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Dangerous goods transportation in inland waterways: case study : Indonesia waterways

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DANGEROUS GOODS TRANSPORTATION IN INLAND WATERWAYS

Case Study: Indonesia Waterways

By

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Declaration

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

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

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Abstract

Title of Dissertation: **Dangerous Goods Transportations in Inland Waterways: A case study for Indonesia waterways**

Degree: **MSc**

In archipelagic countries, like Indonesia, RoPax ferry service will be a catalyst for the growth of the area because low transportation costs will increase the competitiveness of the area so that exports and imports from the area will increase. However, accidents involving domestic RoPax ferries in Indonesia have resulted in catastrophic consequences of loss of life and damage to property. One of the causes of accidents in RoPax ferries that has resulted in catastrophic consequence is the mishandling of dangerous goods. By its nature, transportation of dangerous goods by domestic ferry can be considered as one of the most dangerous maritime transport forms because a single accident involving a domestic RoPax ferry that carries dangerous goods and passengers at the same time, can cause both environmental catastrophe and severe human casualties.

The purpose of this research is to determine how the process of handling and transporting dangerous goods in domestic inland waterways has been implemented by the port authority in Indonesia and the RoPax ferry crews. Furthermore, this study will evaluate how the procedures of dangerous goods handling in domestic RoPax ferry operation have been implemented by port authorities, shippers, forwarding, agents and passengers.

This research, describes the handling process of vehicles with dangerous goods in Merak Port, Ketapang Port and Bajoe' Port in Indonesia. Through this research, it was found that Ketapang Port and Merak Port have procedures for handling dangerous goods developed based on technical guidance from PT. ASDP Indonesia Ferry. However, many violations are committed by officers in the field during the implementation of these procedures. In addition, the limited facilities owned by the ferry port and RoPax ferry, have made it difficult to implement the existing procedures, especially to fulfil the segregation procedure for vehicles carrying dangerous goods.

In the concluding and recommendation chapter, relevant recommendations are developed, which could be a reference for the improvement of safety in dangerous goods handling in Indonesian domestic ferry operation. Some recommendations are to improve regulations and procedures related to dangerous goods handling in domestic RoPax ferry operation. Additionally, some recommendations are related to the improvement of port facilities

KEYWORDS: RoPax ferry, Inland waterways, IMDG, dangerous goods, Crossing Port

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BMKG	:	Indonesia Meteorological, Climatological, and Geophysical Agency
DGLT	:	Directorate General of Land Transportation
GRT	:	Gross Tonnage
IBC	:	Intermediate Bulk Container
ILO	:	International Labour Organization
IMDG	:	International Maritime Dangerous Goods
IMO	:	International Maritime Organization
ISGOTT	:	International Safety Guide for Oil Tankers and Terminals
LPG	:	Liquefied Petroleum Gas
MARPOL	:	International Convention for the Prevention of Pollution from Ships
MoT	:	Ministry of Transportation
NTSC	:	National Transportation Safety Committee of Indonesia
RoPax	:	Ro-ro Passenger
SOLAS	:	The International Convention for The Safety of Life at Sea
UN	:	United Nations

1 INTRODUCTION

1.1 Background

In allocating resources between islands, the Ro-ro Passenger (RoPax) ferry has been an affordable and reliable mode of transport since the 19th century. Ferries form a part of the public transport systems of many waterside cities and islands, allowing direct transit between points at a capital cost much lower than bridges or tunnels and making ferry transport useful for inland waterways. RoPax ferries are considered the most successful operation in the world from the point of view of service reliability; capacity carried and flexibility in operation (IMO, 2012).

For archipelagic developing countries, especially Indonesia, domestic ferries play a significant role in the regular inland waterway transportation of numerous passengers and cargoes. The common ferry type used in developing-archipelagic countries is the RoPax ferry. RoPax ferries typically carry passengers, vehicles and cargo at the same time. There are so many types of cargo carried by land transportation vehicles through domestic ferries and one type of cargo is dangerous goods. Dangerous goods are commonly known as hazardous materials, and include flammable, explosive, radioactive, oxidizing, corrosive, toxic, pathogenic or allergenic substances.

The transport of dangerous goods between islands in Indonesia is done by domestic RoPax ferries which, simultaneously, carry passengers between islands. By its nature, transport of dangerous goods by domestic ferry can be considered as one of the most dangerous maritime transport activity because a single accident involving a domestic RoPax ferry that carries dangerous goods and passengers at the same time, could cause both environmental catastrophe and severe human casualties. More than 10 thousand substances are classed as

dangerous goods that can cause the death of people, environmental disaster or destruction of properties if mishandled (ILO, 2004).

One example of an accident that was caused by the mishandling of dangerous goods was the grounding of the MV. Levina I, a RoPax ferry, on the shore of the Java Sea. As a result, 50 lives were lost and there was a total loss of cargo onboard. From the investigations and research conducted by the Indonesian National Transportation Safety Committee (NTSC), the fire occurred on the main car deck and then spread to other parts of the ship. This fire began when a truck carrying flammable cargo was exposed to high temperatures and self-ignited (NTSC, 2007).

Indonesian Government Regulation No. 20 from 2010, concerning Inland waterways transportation, states that transportation of dangerous goods must be conducted in accordance with the provisions of the Indonesian legislation and that special ships with a special design and meeting specific requirements must be used.

Handling, stacking, stowage, loading and unloading of dangerous goods to and from such ships should be done by workers who have the competency and are equipped with safety equipment. Furthermore, the shipping company transporting dangerous goods via domestic ferry must inform the port officer and harbour master before loading special goods, vehicles and dangerous goods or entering the port limit.

The existence of hazardous cargo in vehicles boarding the ferry for transhipment causes difficulties in surveillance and precise inspection of hazardous cargo. Furthermore, cargo owners' awareness of the damage that dangerous cargo can cause is still very low. They often do not comply with the regulations for transporting dangerous goods. For example, the owners of dangerous goods do not properly classify their cargo as dangerous cargo and do not clearly identify it as such by displaying the appropriate dangerous goods safety mark, label or placard.

To ensure the safety and security of domestic ferry transport services, port authorities have developed handling procedures for dangerous goods carried by RoPax services. However, the procedure developed by the port authority has not been supported by government regulation, creating some issues in its implementation.

1.2 Objectives and research questions

1.2.1 Objectives

Based on the background information described above, this research attempts to map the problems of dangerous goods carriage by domestic ferries in Indonesian inland waterways and define optimum solutions. For more specific objectives, the dissertation provides related information with regard to carriage of dangerous goods by domestic ferry, including:

a. To examine the current condition and regulation of the carriage of dangerous goods, as defined by the IMDG code, by domestic ferry in Indonesia;
b. To determine the gap between the current condition in Indonesia and optimal performance of dangerous goods carriage by domestic ferry;
c. To compare the current condition of dangerous goods carriage by domestic ferry in Indonesia with other countries (benchmarking);
d. To recommend optimum solutions for carrying dangerous goods by domestic ferry in Indonesia.

1.2.2 Research questions

The main questions that need to be addressed and answered in this study are:

a) What types of dangerous goods are most frequently transported using domestic ferries in Indonesia and how are they carried?
b) What is the existing legal and administrative framework for the handling and carriage of dangerous goods at domestic ports and on-board RoPax ferries and what is the degree of implementation of this framework?

c) How may the existing Indonesian legal and administrative framework for the handling and carriage of dangerous goods using domestic RoPax ferry be optimized?

1.2.3 Key assumption

A key assumption of this study is that by mapping the existing problems in the transport of dangerous goods by RoPax Ferry and finding the optimal solution, the risk of transporting dangerous goods by RoPax ferry can be minimized.

1.2.4 Potential limitations

The research method used to observe data and to facilitate analysis has some limitations including the following:

There are more than 30 domestic crossing routes in Indonesia, be they commercial or government subsidized. This study is limited to the three main crossing routes with the highest load factor (Merak – Bakaheuni, Ketapang – Gilimanuk and Bajoe' – Kolaka)

Furthermore, some data may have been withheld from the researcher due to confidentiality concerns on the part of respondents.

1.2.5 Expected result

After completion of this study, the author is expecting to map all existing problems in the transport of dangerous goods in Indonesia domestic ferry operation and to identify the optimum solution to minimize the risk of accidents caused by the transport of dangerous goods in Indonesia's inland waterways.

1.3 Research methodology

The process of the research will be divided into four (4) phases of work, namely (i) Preparation, (ii) Data collection, (iii) Analysis and (iv) Recommendation. Research methods that will be used in this research are a combination of the qualitative and quantitative method. Denzin and Lincoln (1998) defined “triangulation” as the combination of multiple methods in the study of the same object. Triangulation is a method used in qualitative research that involves cross-checking multiple data sources and collection procedures to evaluate all evidence and corroborate each other. Qualitative analysis of text is often supplemented with other sources of information to satisfy the principle of triangulation and increase trust in the validity of the study’s conclusions. The purpose of multiple sources of data is corroboration and converging evidence. The use of triangulation as a technique will increase the researcher’s scientific rigour because this technique may involve a variety of investigation techniques, theories or data. Furthermore, each phase will include several activities (tasks) to support the study.

i. Preparation

During this phase, the author will collect some preliminary data such as:

- Laws and regulations used as a reference (SOLAS, IMDG Code, Government Regulation No. 20, 2010, concerning inland water transportation and Government regulation no. 74, 2001, concerning management of dangerous goods)
- Literature related to management of dangerous goods and cargoes

ii. Data collection

Data collected consists of two kinds of data, namely primary data and secondary data.

- Primary data will be gathered from surveys, questionnaires, and interviews. Data required includes loading and unloading processes at the port of domestic ferry, existing condition of loading and unloading area of the port, existing conditions of road vehicles

carrying dangerous goods and procedures for handling dangerous goods at the domestic ferry port and onboard the ferry.

- Secondary data will be gathered from documents of port operation and ferry operation. Data will be collected from PT. ASDP Indonesia Ferry and Ministry of Transportation.

When all the data required for the analysis has been collected, the next process is the compilation, processing and analysis of the data. Data processing will be done using Microsoft Excel Software.

iii. Analysis phase

In this phase, all primary and secondary data which had been obtained at the stage of data collection will be analyzed using qualitative methods. The analysis includes:

- Analysis of loading and unloading processes for dangerous goods at the domestic ferry port.
- Analysis of process of stowage and segregation of dangerous goods onboard ferry.
- Analysis of the procedures to be followed in planning, preparation, and accident prevention and in responding to accidents and other emergencies involving dangerous goods
- Analysis of obstacles/problems in the handling of dangerous goods at domestic ferry port and on board ferry
- Development of optimization models or processes

iv. Recommendation

The study results will be used as the basis for regulation and framework development of dangerous goods handling by domestic ferry transport.

1.4 Structure and organization

In order to effectively accomplish the objectives as stated above, this dissertation is arranged in several chapters. The first chapter focuses on the background of why this study needs to be performed. The objective, the scope and the methodology used in this study are also elaborated.

Chapter 2 covers the review of the literature on dangerous goods. The discussion covers the definition of dangerous goods, the types of dangerous goods and the issues concerning dangerous goods handling regulations.

Chapter 3 provides a discussion related to the research methodology and flowchart of analysis

Chapter 4 provides a discussion related to the existing condition of dangerous goods handling in the domestic port of Indonesia and on RoPax ferries. There is a review of the existing facilities and overview of the procedure.

Chapter 5 provides an analysis of the current status of Indonesia's performance with respect to the aspects described in chapters two, three and four.

Chapter 6 provides a discussion of the analysis result, focussing on the optimization of the existing Indonesian framework for dangerous goods handling for domestic RoPax ferries and solutions. This chapter also presents a conclusion and summary of the analysis and discussion. Several recommendations are made as a complement to the discussion.

