. Also, tourists will not travel to a location that is hazardous for their health or property.

Resources of non-commercial value are difficult to calculate as they cover all that cannot be invoiced. Some examples of this are a ban on recreational shellfish collection, sterility in certain mammals or damages caused to protected areas. Certain countries are beginning to set up systems to obtain data on the reference condition of the natural environment. In Canada for example, three federal government agencies work together to run the Canadian Shellfish Sanitation Program: Environment and Climate Change Canada, the Canadian Food Inspection Agency and Fisheries and Oceans Canada.This program detects any aquatic contamination and is the basis for imposing shellfish harvesting bans in the concerned areas where necessary. Once analyses indicate that the pollution has disappeared, the area can be reopened to the public.

8. Human error and dangerous goods

8.1 Mislabeled dangerous goods

There are approximately 3,000 regulated articles and substances listed with an internationally accepted Proper Shipping Name (PSN) and a specific four-digit number associated with each one. With so many to choose from it's critical that the shipper, get it right. If he doesn't, the consequences could be catastrophic.

Timing is critical to emergency responders when on-the-spot decisions have to be made. There is no time for second guessing. So from the outset the emergency responders immediately assess the situation by identifying the hazards involved from the placards and labels displayed, and they prepare their response based on those specific hazards.

Let's say a shipper mistakenly identifies your lithium nitride as lithium nitrate. They sound kind of similar, but that's about all. If your product is involved in a fire, a fire fighter must determine how to extinguish that fire. Lithium nitrate happens to be classified as a Div. 5.1 hazard, which is an oxidizer. This would contribute to a fire and make it burn hotter. If your product is next to a fire and they can't remove it safely, responders might want to keep that product cool by spraying it with water. But if the product is actually lithium nitride, it is a Div. 4.3 hazard that is dangerous when wet. So by misspelling "ide" with "ate" the shipper just complicated the situation and endangered the lives of the emergency responders.

The average shipper is not a chemist, and identifying and classifying the product being shipped should already be done for them by the manufacturer. All the necessary transportation information can be found in Section 14 of the product`s Safety Data Sheet (SDS). Although this information should be provided, it is still ultimately the shipper who is responsible for properly identifying the product being shipped.

Consulting the domestic regulations, we find the PSNs in column 2 of the hazardous materials table of Subpart B of Part 172 in the Code of Federal Regulations Title 49. They are listed in alphabetical order as they also are in the ICAO Technical Instructions and the IATA DGR for international air transport. For international vessel, the IMDG Code list is actually in numeric order according to the four-digit

UN identification number.

The PSN in CFR49 is differentiated by regular type with the associated descriptor text appearing in italics. The DG list in the IATA DGR shows the PSN in bold type with the descriptor in regular type. The IMDG Code shows the PSN in capitals with descriptor text in regular lower case type.The name in the hazardous materials table or dangerous goods list that most appropriately describes the article or substance must always be used.The PSN can be singular or plural and printed in capital letters or lower case.Alternate spellings are allowed if they appear differently in the ICAO-TI or IMDG Code, e.g. Caesium or Cesium. Domestic transport in the U.S. allows the word poison or poisonous to be used interchangeably with the word toxic. The materials can be appropriately described by a shipping name that best describes its intended usage, i.e. extracts, flavoring liquid, would be more appropriate.

8.2 Incorrect stowage of hazardous substances

The poor storage of hazardous and dangerous substances can create risks, including the following: Health and safety risks due to substances being stored in an inappropriate state or condition and/or an inappropriate place, without adequate warning of the hazards and potential for unwanted chemical reactions. Also, fire and explosion risks from unwanted reactions, eg from incompatible substances becoming mixed, which may result in the generation of heat, fumes, gases and vapours. If materials are incorrectly stored, the emergency services may be unable to ascertain the substances involved, which could delay mitigating actions. A wide variety of chemicals can develop explosive potential upon deterioration. A number of mechanisms can be in operation, such as the production of explosive deterioration products like ethers and peroxides or the production of gases that generate pressure inside sealed chemical containers. The first sign of deterioration that is noticed may be changes to the container. If a container shows signs of internal pressure, vacuum, deposits on the lid or stopper, any other signs of decomposition, that are not present in a newly purchased chemical container, the material may have decomposed and be unstable.