2 DANGEROUS GOODS HANDLING AND POSSIBILITY OF HAZARD

2.1 Definition of dangerous goods

In the maritime literature and legislation, expressions such as “dangerous cargoes and goods” and “hazardous material” can be seen. However, the diversity of terminology raises the question “What are the differences between these words and terms?” According to Smith (2014), a senior instructor and consultant on dangerous goods and Hazmat, “dangerous goods” and “hazardous material” are fairly interchangeable. To better distinguish between them in the transport chain, dangerous goods should be called “Dangerous Cargoes.” The International Maritime Organization (IMO) uses the phrase “dangerous goods/cargoes” in its documents, for example in the International Convention for the Safety of Life At Sea, 1974 (SOLAS), the International Maritime Dangerous Goods Code (IMDG) and the “Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas”. According to MSC.1/Circ.1216 about the “Revised Recommendations on The Safe Transport of Dangerous Cargoes and Related Activities in Port Areas”, IMO defines Dangerous Cargoes as:

> *“Any of the following cargoes, whether packaged, carried in bulk packaging or in bulk within the scope of the following instruments:*
>
> *A. Oils covered by Annex I of MARPOL 73/78;*
>
> *B. Gases covered by the Codes for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk;*
>
> *C. Noxious liquid substances/chemicals, including wastes, covered by the Codes for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk and Annex II of MARPOL 73/78;*

D. *Solid bulk materials possessing chemical hazards and solid bulk materials hazardous only in bulk (MHBs), including wastes, covered by group B schedules in the Code of Safe Practice for Solid Bulk Cargoes (BC Code);*

E. *Harmful substances in packaged form (covered by Annex III of MARPOL 73/78); and*

F. *Dangerous goods, whether substances, materials or articles (covered by the IMDG Code).*

The term "dangerous cargoes" includes any empty uncleaned packaging (such as tank-containers, receptacles, intermediate bulk containers (IBCs), bulk packaging, portable tanks or tank vehicles) which previously contained dangerous cargoes, unless the packaging have been sufficiently cleaned of residue of the dangerous cargoes and purged of vapours so as to nullify any hazard or has been filled with a substance not classified as being dangerous".

In SOLAS Chapter VII regulation 1 dangerous goods defines as the substances, materials and articles covered by IMDG Code and MARPOL Annex III Chapter 1 (General) regulation 1 defined harmful substances as those substances which are identified as marine pollutants in the IMDG Code or which meet the criteria in the appendix of Annex III MARPOL.

However, to simplify the definition of Dangerous Cargoes, we can define dangerous cargoes as substances which, due to their properties and or concentrations and/or quantities, may, either directly or indirectly, pollute and/or damage the environment, and/or adversely affect the health and survival of humans and other living organisms and cause damage to property.

2.2 The Classification of dangerous goods

At present, millions of harmful chemicals are listed on the world market and more than one hundred thousand of them are trade in the world market (Brunings, 2017). More than 10 thousand new chemicals are developed every year and about 2000 of them enter the industrial sector worldwide. The transport of dangerous goods by sea faces a significant problem as the quantity of dangerous goods shipped by sea has increased significantly, and the amount of cargo carried by ship exceeds land

transport. For example, chemical tankers can carry more than 2000 times the amount of cargo that land trucks carry.

It is important to classify dangerous goods into different classes based on the specific chemical characteristics producing the risk. On the basis of substance characteristics, United Nations (UN) experts on dangerous goods transport published the “Minimum Requirements for the Transportation of Dangerous Goods” in 1956. This book describes chemicals classed as dangerous goods and divides them into nine groups according to their characteristics. These groups are the following:

a) Explosives

b) Gases

c) Flammable liquids

d) Flammable solids

e) Oxidizing substances

f) Poisonous substances

g) Radioactive materials

h) Corrosives

i) Miscellaneous dangerous goods

However, to simplify the grouping of dangerous goods, the types of dangerous goods based on their origin and characteristics can also be classified as follows:

a) Oil by-products – Fire and explosion are their main risk (Benzenes, liquefied petroleum gas and other fuel products)

b) Chemical products (industrial, pharmaceutical and agricultural) - Manufactured and loaded either as final product for consumption or as by-products for industrial use. The latter are the majority of the dangerous goods transported and could cause great damage to people, transport units and the marine environment.

c) Minerals – Such as coal, sulfur, mineral concentrates and other metals or asbestos which can cause many types of illnesses, toxification or fire.

d) Products of animal or vegetable origin – Such as fishmeal, pressed cakes of oleaginous seeds and cotton, which can cause spontaneous combustion, fire or explosion.

e) Radioactive materials – Used in a variety of industrial and medical processes, as well as for military applications. These could cause cancer and other critical illnesses with prolonged exposure.

Dangerous goods that subject to the IMDG code are assigned to one of the classes, 1 – 9, according to the most predominant hazard they present. The classification is made by the consigner/shipper or by the competent authority. The IMDG Code classifies dangerous goods as follows:

1. Class 1: Explosives

2. Class 2: Gases

3. Class 3: Flammable liquids

4. Class 4: Flammable solids; substances liable to spontaneous combustion; substances which, in contact with water, emit flammable gasses

5. Class 5: Oxidizing substances and organic peroxides

6. Class 6: Toxic and infectious substances

7. Class 7: Radioactive material

8. Class 8: Corrosive substances

9. Class 9: Miscellaneous dangerous substances and articles

The numerical order of the classes and divisions does not indicate the degree of danger (IMO, 2014).

2.2.1 Description of classes

In this section, the five main groups of hazardous chemicals that are regularly transported by sea are described. The five groups include: flammable substances, oxidizing substances, radioactive substances, corrosives and poisonous substances.

a. *Flammable substances*

   According to the dictionary, the words “flammable” and “inflammable” are synonyms and refer to the ability of substances to burn. Flammable substances can be gases, liquids and solids that will ignite and burn in air if exposed to an ignition source. Many flammable and combustible liquids and solids evaporate quickly and continually give off vapours. The rate of evaporation varies greatly from one liquid to another and increases with temperature.

b. *Oxidizing substances*

   Oxidizing substances are substances that release oxygen and can trigger fire when decomposing. The combination of flammable and oxidizing materials can be dangerous because this combination can create an explosion.

c. *Radioactive substances*

   A radioactive substance is an unsteady substance that produces dangerous radiation. This substance is unsteady because the strong nuclear force that holds the nucleus of the atom together is not balanced with the electric force that wants to push it apart. If exposed to high doses of radiation, human tissue can be burnt and such radiation can also generate cancer in humans.

d. *Corrosives substances*

   Corrosive substances are substances that will damage other substances with which they come into contact. They cause chemical burns on contact with human bodies and can lead to complications when consumed. These substances will damage other substances such as metals and plastic.

e. *Poisonous substances*

A poisonous substance is any substance that causes injury or illness or death of a living organism by skin contact, swallowing or inhalation. The effect of these substances can be mutable or permanent. For example, the absorption of a small amount of *methanol* can cause respiration problems and, at the same time, can cause permanent blindness.

2.2.2 Packaging of dangerous cargoes

The IMDG Code defines “packaging” as

“one or more receptacles and any other components or materials necessary for the receptacles to perform their containment and other safety functions”

As mentioned in IMDG code section 1.2.1, packaging have different meaning with packages. Packages defined in IMDG Code as complete product of the packing operation that consisting of the packaging and its goods ready to transport.

The packaging of dangerous cargoes, such as steel drums, plastic drums, plastic bags and various boxes, is carefully designed to ensure that the contents are completely safe during land and sea transport. However, with the exception of some packaging of radioactive materials and infectious substances, they are not designed to deal with accidents, such as high-speed crashes or overheating in car fires. It is essential to ensure that the packaging of dangerous cargo is safe even if the vehicle collides or crashes. Strong packaging is also required to prevent friction or breakage between the packs during transport, which may cause damage or leakage. It is important that packaged dangerous goods be checked before loading and that those which show signs of damage or leaks are not loaded.

a. Gas Cylinder

The gas cylinder is a very strong packaging, allowing it to hold the gas pressure safely inside but, for this reason, the gas cylinder is also very heavy. The best way to carry gas cylinders is on a shelf in the vehicle, in the storage (crib) or in a frame that can be opened and closed. If transported one by one, gas cylinders must be secured with a rope or chain to prevent movement in the cargo space, which may cause damage to the cylinder itself, or to other cargo items. Gas cylinder valves shall be protected by fittings such as rings or lids. Otherwise, if the valve is

damaged, the gas coming out under pressure may move the container with great force. In accordance with the technical guidance of LPG transportation with land transportation modes issued by the Ministry of Energy and Mineral Resources, gas cylinders should be transported in an open vehicle. If a small number of cylinders is transported in a closed van, there must be adequate ventilation in the load space. Toxic gases should never be transported in the same space as the driver or the crew. LPG cylinder (with Liquefied Petroleum Gases such as butane and propane) must be transported separately, in order to prevent malfunction of any loose equipment in direct contact with Liquefied Gas.

b. Intermediate Bulk Container (IBC)

An Intermediate Bulk Container (IBC) is a semi rigid/semi-flexible portable packaging with a capacity of up to three cubic meters designed for mechanical handling. IBC can transport between 0.5 and 2.5 tons of material, including liquid, small granules or powder and may be equipped with a pallet-type base or with straps for forklift handling. IBCs should be loaded safely in vehicles; for example, each IBC can be secured with a chain, strap or clamp. IBC should be checked prior to loading to make sure the item is in good condition and no leakage occurs, especially around the connection to fill and remove it.

c. Large Packaging

Larger packaging consists of outer and inner packaging materials, as opposed to bulk material. This large packaging is designed for mechanical handling and has a capacity exceeding 3 cubic meters. Its use is limited to certain materials and it needs to be loaded with the same precision as the IBC.

d. Freight Container

Freight containers are manufactured according to international standards for delivery via multi-modal transportation, such as combined land, rail and sea transport. As with all other cargoes, containers must be loaded safely to prevent damage and leakage of hazardous materials. This is important for sea transport, where containers onboard ships may be exposed to great forces due to long-wave action. The separation of incompatible materials in containers is strictly regulated

under the International Maritime Dangerous Goods Code (IMDG Code). Further guidance on this issue is given in Health and Safety Guidance Safety Executive Manual 78 "Hazardous Goods in Cargo Transportation Units-Packaging and Transport for Marine Transport".

2.2.3 Dangerous goods handling in port

The port is the most important link in the multimode transportation of dangerous goods. This is, firstly, because the port is an interface between inland transportation modes, such as roads and inland waters, and, secondly incorrect handling of dangerous cargoes has a great impact on the safety of people and environment.

The continuous increase in quantity and variety of dangerous goods carried by sea has brought consequences for ports. In the last two decades, ports have been subject to extreme changes due to innovation in transportation and ship design, such as RoPax ships, containerization and terminals for solid, liquid and gas bulk (IMO, 2007). The impact caused by these innovations and also the improvement of regulations for the safe transport of dangerous goods has been different for every ports, especially when comparing ports from developing and developed countries.

To ensure safe handling of dangerous goods in port areas, the port must set up:

1) Terminals and warehouses

   The port as a service centre must have adequate facilities to handle dangerous cargo, such as reception, loading and unloading, storage and dangerous good segregation. Based on the revised recommendation in 2007, the port should have facilities to support the handling of dangerous good and, in developing the facilities, attention should be given to the following matters:

   - Protection of health, property and environment
   - Other hazardous installations in the surrounding area
   - Population density in the area under consideration, including vulnerability of the population
   - Ease of evacuation

- Emergency services and procedures available
- Probability and possibility of an accident occurring and its effect on human health and environment.

2) Stowage and segregation rules

   Stowage and segregation are two operational activities at the port that are interconnected with one another.. The purpose of stowage and segregation operations is to ensure the safety of dangerous goods handling at the port for people, environment and port facilities.

3) Emergency response plan

   Emergency situations caused by mishandling of dangerous cargo may vary, ranging from minor daily incidents to large accidents that can cost lives and material losses. Mishandling of dangerous cargo can result in various consequences, so the port authority needs to prepare an effective emergency plan to minimize the consequences arising because of mishandling of dangerous cargoes

Furthermore, the port authority and administrator should improve their facilities and administration. They must adopt new operation procedures, train workers, and invest in special equipment to handle dangerous cargoes.

Ports around the world should improve their safety requirements by following International regulations and standards. IMO issued a recommendation in 1973 under the name "Recommendations on Safe Practice of Dangerous Goods in Ports and Harbours" which has been adopted by Resolution A.289 (VII). The recommendations are always updated and have been revised several times to follow technological developments and chemical substances updates. The latest update issued by IMO was in 2007 by Maritime Safety Committee Circ. 1216, "Revised Recommendation on The Safe Transport of Dangerous Cargoes and Related Activities in Port Areas". The Recommendations are associated with the IMDG Code in particular and also with other dangerous goods not covered by IMDG Code. It is important to harmonize the

rules within the port area and the ship in order to guarantee safe operations and to avoid misinterpretations between ship and port.