8.3 Insufficient Training and awareness

The person handling the hazardous goods didn't receive training appropriate with their responsibilities and duties nor was familiar with the general provisions of dangerous goods transport requirements. Training that included a description of the classes of dangerous goods, labelling, marking, placarding and packaging, segregation and compatibility requirements didn't take place. The vessel's crew was not trained in the hazards and dangers presented by the dangerous goods during loading, unloading and handling commensurate with the degree of risk of injury or exposure during carriage. The training shall be periodically supplemented by refresher training to take into account the changes in the regulations. All personnel must be aware of the type and class of the dangerous good that they carry as well as all the risks involving it.

9. Correct handling of dangerous goods

Before moving, handling or storing dangerous goods the employes should have adequate training and education, applying general safety principles, such as proper work practices, equipment, and controls. All this can help reduce workplace accidents involving the moving, handling, and storing of materials. Whether moving materials manually or mechanically, employees should know and understand the potential hazards associated with the task at hand and how to control their workplaces to minimize the danger.

Because numerous injuries can result from improperly handling and storing materials, workers should also be aware of accidents that may result from the unsafe

or improper handling of equipment as well as from improper work practices. In addition, workers should be able to recognize the methods for eliminating or at least minimizing the occurrence of such accidents. Employers and employees should examine their workplaces to detect any unsafe or unhealthful conditions, practices, or equipment and take corrective action.

When moving materials manually, workers should attach handles or holders to loads. In addition, workers should always wear appropriate personal protective equipment and use proper lifting techniques. To prevent injury from oversize loads, workers should seek help in the following when a load is so bulky that employees cannot properly grasp or lift it, when employees cannot see around or over a load, or when employees cannot safely handle a load.

Using the following personal protective equipment prevents needless injuries when manually moving materials hand and forearm protection, such as gloves, for loads with sharp or rough edges, eye protection, steel-toed safety shoes or boots, metal, fiber, or plastic metatarsal guards to protect the instep area from impact or compression. Employees should use blocking materials to manage loads safely. Workers should also be cautious when placing blocks under a raised load to ensure that the load is not released before removing their hands from under the load. Blocking materials and timbers should be large and strong enough to support the load safely. In addition to materials with cracks, workers should not use materials with rounded corners, splintered pieces, or dry rot for blocking.

Using mechanical equipment to move and store materials increases the potential for employee injuries. Workers must be aware of both manual handling safety concerns and safe equipment operating techniques. Employees should avoid overloading equipment when moving materials mechanically by letting the weight, size, and shape of the material being moved dictate the type of equipment used. All materials-handling equipment has rated capacities that determine the maximum weight the equipment can safely handle and the conditions under which it can handle that weight. Employers must ensure that the equipment-rated capacity is displayed on each piece of equipment and is not exceeded except for load testing.

Stored materials must not create a hazard for employees. Employers should make workers aware of such factors as the materials' height and weight, how accessible the stored materials are to the user, and the condition of the containers where the materials are being stored when stacking and piling materials. To prevent creating hazards when storing materials, employers must do the following:

- Keep storage areas free from accumulated materials that cause tripping, fires, or explosions, or that may contribute to the harboring of rats and other pests
- Place stored materials inside buildings that are under construction and at least 6 feet from hoist ways, or inside floor openings and at least 10 feet away from exterior walls
- Separate noncompatible material and
- Equip employees who work on stored grain in silos, hoppers, or tanks, with lifelines and safety belts.

In addition, workers should consider placing bound material on racks, and secure it by stacking, blocking, or interlocking to prevent it from sliding, falling, or collapsing.

Stacking materials can be dangerous if workers do not follow safety guidelines. Falling materials and collapsing loads can crush or pin workers, causing injuries or death. To help prevent injuries when stacking materials, workers must do the following:

- Do not store pipes and bars in racks that face main aisles to avoid creating a hazard to passersby when removing supplies;
- Stack bags and bundles in interlocking rows to keep them secure; and
- Stack bagged material by stepping back the layers and cross-keying the bags at least every ten layers (to remove bags from the stack, start from the top row first).

During materials stacking activities, workers must also do the following:

- Store baled paper and rags inside a building no closer than 18 inches to the walls, partitions, or sprinkler heads
- Band boxed materials or secure them with cross-ties or shrink plastic fiber
- Stack drums, barrels, and kegs symmetrically
- Block the bottom tiers of drums, barrels, and kegs to keep them from rolling if stored on their sides
- Place planks, sheets of plywood dunnage, or pallets between each tier of drums, barrels, and kegs to make a firm, flat, stacking surface when stacking on end
- Chock the bottom tier of drums, barrels, and kegs on each side to prevent shifting in either direction when stacking two or more tiers high
- Stack and block poles as well as structural steel, bar stock, and other cylindrical materials to prevent spreading or tilting unless they are in racks.

In addition, workers should do the following:

- Paint walls or posts with stripes to indicate maximum stacking heights for quick reference
- Observe height limitations when stacking materials
- Consider the need for availability of the material and
- Stack loose bricks no more than 7 feet in height. (When these stacks reach a height of 4 feet, taper them back 2 inches for every foot of height above the 4-foot level. When masonry blocks are stacked higher than 6 feet, taper the stacks back one-half block for each tier above the 6-foot level.)

To reduce the number of accidents associated with workplace equipment, employers must train employees in the proper use and limitations of the equipment they operate. In addition to powered industrial trucks, this includes knowing how to safely and effectively use equipment such as conveyors, cranes, and slings.

When using conveyors, workers may get their hands caught in nip points where the conveyor medium runs near the frame or over support members or rollers. Workers also may be struck by material falling off the conveyor, or they may get caught in the conveyor and drawn into the conveyor path as a result. To prevent or reduce the severity of an injury, employers must take the following precautions to protect workers:

- Install an emergency button or pull cord designed to stop the conveyor at the employee's work station.
- Install emergency stop cables that extend the entire length of continuously accessible conveyor belts so that the cables can be accessed from any location along the conveyor.
- Design the emergency stop switch so that it must be reset before the conveyor can be restarted.
- Ensure that appropriate personnel inspect the conveyor and clear the stoppage before restarting a conveyor that has stopped due to an overload.
- Prohibit employees from riding on a materials-handling conveyor.

- Provide guards where conveyors pass over work areas or aisles to keep employees from being struck by falling material. (If the crossover is low enough for workers to run into it, mark the guard with a warning sign or paint it a bright color to protect employees.)
- Cover screw conveyors completely except at loading and discharging points. (At those points, guards must protect employees against contacting the moving screw. The guards are movable, and they must be interlocked to prevent conveyor movement when the guards are not in place.)

Employers must permit only thoroughly trained and competent workers to operate cranes. Operators should know what they are lifting and what it weighs. For example, the rated capacity of mobile cranes varies with the length of the boom and the boom radius. When a crane has a telescoping boom, a load may be safe to lift at a short boom length or a short boom radius, but may overload the crane when the boom is extended and the radius increases.

To reduce the severity of an injury, employers must take the following precautions:

- Equip all cranes that have adjustable booms with boom angle indicators.
- Provide cranes with telescoping booms with some means to determine boom lengths unless the load rating is independent of the boom length.
- Post load rating charts in the cab of cab-operated cranes. (All cranes do not have uniform capacities for the same boom length and radius in all directions around the chassis of the vehicle.)
- Require workers to always check the crane's load chart to ensure that the crane will not be overloaded by operating conditions.
- Instruct workers to plan lifts before starting them to ensure that they are safe.
- Tell workers to take additional precautions and exercise extra care when operating around power lines.
- Teach workers that outriggers on mobile cranes must rest on firm ground, on timbers, or be sufficiently cribbed to spread the weight of the crane and the load over a large enough area. (Some mobile cranes cannot operate with outriggers in the traveling position.)
- Direct workers to always keep hoisting chains and ropes free of kinks or twists and never wrapped around a load.
- Train workers to attach loads to the load hook by slings, fixtures, and other devices that have the capacity to support the load on the hook.
- Instruct workers to pad sharp edges of loads to prevent cutting slings.
- Teach workers to maintain proper sling angles so that slings are not loaded in excess of their capacity.
- Ensure that all cranes are inspected frequently by persons thoroughly familiar with the crane, the methods of inspecting the crane, and what can make the crane unserviceable. Crane activity, the severity of use, and environmental conditions should determine inspection schedules.
- Ensure that the critical parts of a crane—such as crane operating mechanisms, hooks, air, or hydraulic system components and other load-carrying components—are inspected daily for any maladjustment, deterioration, leakage, deformation, or other damage.