2.3 Possible danger from mishandling of dangerous cargoes

The mishandling of dangerous cargoes can cause many types of accidents such as fire, explosion, contamination and radiation. Furthermore, mishandling of dangerous cargoes can kill humans and other living organisms, destroy the environment by water pollution, destroy property and affect the economy. This section will discuss the possible dangers caused by mishandling of Dangerous cargoes.

2.3.1 Pollution of water and ecosystem extinction

Chemical substances discharged into the water can cause ecosystem damage in various ways:

1. Gases spilled into the water initiate biological processes which consume the oxygen in the water.
2. Energy release causes water temperature to increase
3. Toxic substances on the water surface negatively affect marine life.

Pollution from chemical substances can be a direct effect or a long-term effect. While the direct effect has an immediate impact on the environment, the long-term effect influences the flora and fauna even after the pollution ceases to exist. Some chemical substances can be dissolved into the organic food cycle and affect fish and mammal' fertility and growth, physically disturb feeding, or cause contamination and accumulation of substances in the organisms.

2.3.2 Death and serious injury (contamination) in humans

Explosions, fires and toxic gasses of different chemicals are the main hazards that can cause death and serious injury to humans. The flashpoint and the right combination of air and gas are the main causes of combustion and explosions. The flashpoint of a flammable liquid is the lowest temperature at which it gives off sufficient vapour to form an ignitable mixture near the surface of the liquid (ISGOTT, 1996). Substances with low flashpoints are more dangerous than those with high flashpoints.

The temperature of flammable vapours is not enough to ignite a fire; a sufficient amount of oxygen must be also in present. The suitable concentration of vapour and oxygen is called the ”flammable range” (ISGOTT, 1996). The lower limit of that range means that there is an insufficient amount of hydrocarbon gas in the air to support and propagate combustion (ISGOTT, 1996). The upper flammable limit means that hydrocarbon gas in the air is above the flammable limit and there is not enough oxygen to support the fire. Flammable limits vary for different chemicals and physical conditions such as pressure, temperature and mixture (Bond, 1991). In practice the lower and upper limits of gas mixtures of oil cargoes are between one percent and ten percent of volume in the atmosphere (ISGOTT, 1996).

2.3.3 Damage to property and port facilities

In 2015 two massive explosions in the port of Tianjin, China, killed more than a hundred people, left hundreds more injured and devastated large areas of the city (BBC, 2015). From the investigation by State Council Investigatory Team, the cause of the accident was the spontaneous ignition of overly dry nitrocellulose stored in a container that overheated (Xinhua, 2016). Explosions and fires involving hazardous chemicals are the main reasons for damage to vessels and port structures. Especially dangerous are substances belonging to UN classes 1, 2, 3 and 4.

2.3.4 Economic impact

Pollution and accidents caused by mishandling of dangerous cargoes negatively affect the economy due to their high costs, which is can be divided into direct and indirect costs. While direct costs are related to the recovery of physical damage, reconstruction work, and also clean-up operations, indirect costs can be associated with the closure of affected areas for navigation, sea use and customer trust (tourist numbers decrease, 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 insufficient or the pollution claims are not accepted by the fund. In such a case, the money must be taken from the government budget which causes poor financing of some other area.

3 RESEARCH METHODOLGY

Chapter three will describe the work process that will be implemented to support this research. The flow chart of this work process is illustrated in Figure 3.1. In the flow chart, the implementation of the study is divided into 4 (four) stages of work, namely: (i) preparation, (ii) Data Collection, (iii) analysis and (iv) recommendations and suggestions.

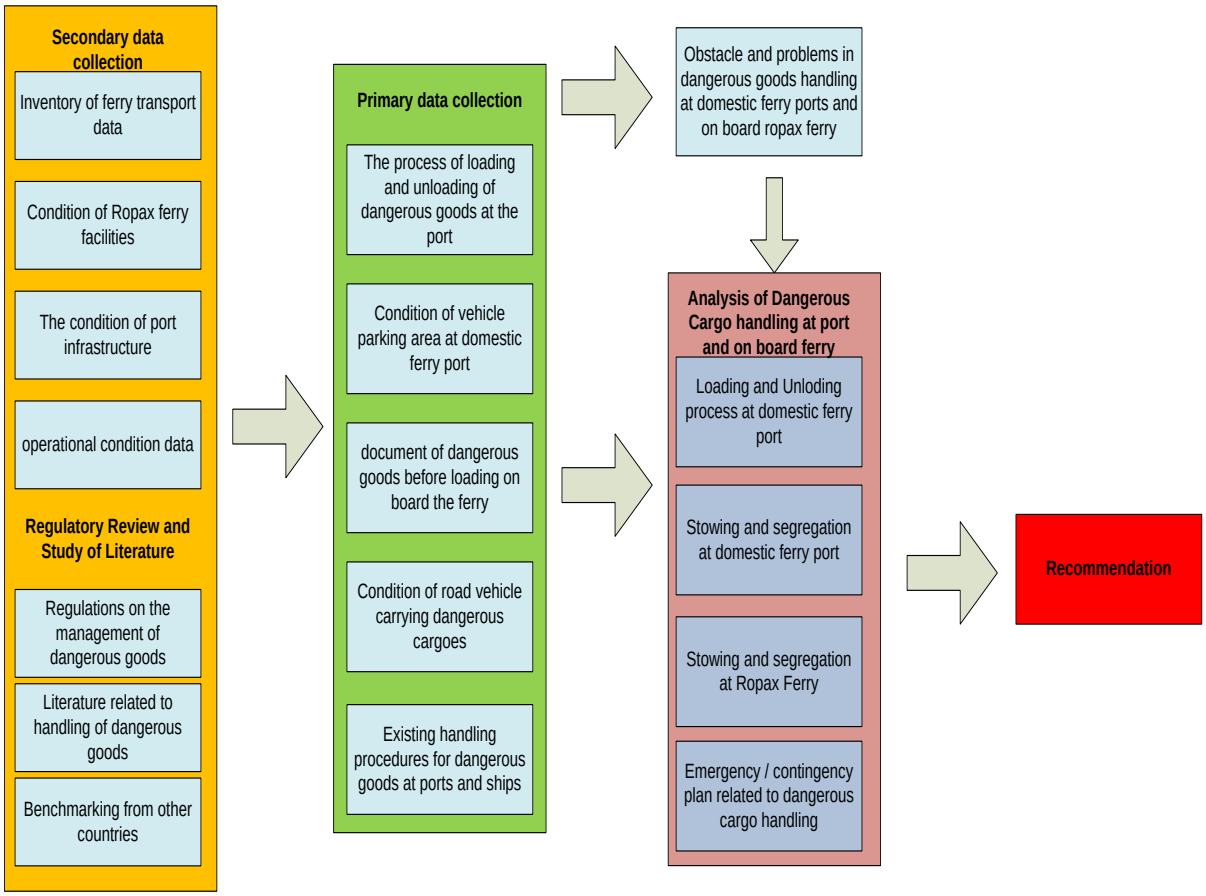

Figure 3-1 Research Flow Chart

3.1 Secondary data collection

The study process will begin with the collection of secondary data covering the inventory of previous studies, references, policies and plans of central / local governments and other relevant secondary data. Secondary data collection will be conducted at central government agencies through an institutional survey.

In this phase, some of the data has been collected from previous studies. Based on the secondary data, a review of the condition of transport and management of dangerous goods will be conducted.

Secondary data will be gathered from documents of port operation and ferry operation. Data will be collected from PT. ASDP Indonesia Ferry and Ministry of Transportation.

3.2 Primary data collection

Primary data will be obtained from field data collection. The main purpose of field data collection is to collect the data required for the analysis of the transport and handling of dangerous goods at ferry ports and on board RoPax ferries.

Data collection will be conducted at 3 (Three) ferry port locations:

a. Merak Ferry port at Banten

b. Ketapang Ferry port at Banyuwangi

c. Bajoe' Ferry Port at South Sulawesi

Field data collection can be conducted in the following ways:

a. Interviews via phone with ASDP (port authority) officer;

b. Data collection at the ASDP Branch Office;

c. Interviews with drivers and officers in the field.

d. Questionnaire forms for drivers and officers

Data collected from the field include:

a. Condition of ferry and port services

b. Condition of the RoPax ferry

c. Loading and unloading process at the domestic ferry port

d. Existing conditions of loading and unloading area of the port

e. Existing conditions of road vehicles carrying dangerous goods

f. Procedures for handling dangerous goods at the domestic ferry port and onboard ferry

g. Existing regulations from local port authorities

3.3 Inventory of obstacles and issues of dangerous goods handling

After the data needed for the analysis process has been successfully collected, the next process is to compile, process and analyse the data. To support data compilation, processing and analysis, data processing software (MS Excel) is used. An inventory of the obstacles and problems in the transport and handling of dangerous goods is required to improve the current system.

The inputs used in the inventory process include:

Portrait of operational conditions in the field of the transport and handling of dangerous goods;

a. The process of monitoring of dangerous goods;

b. Documents used in the process of transporting dangerous goods;

c. Local government policy on handling of dangerous goods;

d. Interviews with related parties in the field, such as: driver, shipping company and field officers

3.4 Analysis of dangerous cargo handling in port and onboard ferry

During this stage, an analysis will be conducted of the secondary and primary data collection results from the previous stage. Furthermore, this analysis identifies the obstacles and problems that occur when handling dangerous goods, mainly related to the transport and handling of dangerous goods in the Port and on board vessels.

3.4.1 Analysis of loading and unloading process of road vehicles with dangerous cargo in ports

An analysis of loading and unloading processes in the port is intended to determine the optimization of loading and unloading process of special goods and dangerous goods at the domestic ferry port with respect to security and safety aspects.

3.4.2 Analysis of stowing and segregation at domestic ferry port

An analysis will be carried out regarding how stowing and segregation of dangerous cargoes are executed in the port particularly under certain conditions, for example such as delayed ferry schedules due to bad weather

3.4.3 Analysis of stowing and segregation on board RoPax ferry

This analysis refers to conditions occurring in the field in accordance with existing procedures. The procedure will be compared with the existing regulations in the IMDG Code, 2016 edition, amendment 38-16 Part 7 chapter 7.5, which describes stowage and segregation on ro-ro ships. Actually, IMDG Code does not apply for ship in domestic operation. However, with the regulation of stowage and segregation in ro-ro ship in the IMDG Code, the regulation can be used as a benchmark to evaluate and improve existing procedures.

3.4.4 Analysis of emergency/contingency plan

An analysis will be conducted of “the procedures to be followed in planning, preparation, and prevention, dealing with accidents and other emergencies involving dangerous goods handling.” During this stage, an analysis will be conducted on how the port authorities make plan/prepare for emergencies and for undesirable circumstances. Furthermore, there will be an analysis of how the port authority responds to the existing emergency plan. To complement these emergency response

requirements, the IMO drafted the IMDG code Volume: Supplement contains guidance on Emergency Response Procedures for Ships Carrying Dangerous Goods. The supplement includes directions for dealing with incidents involving dangerous substances, materials or harmful substances (marine pollution) regulated under the IMDG Code. This guide is intended as support and guidance to all concerned parties in handling dangerous goods to develop emergency procedures and integrate it with the ship contingency plan.

3.5 Recommendation

The study results will be used as the basis for regulation and framework development of dangerous goods handling by domestic ferry transport. The regulation is expected to be flexible so that it can be applied in all domestic ferry ports in Indonesia.

4 DANGEROUS GOODS TRANSPORTATION IN INDONESIAN DOMESTIC ROPAX OPERATION

Chapter four will present general information on the nature of dangerous goods transport and handling in Indonesian domestic RoPax operation, from the perspective of existing conditions of three main crossing routes in Indonesia, existing domestic regulation of dangerous cargo handling and common issues that take place in the operation of dangerous cargo transport in domestic RoPax operation.

4.1 Existing conditions of three main domestic crossing routes

As described in the previous chapter, Indonesia has more than 30 domestic crossing routes. However, this chapter will explain the existing condition of three main domestic crossing routes: Merak - Bakaheuni, Ketapang - Gilimanuk and Bajoe' - Kolaka.

4.1.1 Merak – Bakaheuni crossing routes

The track distance for the Merak - Bakauheni crossing route is 15 miles. The operation frequency (number of trips) within 1 (one) year for the Merak - Bakauheni crossing route in 2011 was 29,431 trips (one way) for RoPax vessels and 444 trips (one way) for fast vessels. The vessels operated on Merak - Bakuheni crossing track in 2009 were 33 RoPax Ships and 3 Fast Ships. The characteristics of the ships operated in the Merak - Bakauheni trajectory are as shown in Table 4-1.

Table 4-1. RoPax vessel Which Operates on the Merak – Bakauheni Route

No:	SHIP NAME	SHIP OWNER	YEAR BUILD	MAIN DIMENSION			TONNAGE		MAIN ENGINE			CAPACITY		
				Length (m)	Height (m)	Draft (m)	GT	NT	Vendore	HP	V(Kn)	Passenger	4 wheels	Crew
1.	JATRA I	PT.ASDP (Persero)	1980	90.79	15.60	5.22	3.932	1.689	Niigata	2x1600	12	800	80	29
2.	JATRA II	PT.ASDP (Persero)	1980	90.79	15.60	5.22	3.902	1.689	Niigata	2x1600	12	900	75	30
3.	JATRA III	PT.ASDP (Persero)	1985	89.95	16.60	5.50	3.123	937	Daihatsu	4x1800	17.5	800	84	32
4.	NUSA DHARMA	PT.SP Ferry	1973	105.34	15.02	4.65	3.282	985	Normo	2x1835	9	622	100	26
5.	NUSA JAYA	PT.SP Ferry	1989	105.00	18.03	4.50	4.564	1.370	Yanmar	2x1800	8	800	150	32
6.	NUSA BAHAGIA	PT.SP Ferry	1979	98.53	15.70	4.60	3.555	1.066	MWM	2x2700	10	400	110	43
7.	NUSA MULIA	PT.SP Ferry	1979	114.75	17.40	10.80	5.837	1.752	MAN	2x3400	10	500	110	38
8.	NUSA SETIA	PT.SP Ferry	1986	111.08	16.00	5.00	6.095	1.828	Watsila	2x4500	10	534	100	29
9.	NUSA AGUNG	PT.SP Ferry	1986	118.08	17.40	4.69	5.730	1.719	MAK	2x4500	12	600	100	29
10.	HM. BARUNA I	PT.HM Baruna	1983	91.50	17.60	5.00	4.535	1.361	Yanmar	2x1600	13	980	80	28
11.	BAHUGA PRATAMA	PT. Atosim Lampung	1993	86.99	15.00	4.01	3.351	1.425	Daihatsu	4x1600	12	520	75	28
12.	BSP I	PT. Atosim Lampung	1973	93.50	18.00	4.62	5.057	1.998	Daihatsu	4x2000	12	835	90	40
13.	ONTOSENO I BSP II	PT. Atosim Lampung	1983	100.00	20.40	5.20	5.227	1.590	Pielstyc MAN	2x5884	8	600	125	29
14.	BSP III	PT. Atosim Lampung	1973	139.40	22.00	11.33	12.498	3.750	Work Spoor	2x4650	13	893	175	35
15.	WINDU KARSA. P	PT.Windukarsa	1985	89.96	16.60	5.50	3.123	937	Daihatsu	4x1800	17	600	100	26
16.	RAJABASA I	PT.Gunung.M Permai	1985	91.50	17.52	3.75	4.764	1.430	Miries	2x1571	13	869	80	35
17.	MENGGALA	PT.Jemla Ferry	1987	93.44	17.00	3.75	4.330	1299	Yanmar	2x1500	13	898	100	24
18.	MUFIDAH	PT.Jemla Ferry	1973	93.50	18.00	4.62	5.584	1956	Daihatsu	4x2000	12	759	90	25
19.	DUTA BANTEN	PT.Jemla Ferry	1979	120.58	17.80	5.15	8.011	3853	Pielsttyc	2x7000	19	550	127	40

No:	SHIP NAME	SHIP OWNER	YEAR BUILD	MAIN DIMENSION			TONNAGE		MAIN ENGINE			CAPACITY		
				Length (m)	Height (m)	Draft (m)	GT	NT	Vendore	HP	V(Kn)	Passenger	4 wheels	Crew
20.	TITIAN MURNI	PT.Jembatan Madura	1982	93.00	11.00	5.11	3.614	1085	BMW	2x2310	13.5	887	55	34
21.	PRIMA NUSANTARA	PT.Jembatan Madura	1990	76.00	16.10	5.10	2.773	832	Fuji Semp	2x3400	10	1150	45	44
22.	TRIBUANA I	PT.Tribuana I	1984	107.00	21.00	4.51	6.186	2658	UBE MAK	2x4500	15.5	400	175	32
23.	MITRA NUSANTARA	PT.Jembatan Madura	1994	101.55	19.20	6.15	5.813	1744	Niigata	4x2000	15	975	100	40
24.	SMS.KARTANEGARA I	PT.Sekawan Maju	1975	96.08	18.00	6.40	4.449	1828	MAN	4x868	12	400	50	30
25.	ROYAL NUSANTARA	PT.Jembatan Madura	1992	114.52	16.00	4.48	6.034	4123	Normo	4x1260	12	1005	100	40
26.	BAHUGA JAYA	PT. Atosim Lampung	1992	85.44	16.20	6.30	3.972	1593	Trok Werks	2x4400	15	697	70	27
27.	PANORAMA NUSANTARA	PT.Prima Eksekutif	1995	125.60	19.60	6.15	8.915	2675	Akasaka	2x6500	14	1028	150	52
28.	WINDU KARSA DWITYA	PT.Windu Karsa	1997	87.00	14.50	5.70	2.553	766	Daihatsu	2x4000	18	378	85	30
29.	MUSTIKA KENCANA	PT.Dharma Lautan Utama	1992	97.69	16.20	9.20	4.183	2092	Niigata	2x4200	16	607	60	31
30.	LAUT TEDUH 2	PT.BPR	1990	95.80	16.00	4.33	4.216	1576	Cummins	4x550	12	350	75	37
31.	TITIAN NUSANTARA	PT.Jembatan Madura	1990	101.101	19.20	6.15	5.532	1659	Niigata	4x2000	19.12	607	100	41
32.	VICTORIUS V	PTTimur Surya Line	1990	89.66	15.019	3.60	4.280	1576	Cummins	4x550	10	450	80	34
33.	JAGANTARA	PT.Jemla Ferry	1994	119.49	20.00	11.5	9.956	2997	Pielstic	2x6290	18.5	520	100	31
Kapasitas Total												22794	3174	
Kapasitas Rata-Rata												691	96	

Source: PT. ASDP Persero, 2012

4.1.1.1 Port facility condition

Merak Port is a ferry port operated by PT. ASDP with a total area of 150,615 m^2. Jetties owned by Merak Port are shown in Table 4-2:

Table 4-2. Merak Port facilities

Facility	Jetty I	Jetty II	Jetty III	Jetty IV	Jetty V
Spesification					
- Length	120 m	80 m	150 m	90 m	125 m
- Width	80 m	20 m	20 m	20 m	20 m
- Draught	5,50 m	6,50 m	6,50 m	6,50 m	10 m
- Dolphin	10 Unit	5 Unit	10 Unit	5 Unit	5 Unit
- Frontal Frame	11 Unit	6 Unit	11 Unit	5 Unit	7 Unit
- Cell Fender	35 Unit	19 Unit	40 Unit	-	-
- Mooring Dolphin		2 pieces			4 pieces
- Capacity (GRT)	3000 GRT	2500 GRT	5000 GRT	3500 GRT	6000 GRT

Source: PT. ASDP Persero, 2012

Merak port is also equipped with a large parking area and is divided into several areas. Table 4-3 presents data on the parking area owned by Port Merak.

Table 4.3. Merak Port access facilities

No	Description	Construction	amount	Main road facilities (m2)	Supporting road facilities (m2)	Waiting Park Facilities (m2)	Loading Park Facilities (m2)
1	Main Road Entry	Concrete	1 Line	840.00			
2	Main Road Exit	Concrete	1 Line	2,500.00			
3	Jetty I Road	Asphalt			2,000.00		
4	Jetty II Road	Concrete			600.00		
5	Jetty III Road	Paving block			1,200.00		
6	Jetty IV Road	Concrete			2,100.00		
7	Jalan Kajima	Concrete			1,200.00		
8	Jetty I Parking Area	Paving block	2 Line				4,350.00
9	Jetty II Parking Area	Concrete	2 Line				4,200.00
10	Jetty III Parking Area	Paving block					8,560.00
11	Jetty IV Parking Area	Paving block					8,000.00
12	Weighting Bridge Parking Area	Concrete				14,938.00	
13	Bus Shelter Parking Area	Concrete				3,880.00	
14	Bus Terminal Parking Area	Paving block				8,260.00	
15	Ticket Building Parking Area	Asphalt				700.00	
16	Office Building Parking Area	Asphalt				900.00	

Source: PT. ASDP Persero, 2012

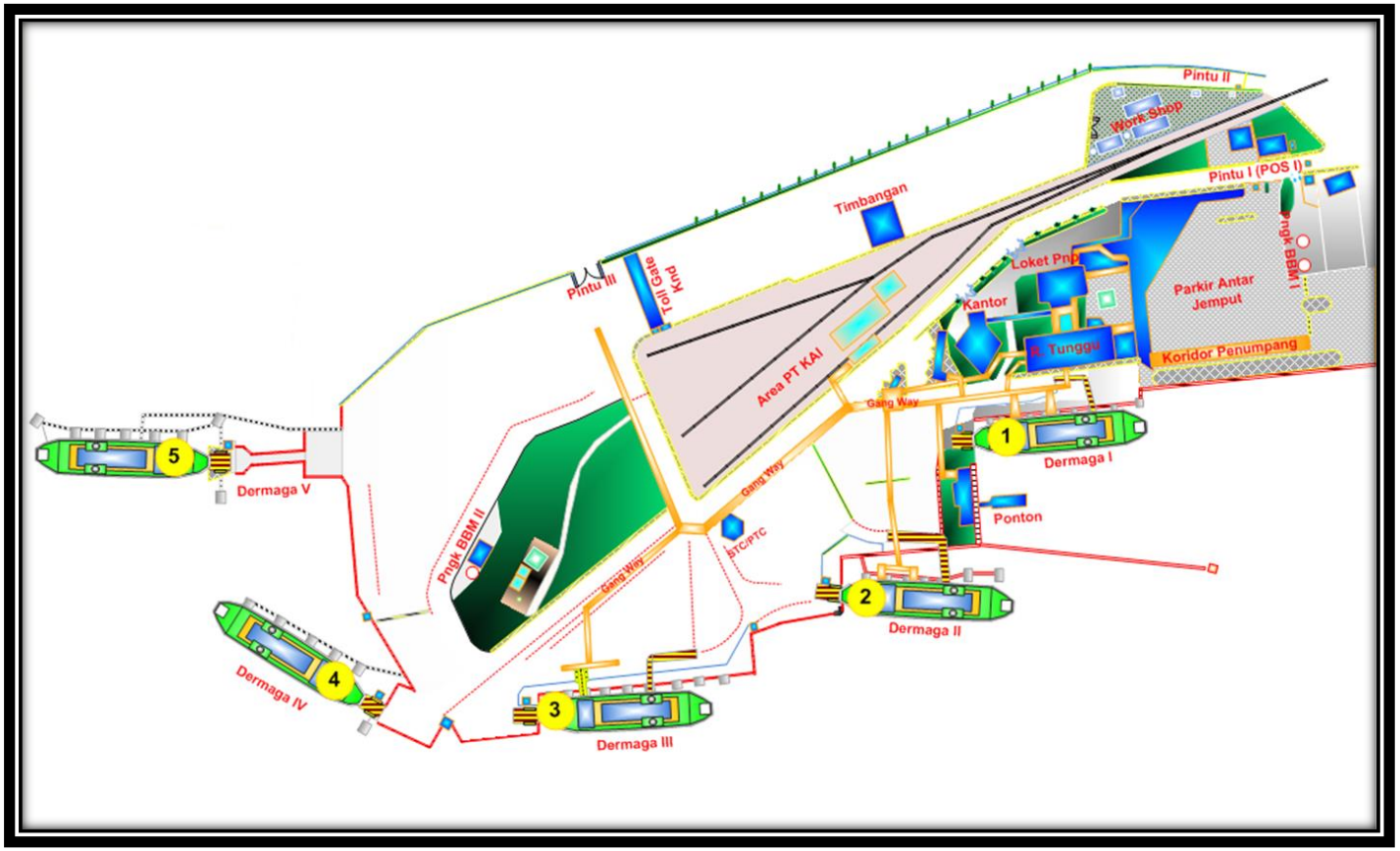

Figure 4-1. Layout of Merak Port

Source: PT. ASDP Persero)

4.1.1.2 Existing condition of dangerous cargo services

The arrangement of vehicles carrying dangerous goods through Merak Port based on field survey results is as follows:

1. Vehicle types that often use ferry facilities at Merak Port are vehicles carrying fuel, asphalt, used oil, gas, liquid chemicals and crude oil.