A competent person should conduct inspections of slings before and during use, especially when service conditions warrant. In addition, you must ensure that workers observe the following precautions when working with slings:

- Remove immediately damaged or defective slings from service.
- Do not shorten slings with knots or bolts or other makeshift devices.

- Do not kink sling legs.
- Do not load slings beyond their rated capacity.
- Keep suspended loads clear of all obstructions.
- Remain clear of loads about to be lifted and suspended.
- Do not engage in shock loading.
- Avoid sudden crane acceleration and deceleration when moving suspended loads.

9.1 Handling dangerous chemicals

Here are some ground rules that can be useful to have while at work to ensure safe handling of chemicals:

- Keep track of which chemicals are being used in the business. Keep a list of the substances, the amounts being used and the risks associated with them.
- This also applies to gathering information and distributing it to those who need it. Current safety data sheets are one condition. Read more in Safety data sheets. There may be a need for special instructions and training to assure safe handling. To understand the risks it is often necessary to carry out an overall risk analysis.
- Storing and using chemicals in a safe way is a further foundation for working with chemicals.
- In continuing risk reduction work it is necessary to decide whether a particular chemical is really needed. In many cases there can be another substance that is less hazardous to health and the environment, or perhaps a different method, see more under substitution.

Things to remember when storing, labelling, handling and personal hygiene

Storage

- All chemical products must be stored and labelled in accordance with the instructions on the safety sheet.
- Chemicals must not be stored together with inflammable material and gas cylinders.
- Do not store acids and alkalis together.
- Do not store strong acids and organic substances together.
- Do not store strongly oxidising substances together with oxidisable substances.
- Ethers and other peroxide-building substances must be stored in the dark and cool, in tightly sealed containers.
- Chemical containers must be stored with closed lids when they are not being used.
- Refrigerators and freezers for storage of chemicals must be of such a type that is specially made for this purpose. Chemicals and similar items must not be stored in refrigerators or freezers that are intended to store food.
- Chemical stores must not have open floor drains. If there is a floor drain, it must be equipped with protection to prevent leakage. This means for example tight fitting lids, a manual opening and closing function in the drain or other comparable arrangement.
- Equipment for handling and cleaning up spillage must be in readiness and suitable for the chemicals that are stored. It is suitable to have equipment placed outside the chemical store.

- It is important for the fire classification of storage lockers and rooms to match the types and amounts of chemicals stored therein.
- Combustible material must be stored in fireproof cupboards or in separate spaces.

Labelling

- Chemicals must normally be stored in their original packaging. If you need smaller amounts of a chemical, the new packaging must be suitable for the substance. Labelling must be in accordance with the original packaging. It must always be possible to know what substance the packaging contains and what risks there may be.

Handling of chemicals

- Always read the safety data sheet and the text on the packaging carefully when you are about to use a product with which you are not completely familiar with the risks. Contact the environmental co-ordinator if you are unsure about handling methods.
- Use personal protection equipment (e.g. gloves, face mask) where necessary.
- Surplus chemicals and hazardous waste must be dealt with in accordance with the information in the safety data sheet.
- First Aid equipment must be available.
- Workplaces must be cleaned regularly. There must not be chemical spills on the floor.

Personal hygiene

- Smoking is forbidden in the factory area outside specially assigned smoking areas. If you smoke, remember to wash your hands before lighting up a cigarette. Otherwise chemical substances can be transferred by skin contact or breathed in.
- Immediately wash off chemical traces from the skin. Read the safety data sheet or ask your immediate superior if you are not sure what needs to be done.
- Food products must not be stored or eaten in premises where chemicals are handled.
- Work clothes must be kept clean. If you have been in contact with chemicals, take a shower before you go home.

Some rules concerning handling chemicals

- In accordance with the product choice or substitution principle such chemicals that can be replaced by those that are less hazardous should be avoided.
- Chemical products that are hazardous to health or are inflammable must be listed.
- There must be a safety data sheet for every chemical products that is hazardous to health or environment or is inflammable.
- The risks associated with the use of chemicals must be continuously examined, assessed and minimised. The results must be documented. The regulations apply to permit and notification requirements in the case of environmentally hazardous activities.