2. Merak Port has provided a special parking area for vehicles carrying dangerous goods. However, in some situations and conditions, utilization of such special areas for such vehicles is not evident, especially if the port is full of queues of vehicles caused by delays in ship schedules. This can be seen in Figure 4-2. The figure shows that vehicles carrying dangerous goods did not use the special parking area and are parked in the same area with other trucks or vehicles.

Figure 4-2. Road vehicle carrying dangerous goods in Merak Port parking area

3. The port authority has a standard procedure for vehicles carrying dangerous goods cargo. However, it is still lacking in the application of this procedure in the field, especially when the harbour is full of queues of vehicles. This needs to be evaluated.

4.1.2 Ketapang - Gilimanuk crossing routes

PT. ASDP Indonesia Ferry (Persero) Ketapang is a branch office of PT. ASDP located in Ketapang, Banyuwangi, East Java Province. The office is a branch office of PT. ASDP with Classification A. Classification A means that Ketapang Port has a passenger volume more than 2000, jetty capacities 1000 GRT and operates 24 hours nonstop. This port serves only one route, Ketapang - Gilimanuk path with Gilimanuk Port is located in Bali Province. The Ketapang - Gilimanuk crossing route is an inter-province commercial crossing connecting East Java Province on Java Island with Bali Province on the Island of Bali.

The route distance for the Ketapang to Gilimanuk crossing is six nautical miles. Operation frequency (number of trips) in one year for Ketapang - Gilimanuk in 2011 was 141.158 trips. The number of Ferries on the Ketapang - Gilimanuk route is 24 vessels, divided into 14 RoPax vessels using the Moveable Bridge and 10 ships using the Beaching Dock: Details of ships are shown in Table 4-3.:

Table 4-3. Ship operating In Ketapang - Gilimanuk route

No:	SHIP NAME	SHIP OWNER	YEAR OF BUILD	MAIN DIMENSION			TONAGGE		MAIN ENGINE			CAPACITY		
				L	B	d	GRT	NT	Vendor	HP	V(Kn)	Passenger	vehicle	mix
1.	PRATHITA	PT. ASDP	1968	41.44	16	2.34	459				14	332	100	24
2.	MUTIS	PT.ASDP	1990	45	11	1.89	621				11	259	65	19
3.	GILIMANUK I	PT. Jemla Ferry	1964	41.43	16	3	733				14	248	80	25
4.	GILIMANUK II	PT. Jemla Ferry	1990	44.29	14	2	840				11	271	75	25
5.	NUSA DUA	PT. Putra Master	1982	47.9	15	2.25	536				11	282	125	22
6.	NUSA MAKMUR	PT. Putra Master	1990	47.9	15	2.34	497				10	264	125	25
7.	RAJAWALI NUSANTARA	PT. Jembatan Madura	1989	48.2	13.5	2.59	815				12	319	140	55
8.	MARINA PRATAMA	PT. Jembatan Madura	1993	54.5	12	2.7	688				-	300	175	37
9.	CITRA MANDALA ABADI	PT. Jembatan Madura	1985	47.79	11	3	580				12	270	125	18
10.	RENY II	PT. Jembatan Madura	1968	41.44	16	2.92	456				13	374	135	23
11.	EDHA	PT. Lintas Sarana Nusantara	1967	41.4	16	3.09	456				14	300	83	24
12.	DHARMA RUCITRA	PT. Dharma Lautan Utama	1964	48.59	12.4	2.2	496				9	200	150	25
13.	TRISILA BHAKTI	PT Trisila Laut	1995	60	13.5	2.09	669				12	300	150	30
14.	SEREIA DO MAR	PT. Ply Surya TL Kso ASDP	1990				409					285	100	12

No:	SHIP NAME	SHIP OWNER	YEAR OF BUILD	UKURAN UTAMA			TONAGGE		MAIN ENGINE			CAPACITY		
				L	B	d	GT	NT	Vendor	HP	V(Kn)	Passenger	vehicle	mix
1.	DHARMA BADRA	PT. Dharma Lautan Utama	1984	34.5	10	2	193				11	156	85	19
2.	PERTIWI NUSANTARA	PT. Jembatan Madura	1971	43.5	12.5	2.54	605				14	219	100	17
3.	TRISNA DWITYA	PT. Lintas Sarana Nusantara	1975	14.4	2.5		876				8	-	-	16
4.	BHAITA CATURTYA	PT. Lintas Sarana Nusantara	1983	57.8	12.2	2.22	536				7	-	-	14
5.	ARJUNA	PT. Lintas Sarana Nusantara	1975	39.72	9.9	1.22	221				9	-	-	9
6.	PUTRI SRITANJUNGI I	PT. Pelayaran Banyuwangi S	2001	60	12	1.91	497					-	-	17
7.	PUTRI SRI TANJUNG I/	PT. Pelayaran Banyuwangi S	2002	60	12	1.89	529				10	-	-	17
8.	JAMBO V	PT. Duta Bahari Menara Line	2000	51.85	10	2.42	423					-	-	11
9.	LABITRA RISA	PT. Labitra Bahtera Pratama	2000				721					-	-	12
10.	LABITRA ADINDA	PT. Labitra Bahtera Pratama	1998				669					-	-	12

Source: PT. ASDP Persero, 2012

4.1.2.1 Port facility condition

Ketapang Port is a domestic ferry port operated by PT. ASDP. Ketapang Port has two moveable bridge Jettys and three beaching Jettys. The draught of Ketapang port is five meters, with capacity of moveable bridge 2000 GT, while pontoon capacity is 1000 GT. The length of the moveable bridge (MB) Jetty is 120 meters, while the pontoon Jetty is 80 meters.

Ketapang port is also equipped with several supporting facilities including parking area, waiting room and other facilities. Table 4-4 details the supporting facilities owned by Ketapang port.

Table 4-4 Ketapang port facilities

Type	Size/Amount	
- Port area	24. 024 m2	All Facilities in good condition and ready to use
- Parking field	11.957 m2	
- Terminal and office building	2.977 m2	
- Transit room	462.08 m2	
- Measurement scale building	96 m2	
- Generator room	28 m2	
- Shelter	259 m2	
- Control room of Movable Bridge (MB).	42 m2	
Gangway / Boarding Bridge	141 m2	
Catwalk	128 m2	
Trestle	892 m2	
-Clean Water Tank	150 m2	
- Garden	2.367 m2	
- Weighing Bridge	1 Unit (50 ton)	
- Electricity Power Supply	345 Kva	
- Generator	1 Set	
- Bunker Fuel	1 Set	
- Information equipment	2 Set	
- Praying Room	1 Unit	
- Toilet	4 Unit	
	1 Unit	

(Source: PT. ASDP Persero, 2012)

Table 4-5 Ketapang Port parking facilities

Parking Area Name	Location	Capacity	Additional Info
Ketapang Port: - Moveable Bridge (MB) I & II - Pontoon - Landing Craft Mechanized	 MB / Pontoon MB / Pontoon LCM	 171 Unit 50 Unit 102 Unit	 Additional parking area for 70 Vehicle
Total		323 Unit	

Source: PT. ASDP Persero, 2012

4.1.2.2 Process activity flow

The process flow of activities in Ketapang Port can be seen from the Layout of Ketapang Ferry Port as shown in Figure 4-3.

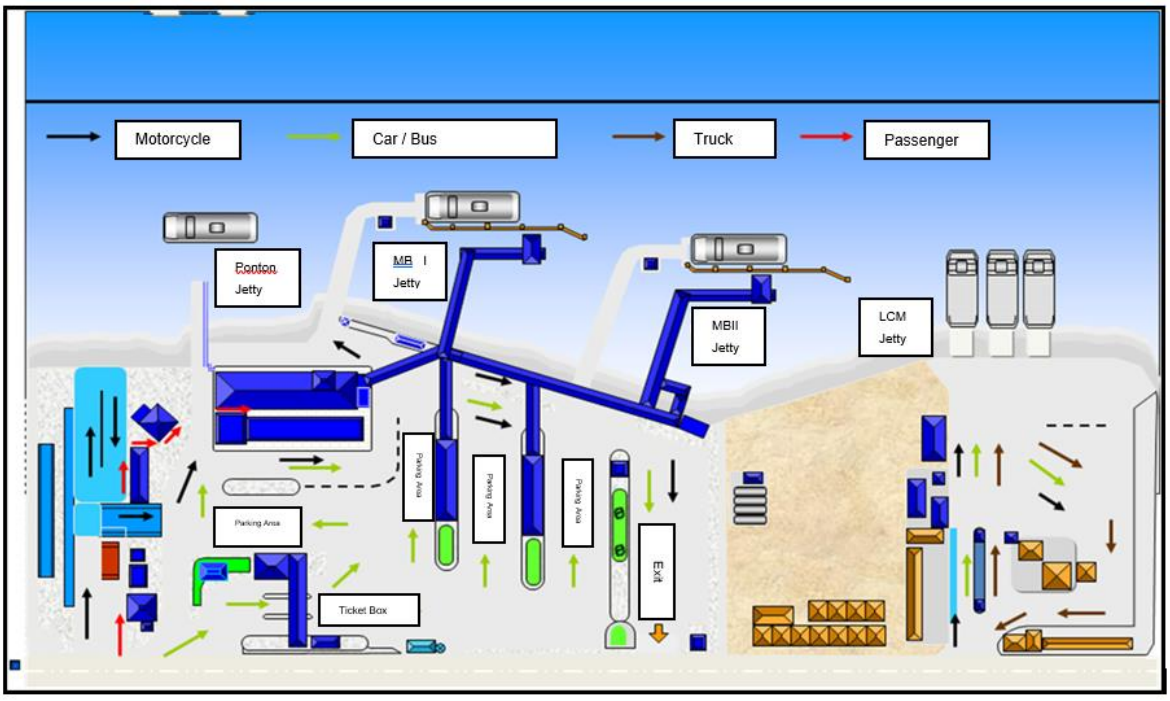

Figure 4-3. Ketapang Port Layout

Source: PT. ASDP Persero

From the layout shown in Figure 4-3, the flow of activities at the Ketapang port can be explained. Passengers without vehicles enter from the left side of the image to the waiting room (or just pass through) via a special pedestrian path. They buy tickets at the counter before entering the waiting room. From the waiting room, passengers go to the ferry through the gangway on the Jetty where the ferry is waiting to travel, and finally arrive at the port of destination.

Figure 4-4. Gangway Passenger Access

Vehicles access Ketapang Port via the vehicle line and pay for tickets via the counter located at the gate to the vehicle path.

Figure 4-5. Ticket counter on the gate of vehicle path

From the ticket counter, vehicles are directed by the officer to park according to the type of vehicle and cargo. The parking also use as a place for the port officers to

manage the vehicle before on board the ferry. For vehicles with a payload over two tonnes, the officer will direct the vehicle to a special Jetty for Landing Craft Mechanized ships, which is used solely for large vehicles with large tonnage.