10. Emergency response

Emergency response is action taken in response to an unexpected and dangerous occurence in an attempt to mitigate its impact on people or the environment. Emergency situations can range from natural disasters to hazardous materials problems and transportation incidents. Emergency response may refer to services provided by emergency and rescue services agencies, as well as the plans made and actions taken within an organziation to respond to emergencies. Emergency response plans are an important component of workplace safety.

10.1 Emergency response plan

An emergency response plan is important for any organisation handling potentially polluting substances. An effective ERP means being well prepared for accidents and emergencies. It should include:
a. An assessment of risk scenarios leading to spills and the probable impacts
b. Site incident response manuals, including the provision and maintenance of relevant Material Safety Data Sheets (MSDS) in locations accessible to incident management staff.
c. Staff training in incident response protocols.
d. Continuous availability of suitable equipment to protect workers and mitigate the effects of chemical spills.
e. Installation and maintenance of warning and emergency contacts signage. All chemical containers should be labelled with the contents and supplier's safe use instructions.
f. Plans for containment and disposal of contaminated fluids if there is a large spill or fire. Plans should be available for site drainage systems and where they discharge should be defined.

Content of emergency response plan (ERP)
The following details should be included in the ERP:
a. Purpose of the plan.
State the aim, objectives, application and extent of the plan.
b. A contaminant inventory.
This details the types and quantities of chemicals/contaminants stored or handled on-site. A MSDS for each chemical should be available.
c. A site layout diagram.
This should show the location of contaminant storage and use points, emergency equipment (including fire control), access ways, escape paths and assembly points.
d. Description of potential emergencies
Determine what incidents are likely to occur and the associated possible impacts both on and off the site. Contaminant pathways to environmental receptors should be determined. Define the actions that may aggravate or limit the environmental impacts. Develop action plans for each scenario. Action plans should include both on-site and off-site mitigation measures such as working with Government agencies to block stormwater drains.
e. Risk assessments
These should be prepared by defining incident triggers, the probable frequency of a spill occurrence (eg once a year), the probable scale of an incident and the impact thresholds i.e. the concentration of chemicals that may cause pollution. Factors such as dilution, soil filtration and stormwater impact should be considered and applied in a conservative manner. Importantly there are considerable penalties under the Environmental Protection Act 1986 for unlawful discharges and pollution.
f. Employee safety the prime concern
Adequately trained and equipped staff should respond immediately to contaminant spills. All other staff, in response to an alarm, should evacuate the area to a designated

safe zone or as directed by the agency that has taken charge of the emergency response such as the Fire and Emergency Services Authority.

g. Allocate responsibility

An Emergency Response Manager (ERM) should be appointed to implement the emergency response plan . The roles of key support staff could be defined using a flow chart. Ensure all staff are effectively trained to carry out their assigned function. A 24-hour roster should be available so trained staff can respond at any time.

h. Communications

An effective communications system is essential. Individual action cards should be prepared for personnel with roles and responsibilities under the emergency response plan.

i. Backup resources

Trained staff and equipment should always be available to deal with emergencies. Such equipment may include personal protective gear, monitoring equipment, absorbent litter or sand, fire-fighting equipment, access to earth-moving machinery and waste containment skips. Where necessary, stand-by contracts should be arranged and contacts defined for those expected to fulfil the emergency response role.

j. Test emergency procedures

The emergency response plan should be periodically tested to ensure the organisation is prepared, and response procedures work in an adequate and timely manner.Changes to the emergency response plan should be made if tests demonstrate procedures can be improved. Exercises can include desktop incident simulation, practice evacuations, communication system tests and team training.

k. Notification of authorities

Procedures for contacting emergency services, and regulatory agencies in the event of significant emergencies should be defined including who will contact the emergency services, under what conditions and the relevant all hours phone numbers. Examples of those to be contacted include: the Fire and Emergency Services Authority, police, ambulance, this Department's Response and Audit Branch or our nearest regional office in remote areas , water services authority and local government.

l. Notification of neighbours

A contact list of neighbours and the circumstances under which they need to be notified should be maintained. A cooperative approach can assist in an emergency response situation.

m. Evacuation

In situations where people's health or well-being may be at risk, a procedure should be prepared describing who, when, where, and how people will be evacuated and accounted for and how the evacuation protocol applies. Periodic evacuation drills are recommended.

n. Incident Investigation

Staff should report both actual incidents and near misses to the designated ERM. An incident review should follow to assess and correct any procedural defects discovered during the emergency.

o. Media interest

Effective media communication (press, radio, television and Internet) can be a key element both in implementing the emergency response plan for major incidents and dealing with community interest during and after the incident. Adequate attention should be given to this issue prior to an incident occurring so the site operator is seen to be an honest, competent, caring and valued member of the community.