Figure 4-6. LCT ship for vessel more than 2 tonnes

4.1.2.3 Existing condition of dangerous cargo handling

1) Vehicles carrying dangerous cargoes that frequently use the ferry facilities in Ketapang port are vehicles (trucks) carrying fuel, liquid chemicals and gas.

2) The port authorities provide a special parking lot for vehicles with dangerous goods cargoes; however, based on interviews conducted with drivers, vehicles with dangerous goods cargo often park alongside other vehicles, as seen in Figure 4-7.

Figure 4-7. Vehicle parking area in Port of Ketapang

3) For port facilities associated with the prevention of dangerous goods accidents are still very limited and inadequate

4) The Ketapang port authority has set up a Standard Operation Procedure (SOP) on the handling of dangerous cargoes, especially those carried by vehicles.

4.1.3 Bajoe' - Kolaka crossing routes

Bajoe' - Kolaka crossing route has a distance of 86 nautical miles. The route connects Bajoe' in South Sulawesi Province and Kolaka in Southeast Sulawesi Province. The Bajoe' - Kolaka crossing line is the economic pulse that connects South Sulawesi Province with Southeast Sulawesi through Bone Bay.

Bajoe'- Kolaka crossing line is the main transportation route for natural product shipments from Southeast Sulawesi, especially marine products (fish and seaweed), while from South Sulawesi, this crossing is widely used to send foodstuff and household appliances such as refrigerators, televisions and other electronic equipment.

Travel time to complete the Bajoe' – Kolaka crossing is more than 10 hours. The length of the journey is due to the necessity for the ship to follow a safe path through

waves and wind. Weather conditions at the Bajoe'-Kolaka crossing line are currently difficult to predict. Current and weather conditions are strongly affected by global weather conditions and may change at any time. Weather information can be obtained from Indonesia Meteorological, Climatological, and Geophysical Agency (BMKG). Bad weather often occurs on the Bajoe' crossing route to Kolaka, causing frequent delays of vessels operating on the line. Delays in the schedule cause the accumulation of passengers and vehicles in ports and the availability of parking spaces is inadequate.

In 2015, 9 RoPax ships were operating on the Bajoe' – Kolaka crossing. The characteristics of ships operated on the Bajoe' - Kolaka track are as shown in Table 4-5.

Table 4-6. RoPax ferry operated in Bajoe" – Kolaka Route

No:	SHIP NAME	SHIP OWNER	YEAR OF BUILD	MAIN DIMENSION			TONNAGE		MAIN ENGINE			CAPACITY		
				L	B	d	GT	NT	Vendor	HP	V(Kn)	Passenger	Vehicles	Mix
1.	PELANGI NUSANTARA		1993	55.74	12.30	2.00	909		Yanmar	2x1000	12	351	21	
2.	KOTABUMI	PT. Jemla Ferry	1968	71.67	12.40	3.65	1080		Yanmar	2x1000	16	477	29	
3.	KOTA MUNA	PT. July Rahayu	1974	57.34	13.20	3.00	686		Daihatsu	2x1600	14	488	10	
4.	MERAK	PT. ASDP	1970	44.5	11.3	2.6	490		Daihatsu	2x1000	13	500	20	
5.	MISHIMA	PT. Jemla Ferry	1982	56.65	13.10	-	1172		Daihatsu	2x1300	14	400	26	
6.	MUCHLISA	PT. Bukaka Lintas Utama	1980	44.4	10.90	2.79	850		Daihatsu	2x750	13	265	20	
7.	PERMATA NSTR	PT. Jembatan Madura	1968	62.06	13.46	3.58	1504		Daihatsu	2x1330	13	350	-	
8.	TUNA	PT.ASDP	1992	54.29	14.00	2.09	600		Niigata	2x900	10	400	22	
9.	WINDU KARSA	PT. Bukaka	1980	55.72	16.20	3.10	1376		Yanmar	2x1600	10	379	29	

Source: PT. ASDP Persero, 2012

4.1.3.1 Port facility condition

Bajoe' Port is a domestic ferry port operated by PT. ASDP. Bajoe' Port has one moveable bridge Jetty and one beaching Jetty. The draught of Bajoe' port is five meters, and the capacity of the moveable bridge is 1000 GT. The length of the moveable Bridge (MB) Jetty is 68 meters.

Bajoe' port is also equipped with several support facilities including parking area, waiting room and other facilities. Table 4-6 describes the support facilities owned by Bajoe' port.

Table 4-7. Bajoe'' Port Facilities

NO	Equipment/Facilities	Specification	Condition
1	MB Jetty	1 Unit	Good
2	Length of Jetty	234 M2	Good
3	Kapsitas MB	30 Ton	Good
4	Jetty Pontoon	- M2	NIIHIL
5	Jetty Plengsengan	744,17 M2	40%
6	Depth of pond	5.5 M2	Good
7	Wide of pond	120 M x 200 M	Good
8	Causeway	16,640 M2	Good
9	Trestel	9 M x 1240 M	Good
10	Catwalk	188 M	Good
11	Mooring Dolphin	3 Unit	Good
12	Breasting Dolphin	3 Unit	Good
13	Frantal Frame	5 Unit	Good
14	Fender	5 Unit	Good
15	Bollard	9 Unit	Good
16	Breakwater	- m^2	NIHIL
17	(Beacon/Static)	5 Unit	Good
18	(Buoy)	1 Unit	Good
19	Weighing bridge	1/30 Unit/ton	Good
20	Administration building	2 m^2	Good
21	Office	396 m^2	Good
22	Access Bridge/Coridor	256.65 m^2	Good
23	Gangway	- m^2	-
24	Total Port Area	94,735 m^2	Good
25	total parking area	2,453 m^2	Good

4.1.3.2 *Source: PT. ASDP Persero, 2012*Existing condition of dangerous cargo handling

1) Vehicles carrying dangerous cargoes that frequently use the ferry facilities at Bajoe'' Port are vehicles (trucks) carrying fuel and gas by PT. PERTAMINA (Persero)

Figure 4-8. Vehicle carrying LPG parking in Bajoe'' Port

2) Port facilities associated with the prevention of dangerous goods accidents are still very limited and inadequate (only fire extinguisher)

3) The port authority has no contingency plan, especially in the case of ferry schedule delays due to bad weather. The port authority needs to develop a contingency plan, especially regarding emergencies that arise dangerous goods in the limited parking area at the port when ferry schedule delays.

4.2 Indonesia regulation of dangerous goods handling in port and onboard ferry

This section will discuss the prevailing laws and regulations in Indonesia related to dangerous goods handling in Indonesian waters. These regulations include laws, government regulations, ministerial decrees, and the Directorate General of Land Transportation Decree.

4.2.1 Act no. 17, 2008, about shipping

Act Number 17, 2008, is a substitute for Act Number 21, 1992, on Shipping. In the case of dangerous goods transport, Act No. 17 of 2008 states that the transport of special goods and dangerous goods shall be carried out in accordance with the provisions of laws and regulations.

Article 45 stipulates that the owner, operator, and / or agent of a sea transport company carrying dangerous goods and special goods shall be required to give notice to port authorities (Syahbandar) before the dangerous goods arrive at the port.

Port Business Entities and Port Operating Units are required to provide stowage or stockpiling for dangerous goods and special goods to ensure the safe and smooth flow of goods in port traffic, and is responsible for the preparation of systems and procedures for handling dangerous goods and special goods at ports.

Furthermore, this law stipulates that further provisions on the procedure of transporting special and hazardous goods shall be regulated by a Government Regulation.

4.2.2 Government regulation no. 20 of 2010 about water transportation

Government Regulation No. 20 of 2010, concerning transportation on water, is an elaboration of Act No. 17 of 2008. This government regulation deals with sea transport, river and lake transportation and ferry transportation;; service activities related to transport on water; licensing of various businesses related to water transport; obligations and responsibilities of the carrier; transport of special and dangerous goods; empowerment of the national water transport industry; and administrative sanctions.

Matters relating to the carriage of special and hazardous goods declared in this government regulation, which are not stated in Law No. 22 of 2008 concerning voyages, are as follow:

A. In the case of regulations concerning the provision of special goods and hazardous goods, this government regulation requires special venues and specialized ships for the transport and unloading of special and dangerous goods.

B. The management of dangerous goods must also be done by a competent workforce, equipped with safety facilities.

Furthermore, this government regulation states that further provisions concerning port transportation and handling of special and dangerous goods shall be governed by a Ministerial Regulation.

4.2.3 Regulation of the Minister of Transportation No. 02/2010 on the Amendment of Decree of the Minister of Transportation No. KM 17/2000 on Guidelines for Handling of Dangerous Goods / Materials in Shipping Activities in Indonesia

Regulation of the Minister of Transportation No. 2, of 2010, was issued in order to guarantee safety in handling dangerous goods in shipping activities in Indonesia. This Ministerial Regulation is derived from the International Maritime Dangerous Goods (IMDG) Code and its supplements, and is mandatory in Indonesia.

In 2007, the Directorate General of Sea Transportation applied a new model of Sailing Permit (SIB,) allowing Port Authority (Syahbandar) to examine more closely the dangerous goods to be loaded into the vessel. SIB, effective April 1, 2007, is called a new model because the old SIB does not explicitly mention dangerous goods. Dangerous goods in SIB refers to Law no. 21 of 1992, concerning shipping, affirmed in Government Regulation No. 51/2002 on Shipping. The SIB, in addition to a special column of dangerous goods that will be transported by shipper to the ship, contains a standard sailing declaration form that contains the captain's statement that the ship is seaworthy before asking permission to sail. This new rule requires the owner of the goods to report the load of dangerous goods. The report is first addressed to the ship owner, then to Port Authority (Syahbandar). The purpose of reporting is to ensure that

the goods are placed in the right position since every dangerous good requires different handling. For example, an explosive item is not placed in a hot place.

Dangerous goods transport rules are now being upgraded. This is shown in Law Number 17 of 2008, concerning shipping, especially in Articles 44 to 49. The Government has also ratified the 1973 International Convention on Prevention of Pollution from Ships (MARPOL) Annex III which among other things, addresses the handling of toxic and dangerous goods. The ratification was signed on March 20, 2012, set forth in Presidential Regulation No. 29 of 2012 on Ratification of Annex III, Annex IV, Annex V and Annex VI, as amended by the Protocol of 1978. By ratifying the international convention, the government has the authority to supervise and arrange dangerous goods on ships. All must meet the packaging, stockpiling and stowage requirements at the port, and handling of loading and unloading as well as accumulation and stowage while on board. However SOLAS and MARPOL are not mandatory for domestic shipping, so the Indonesian government should use SOLAS and MARPOL as a reference for developing its own laws for handling hazardous materials / goods in shipping activities in Indonesia.

They must also meet safety requirements in accordance with national and international standards and regulations for special ships carrying dangerous goods, and, of course, must be given special signs in accordance with the dangerous goods transported.

Owners, operators and / or agents of sea transporting companies carrying dangerous goods are required to deliver the shipment document to Port Authority (Syahbandar) before the cargo arrives at the port. The Port Authority shall provide storage or stacking of dangerous goods to ensure the safe and smooth flow of goods at ports and is responsible for the preparation of systems and procedures for handling dangerous goods in ports.

5 ANALYSIS OF DANGEROUS GOODS HANDLING IN DOMESTIC ROPAX FERRY OPERATION

5.1 Analysis of dangerous goods handling at domestic RoPax ferry port

Inter-island ferry transportation in Indonesia is conducted by several operators, and one of the largest operators is PT. ASDP Indonesia Ferry. As one of the ferry crossing operators, PT. ASDP has implemented safety standards on all ship operations. PT. ASDP also serves as an operator in several ferry ports, so it also manages the handling of dangerous goods cargo in the port, before entering the ship. PT. ASDP has also prepared an operating standard for handling dangerous goods cargo transported by their ferries. Standard operation for handling dangerous goods at PT. ASDP is described in document number OPS-109 issued by PT. ASDP on November 1, 2005. However, there are some ports and ferries that are not operated by PT. ASDP but operated by the local government. This causes inequality in the service standards of vehicles with dangerous goods cargo. Additionally, the operators in the field have failed to fully implement the rules and procedures.

Dangerous goods transport between islands in Indonesia is dominated by transport of fuels and LPG cylinders. More than 80 percent of dangerous goods transport involves the transport of fuel oil and LPG cylinders using RoPax Ferry crossing services to distribute the cargo throughout Indonesia.