10.2 Emergency response in case of fire due to hazardous goods

Locating the fire

Firstly, locating the fire is of extreme importance because if successfully achieved, it will enable the crew member to assess the situation and conduct his response. The fire can be discovered by the crew member or detected by special equipment. Early detection or discovery provides quick information concerning, not only the place of the fire but also, possibly, its nature. Early detection is of prime importance. This will enable the selection of an adequate and feasible response. The crew member has various methods and pieces of equipment at his disposal for this purpose.

The location of the fire is very important, as it dictates not only the access to the fire for the fighting operation but also the way to escape in case it has to take place. For example, a fire on the main deck is probably less dangerous, considering the accessibility, than one in a cargo hold. The location of the fire also determines the appropriate extinguishing agent to fight it . For example, a cargo hold fire is fought with CO2 while a fire in the accommodation, unless involving electricity, is usually fought with water. Furthermore, knowing the location of the fire helps to identify what can be threatened or persons in danger if the fire should spread.

The nature of the fire determines the fighting agent that is to be used to extinguish the fire. Cooling the burnt material below its ignition temperature fights fires in bedding, or clothing, known as class A fires. Meanwhile, fire in flammable liquids, known as class B fire, is dealt with by cutting off the supply of air. Class A fires are mostly fought by water while class B fires are fought by the use of water fog, foam, carbon dioxide or other gases such as halotrone and argonit, and dry chemicals.Therefore, ignorance and misjudging of the nature of the fire could easily promote its spreading by undertaking inappropriate action.

Several methods can be used to locate the fire. One method is to touch a compartment door or a bulkhead with a bare hand to check for temperature. If it is hot, it means that it is heated by a fire from behind. The presence of discoloured or blistering paint found on a bulkhead may also indicate that fire is present behind it. In addition, if smoke can be observed passing through wiring holes or other routes such as portholes or zipping under a door, it means that fire is present behind. Furthermore, if unusual noise can be heard, it is a possible indication that fire may be present.

Some precautions should be considered when trying to find the location of a fire. If there is a suspicion that a fire may be hidden behind a compartment door, it is imperative not to open the door during the first response to prevent explosion due to demand of O2 of the fire. The person has to be equipped with charged hose line at hand, which is not to be performed during this immediate response. In addition, it is vital that the crew member does not persist in trying to find the location of the fire if it is likely to put his life in jeopardy.

Serious fires are often the result of small fires, which have not been detected and acted upon quickly, and which, reaching dangerous proportions, overpower the ability of personnel. Therefore, it is right to mention that with a quick use of appropriate methods using adequate equipment, a disaster can be prevented if early fighting can be conducted. However, it is important to mention that if the attempt to locate the fire fails or is delayed, a quick activation of the alarm should be conducted

Sound the alarm

Sounding the alarm is the next step that is to be followed after the fire is located or after an attempt to locate the fire is undertaken. The purpose of sounding the alarm is to give warning to other people onboard. For sounding the
alarm to be effective, it must be sounded as early as possible, and must be heard by everyone on board throughout the ship. Early sounding of the alarm is necessary to give enough time for crewtoget prepared to tackle the fire or escape if it is needed.

Attempt to fight the fire if possible

The person who discovers the fire should assess the situation very quickly before acting. It is very important to contain the fire, but he has to assess whether it is safe for him to attempt to fight the fire alone or not. The attempt to fight the fire has to be conducted with portable fire extinguisher or other items readily available such as blankets.The person who will try to extinguish the fire must identify the hazardous material that is on fire and use the appropriate mean to put out the fire. In conclusion, if the crew member who discovers the fire judges that he is able to extinguish it with the available equipment, an attempt is to be undertaken. There are cases on record where a crew member tried to tackle fire situation unequipped and lost his life when trying to be a hero.

Evacuation of areas in the event of fire that emits toxic gas should be addressed in an emergency evacuation procedure. This should specify designated safe areas, assembly points and toxic gas shelters.