Currently, there are 35 ferry ports in Indonesia. However, all 35 ports still have low service standards and poor facilities. Based on surveys of three ferry ports (Merak Port, Ketepang Port and Bajoe'' Port), it can be seen that in all three ports, service performance and standards for dangerous goods handling are still below the recommended levels as indicated IMO through MSC1. Circ. 1216, "Revised

Recommendation on The Safe Transport of Dangerous Cargoes and Related Activities in Port Areas". One of the requirements listed in MSC1. Circ. 1216 paragraph 3.4 states that each port must have specific consideration for warehouses and terminal areas for dangerous cargo. However, none of the ferry ports in Indonesia have warehouses and only a few ferry ports have special parking areas for vehicles carrying dangerous goods cargo.

Three ferry ports have been selected for analysis of operational performance, especially in the handling of dangerous goods.

5.1.1 Dangerous goods handling at Merak ferry port

Merak port, as the largest crossing port in Indonesia, actually has adequate facilities to serve vehicles with dangerous goods cargo. It has a large parking area and the port authority has a standard operating procedure for dangerous cargo handling at the port.

Based on the results of interviews with port officers in Merak Port, it is known that the Port has a procedure for handling vehicles with dangerous goods cargo, as follows:

a) There must be an agreement to transport dangerous goods from related agencies (PT ASDP as operator, port authority, police)

b) There shall be a notification letter from the carrier to PT. ASDP, concerning the transport of dangerous goods cargo.

KEMENTERIAN PERHUBUNGAN
DIREKTORAT JENDERAL PERHUBUNGAN LAUT
KANTOR SYAHBANDAR BAKAUHENI
TELP./FAX. (0727) 331341, 331116

PENGAWASAN PEMUATAN BARANG BERBAHAYA
Nomor : KL. 947 / 040 / /AD. BKH. 20..

DASAR : 1. UNDANG-UNDANG PELAYARAN NO. 17 TH. 2008
2. PERATURAN BANDAR 1925 PASAL 13
3. P.P. NO. 20 TAHUN 2010 TENTANG ANGKUTAN PERAIRAN
4. KM. 64 TAHUN 2010 TENTANG ORGANISASI DAN TATA KERJA KANTOR SYAHBANDAR
5. SOLAS 74
6. IMO DG CODES
7. PERMOHONAN DARI : YAKUB TGL. 20 - 06 - 2012

DIMUAT DENGAN KAPAL :
- Nama Kapal : GT.
- Bendera : Indonesia
- Nahkoda :
- Pemilik/Agen :

UNTUK BARANG-BARANG : OLI BEKASI
1. Nama/Jenis Barang :
2. Banyaknya : 1 (satu) Truck / Tronton / Tangki B 9033 FFA
3. Nomor Polisi :
4. Nama Sopir :

Dengan mengikuti ketentuan-ketentuan dan petunjuk Nahkoda/Perwira Kapal, SEMUA AKIBAT YANG DITIMBULKAN ATAS KEGIATAN PEMUATAN BARANG TSB. ADALAH TANGGUNG JAWAB PEMOHON/PEMILIK BARANG ========== BERLAKU UNTUK 1 X PENGAWASAN ==========

PETUGAS KAPAL/PELAYARAN

Dikeluarkan di BAKAUHENI
Pada Tanggal 20 - 06 2012
SYAHBANDAR,

Lembar 1 PUTIH : U/Pemohon, Lembar 2 HIJAU : U/Kapal

Figure 5-1.notification form of carrying dangerous goodsfrom carrier

c) Port authorities ensure that dangerous goods cargo does not mix with other cargo in a vehicle

d) The port authorities conduct inspections of the condition of dangerous goods transporting vehicles, in accordance with the technical guidelines set by the Ministry of Energy and Mineral Resources. [2]

e) The port authority has full authority to determine the boarding schedule for vehicles carrying dangerous goods on ship

f) There are only two port authority officers who have received training and certification on dangerous good handling in the port area

g) The port authority must provide a special parking area for vehicles with dangerous goods cargoes, which are separate from other public vehicles and meet the requirements of the IMDG code.[3]

However, based on interviews with drivers of vehicles with dangerous goods cargo and ferry passengers, there are some facts as follows:

a) There is no specific letter to PT. ASDP to transport dangerous goods

b) Vehicles carrying LPG cylinders do not meet the standards set by PT. Pertamina and the Ministry of Energy and Mineral Resources[4]

c) Like other truck vehicles, there is no special lane and special parking area for vehicles carrying dangerous goods

[2] PEDOMAN TEKNIS TRANSPORTASI LPG DENGAN MODA ANGKUTAN DARAT by Ministry of Energy and Mineral Resources, 2010

[3] Revised recommendations on the safe transport of dangerous cargoes and related activities in port areas

[4] PT. Pertamina is a state-owned company that produces and distributes gas and fuel in Indonesia

Figure 5-2. Vehicle carrying dangerous goods parking in the same area with other truck

d) Some drivers have been trained on the transport of dangerous goods by the freight forwarder company

e) Most of the ships' passengers did not understand the risks and dangers of dangerous goods, as demonstrated by some passengers carrying gas cylinders in their private vehicles without declaring them.

5.1.2 Dangerous goods handling at Ketapang Ferry Port

As the second largest crossing after Merak Port, Ketapang Port located in Banyuwangi, East Java has different characteristics when compared with Merak Port. Ketapang port has its own jetty for truck vehicles with a payload over 2 tonnes. Trucks carrying dangerous goods over 2 tons are required to use a special jetty that is only used for transporting trucks and is not allowed to carry passengers or public transportation. Based on the layout shown in Figure 5-3,, vehicles with a charge of more than 2 tons are directly separated upon entering the main entrance of the ferry port.

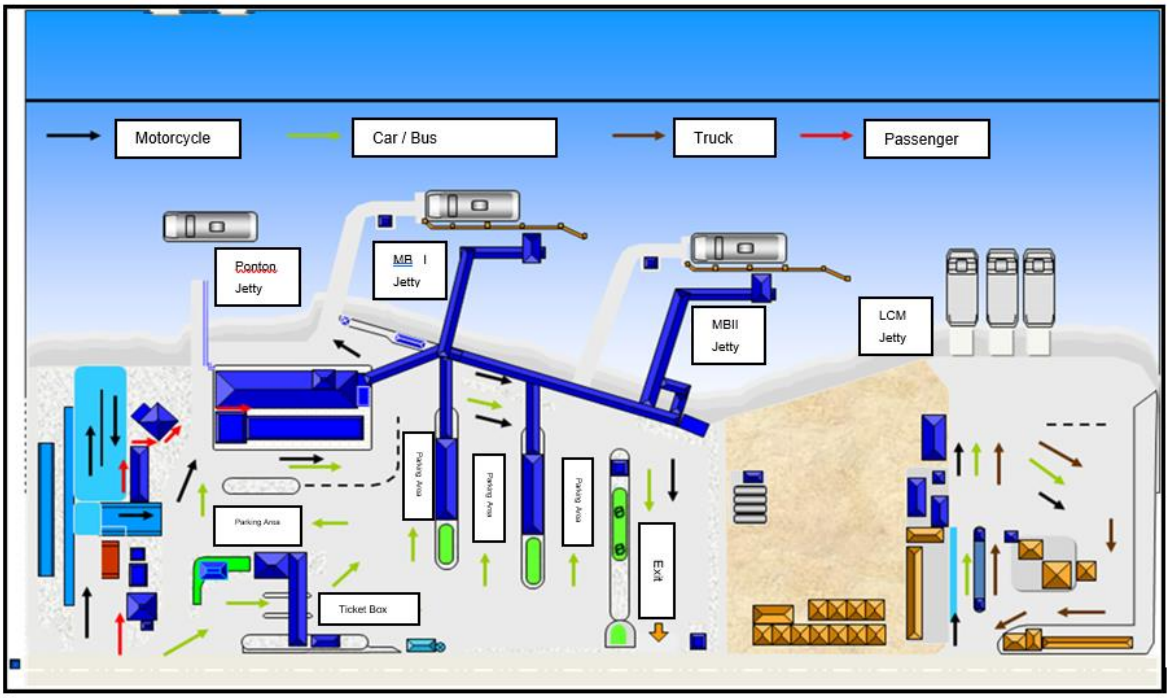

Figure 5-3. Layout view of Ketapang Port

Source: PT. ASDP PerseroBased on interviews with port officers in Ketapang Port, all operations in Ketapang Port related to the handling of dangerous goods have the followed the rules of procedure which have been prepared by PT. ASDP branch office Ketapang. Based on interviews, the procedure is structured based on some IMDG Code regulations and some technical guidance from PT. ASDP. Rules used in the preparation of dangerous goods handling procedures in Ketapang port are as follows:

a) IMDG code

b) Ship Operations Service Procedures (OPS-102)[5]

c) Ship Operational Procedures (OPS-103)

d) Emergency Procedures (OPS-105)

This procedure provides guidance to the parties concerned in the handling of dangerous goods on the vessel. It includes all planning, execution and monitoring

[5] Operation standard document from PT. ASDP

activities on ships and ports in accordance with the Quality and Safety Management System of PT. ASDP Indonesia Ferry (Persero). The aim is to provide protection to human life, ships and the environment in the implementation of loading and unloading activities, especially those related to dangerous goods. The procedure for vehicle carrying dangerous goods cargo is mentioned below:

a) The dangerous goods carrier company reports to the PT. ASDP officer to carry out dangerous goods transport by ferry and to charter the ferry.

b) The vehicle is weighed and then directed to the LCM jetty parking area

c) Vehicles are recorded and the document of cargo and condition of the vehicle are inspected

d) Vehicles are directed to board the ferry that has been chartered along with other vehicles carrying dangerous goods by the port officers and ferry crew

e) Vehicles with dangerous goods cargo are transported by ferry during the daytime with a schedule from 08.00 AM to 11.00 AM

f) Drivers of vehicles with dangerous goods cargoes will have explained to them, by the port officer, the risks of the cargo and the contingency plan in case of an accident.

However, the technical procedures of dangerous goods cargo handling should still be evaluated, including the parking lot allocation for vehicles carrying dangerous goods, the location of the vehicle parking, and whether dangerous goods vehicles are still mixed with other heavy vehicles. The port authorities have not set up special parking lots for vehicles with dangerous goods cargo as regulated in the regulation.

Moreover, based on interviews with drivers of vehicles, there are some procedures that are different from the existing procedures issued by port authorities. Problems in the field related to dangerous goods handling procedures are as follows:

a) There is no specific letter or document to PT. ASDP for transporting dangerous goods

b) Vehicles carrying LPG gas cylinders did not meet the standards set by PT. Pertamina and the Ministry of Energy and Mineral Resources

c) Like other truck vehicles, there is no special lane or special parking area for vehicles carrying dangerous goods

d) The port authorities has no special procedures for vehicles with dangerous goods cargoes in the event of a ferry schedule delay. Vehicles with cargo of dangerous goods are not given priority and no special parking space is provided.

e) Some drivers have been trained on the transport of dangerous goods by the freight forwarder company

5.1.3 Dangerous goods handling at Bajoe' Ferry Port

Bajoe' port is a port that serves ferry crossing for the Bajoe' - Kolaka route. Bajoe' port has two ferry departure times every day under normal conditions. The travel time from Bajoe' to Kolaka and the uncertain weather conditions cause frequent delays in ferry departures. Delayed ferry schedules due to bad weather can cause ferries to sail for long periods of time and result in accumulation of vehicles at ports.

One of the problems in arranging vehicles with dangerous goods cargo at Bajoe' is the limited parking space for vehicles, as can be seen in Figure 5-4.