Report the fire

Reporting is made to the bridge and more precisely, to the officer of watch. This last step on the discovery of the fire is very important because it provides information on the fire in order to choose appropriate plan for the fighting operation. This information includes the location of the fire, the type of fire to be expected, and its extent. A report shall also include general information of the situation such as threat of spreading or endangered persons. However, the reporting has to be as brief as possible. The master should also inform local authorities and emergency services if the hazardous good that is on fire needs special treatment.

10.3 Emergency response in case of environmental pollution

Type of contaminant spill posing an environmental concern

The risk that contaminants pose to water resource quality and values varies based on factors including the nature of the contaminant and its toxicity to living things, the spill volume, timeliness and effectiveness of spill management measures, contaminant's persistence in the environment whether it will evaporate, be filtered out in soils, degrade on contact with soil micro-organisms, or move under the influence of gravity or rainfall to cause harm, location of the spill relative to sensitive receptors in the environment mobility of the contaminant, whether the contaminant will react with substances present in the environment and the subsequent outcome and risk of downstream harm to living things from exposure to contaminant residue.

The objectives are to prevent, reduce and mitigate the damage to the environment. To do this a comprehensive emergency response plan should be prepared, maintained and used by anyone handling, managing or using toxic or hazardous substances. It should be easy to read, logically formatted and provide sufficient detail.

The emergency response plan should establish any necessary links between site emergency response protocols and the State's emergency management structures and advisory committees.

Operational plans should ensure that the user is able to quickly and effectively respond in the event of a contaminant spill or other serious emergencies. The effectiveness of an emergency response system depends on the documentation of the response process, the availability of adequate resources and training of those responsible for its implementation. The plan should support the concepts of spill Prevention, Preparedness, Response and Recovery.

The emergency response plan should be periodically reviewed (at least every five years) to ensure it remains up to date and effective. The most important concern after making the site safe should be to contain then recover as much of the spilt chemical as practical prior to any escape of residues into the environment. The main emergency response plan steps are:

Prevention.

The site operator should aim to eliminate or reduce the probability of an unplanned release of contaminants and reduce the degree of damage that could occur to the environment. In situations where a spill risk exists, the following management measures should be arranged:

a. Use chemical alternatives. Where practical substitute a chemical that has a lower toxicity, mobility in the environment or persistence in toxic form.

b. Store chemicals on hardstand flooring on safe racks or pallets in secure and weatherproof buildings.

c. Place spill risk facilities away from sensitive environments with a sufficient buffer to allow for effective intervention prior to water pollution occurring.

d. Use secondary spill control facilities such as bunded containment compounds.

e. Avoid risk related activities at times when weather conditions may magnify any harm caused by a spill.

f. Where practical, ensure all drainage structures can be sealed to halt the passage of spilt fluids.

g. Ensure all employees and contractors are trained on safe procedures and good environmental practice.

Response to incidents or emergencies

The type of response will depend on the nature and amount of substances discharged, the environmental values (water users and ecosystems) present in the surrounding area and the risk of transmittal of the hazard to a receptor. Emergency response can be managed using a three-tier impact classification system based on a risk assessment of the potential severity of environmental impact. The following three-tier Impact Classification (high, moderate and low) is aimed at indicating the severity of the incident, so that appropriate resources can be deployed in response to the emergency.

a. High Impact Incident.

This applies to any one or more of the following situations:

•There is a significant and immediate threat to human life or property.

•Located within any proclaimed Public Drinking Water Source Area, including Underground Water Pollution Control Areas, declared Catchment Areas and Water Reserves.

•Could result in significant or immediate harm to native fauna and flora.

•Observable harm has occurred to environmental receptors eg fish deaths.

•Located within water catchments that have recognised conservation or scientific values.

•The incident has the potential to persistently contaminate soil or water resources.

b. Moderate Impact Incident.

Thisapplies to any one or more of the following situations:

•There is a significant (but not immediate) threat to human life, amenity or property.

•Located outside any proclaimed Public Drinking Water Source Area, but within close proximity to private water supply sources.

•Chronic or long-term harm to native fauna and flora may result.

•Long-term (but not immediate) observable impact may occur to environmental receptors.

c. Low Impact Incident.

This applies to any one or more of the following situations:
•No perceived threat to human life or property.
•Located outside sensitive environments eg areas with recognised water resource values.
•Poses no immediate or long-term threat to environmental receptor.

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