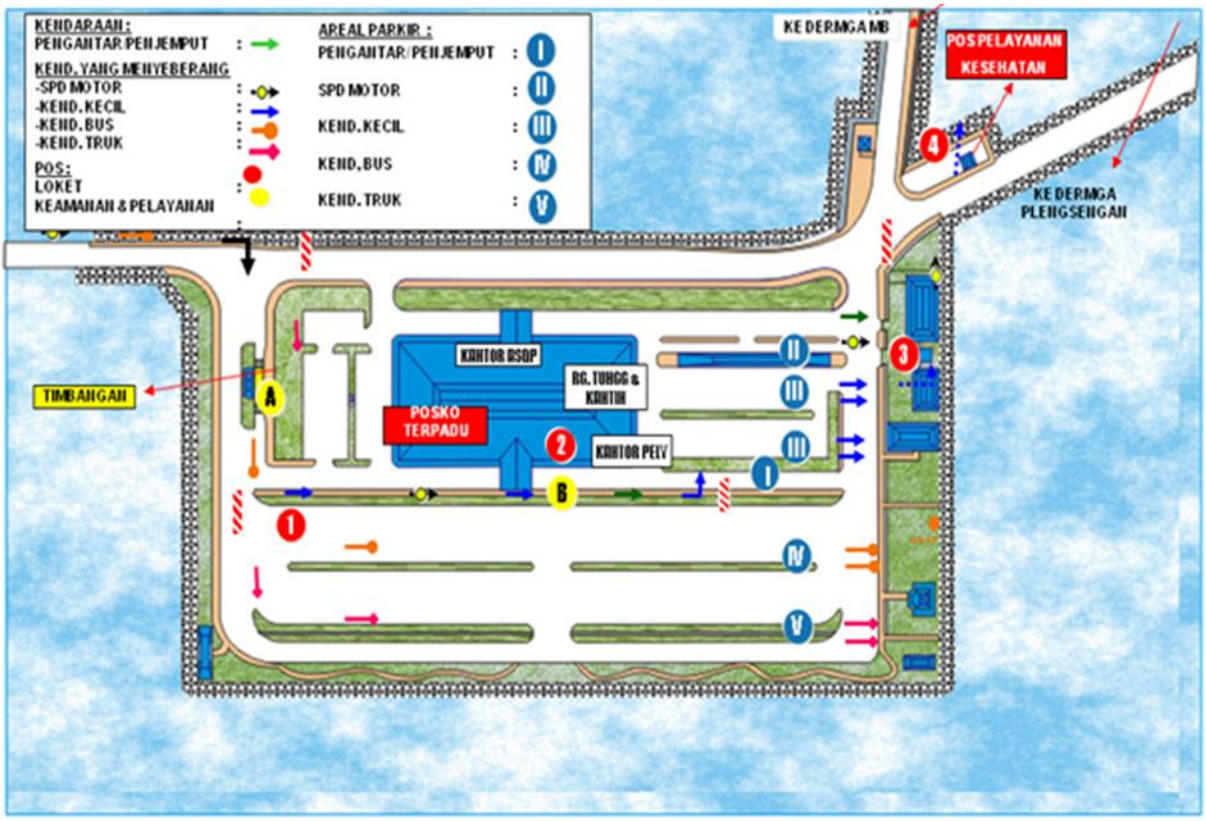

Figure 5-4. Layout of Bajoe' Ferry port.

As seen in Figure 5-4, the parking lot for trucks is marked by a "V" symbol. And the area does not have special parking for trucks with dangerous goods cargo. Figure 5-5 shows the condition of the vehicle parking area.

Figure 5-5. Condition of truck parking area in Bajoe' ferry port

Moreover, the Port does not have standard service procedures for vehicles with dangerous goods cargo. So far, the same standard of service is provided for each truck vehicle. One of the reasons they do not yet have standard service for trucks with dangerous goods cargo is the limited number of personnel in the field. Furthermore, Bajoe' port does not have a port officer with expertise in handling dangerous goods.

Based on interviews with drivers of vehicles with dangerous goods cargo and ferry passengers, the following conditions were established:

a) There is no specific letter or document from carrier to PT. ASDP to transport dangerous goods

b) Vehicles carrying LPG cylinders did not meet the standards set by PT. Pertamina and the Ministry of Energy and Mineral Resources

Figure 5-6. Pickup carrying LPG gas in Bajoe' port parking lot

c) Like other truck vehicles there is no special lane and special parking area for vehicles carrying dangerous goods

d) Almost all drivers of LPG cylinder transporters lack the skills and capabilities in accordance with the standards set by PT. Pertamina and the Ministry of Energy and Mineral Resources. They are only public transportation drivers hired to drive trucks carrying LPG.

e) Most of the ship's passengers did not understand the risks and dangers of dangerous goods, which was demonstrated by some passengers carrying

LPG gas cylinders in their private vehicles as their personal belongings, without declaring them.

Another problem concerns the travel time of the ferry, which is about ten hours. The risk of incident increases with sailing time due to improperly regulated arrangement of vehicles containing dangerous goods. The vehicle parking arrangement within the ferry is based solely on ferry stability considerations without considering the segregation rules as set in the IMDG code.

5.1.4 Analysis of stowing and segregation on board RoPax ferry

Based on data from the Directorate General of Land Transportation (DGLT), in 2014, the number of RoPax ferry boats operating in Indonesia about 258 units, with ship ages varying from five to 50 years. More than 50% of the domestic RoPax ferry fleet is over 25 years old, whereas only 5% is under 5 years. RoPax ferries operating in Indonesia have a carrying capacity of between 600 GT to 4000 GT, depending on the route they serve. For example, for the Merak - Bakaheuni and Ketapang - Gilimanuk routes are served by RoPax ferries with capacity above 2000 GT, while the Bajoe' - Kolaka route is served by RoPax ferries with a maximum capacity of 1500 GT. Location arrangement of ship placement and vessel capacity is fully regulated by DGLT, Ministry of Transportation and PT. ASDP Indonesia Ferry.

Old ships have become one of the obstacles in RoPax ferry operations in Indonesia. This is due to limited space in the car deck and limited operational RoPax ferries. This affects the planning of vehicle parking inside the RoPax ferry. Because of the high number of vehicles and the limited operational RoPax ferries, port authority officers should be able to arrange vehicles by maximizing the existing space on the car deck. The car deck on the RoPax ferry is a place devoted to vehicles that are loaded on the RoPax ferry. In the car deck, all vehicles shall be arranged, so the space in the car deck can be used optimally, and loading and unloading time can be minimized. For vehicle arrangement in the RoPax ferry car deck, port authority and RoPax ferry crews always use the guidelines issued by DGLT, Ministry of Transportations, the Director General of Land Transportation decree no. SK4608 / AP.005 / DRJD / 2012 annex II about Minimum Service Standards for Vehicle Loading. The regulation requires that:

1) Car deck floor should be able to withstand the load of four or more wheel vehicles with maximum axle load of 10 tonnes

2) The highest stack shall not exceed 250 centimetres for vehicle classes I through V and 420 centimetres for vehicle classes VI through IX

3) The shortest distance between vehicles on the car deck not less than 60 cm for side end and 30 cm for both forward and after end.

4) Each ferry is required to provide vehicle props and lashing equipment to maintain longitudinal and transverse stability of ferries

5) Securing lines for vehicles are required for ferries that transit routes with a probability of ship inclination up to 10 degrees due to local sea state.

This regulation is also strengthened by the operational procedures of ship operations (OPS-102) issued by PT. ASDP. OPS-102 was one of the references used by PT. ASDP for drafting the Dangerous Handling Procedures (OPS-109). OPS-102 and OPS-109 set out the duties and responsibilities of each officer of PT. ASDP at the port and before entering the RoPax ferry.

The problem is that neither regulation deals with dangerous goods handling in the RoPax ferry, as set out in IMDG code Chapter 7.5, which deals with the Stowage and Segregation of vehicles carrying dangerous goods cargo on ro-ro ships. In general, the segregation process of dangerous goods cargo follows the flowchart shown in Figure 5-7.

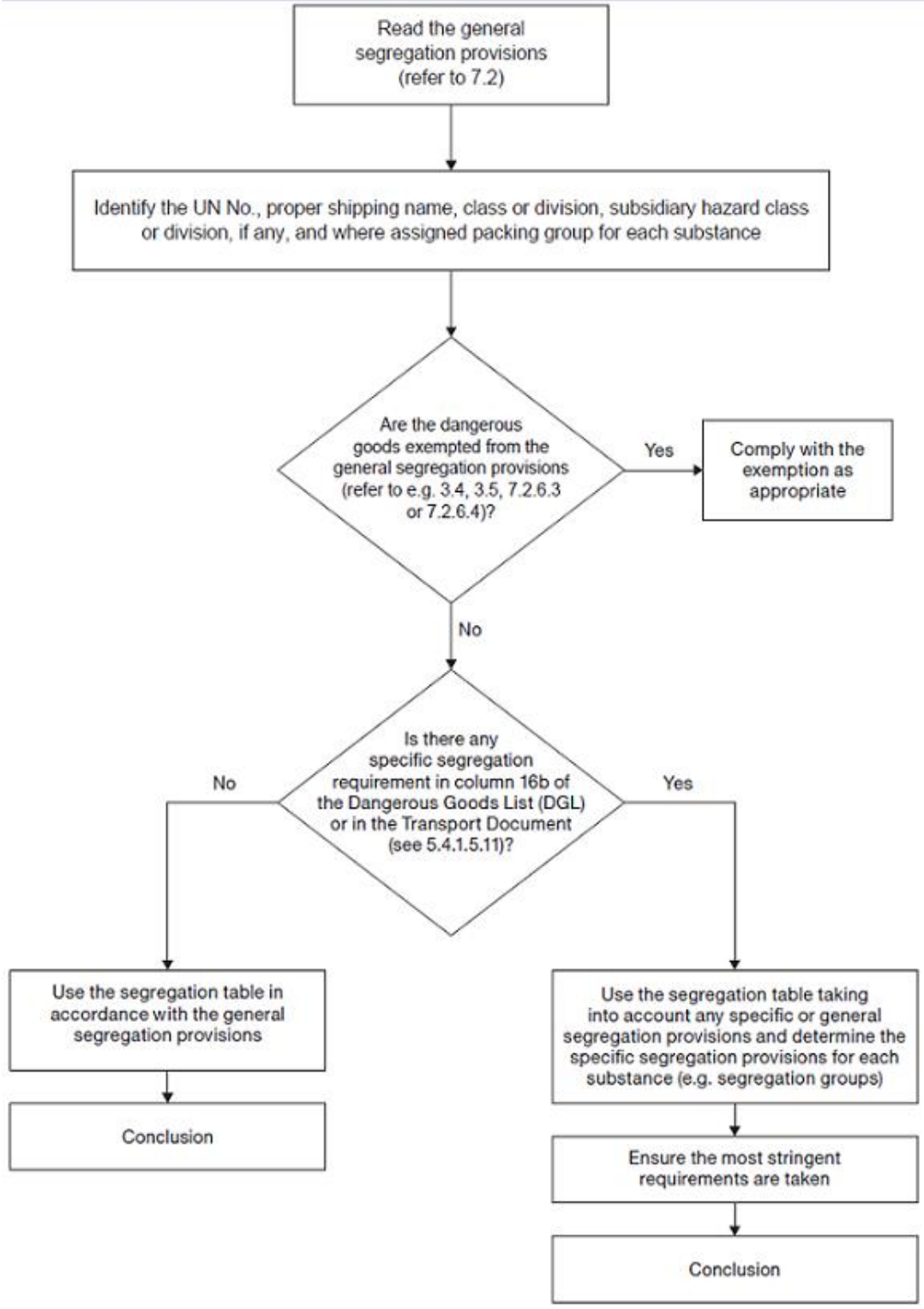

Figure 5-7. Segregation flow chart

Source: IMDG code Chapter 7.2

Based on survey results, the type of dangerous goods cargo that is mostly transported by ferry transportation in Indonesia is Liquefied Petroleum Gas (LPG), with hazard class 2.1 (flammable gas) and fuel oil (Diesel or Gasoline) with hazard class 3 (Combustible liquid). [6]

According to Figure 5-7, all types of cargo normally transported by RoPax ferry should follow the segregation table (Table 5-1) in accordance with general segregation provisions.

Table 5-1. Table of segregation of cargo transport unit on board ro-ro ships

Segregation requirement		Horizontal					
		Closed versus closed		Closed versus open		Open versus open	
		On deck	Under deck	On deck	Under deck	On deck	Under deck
"Away from" .1	Fore and aft	No restriction	No restriction	No restriction	No restriction	At least 3 m	At least 3 m
	Athwartships	No restriction	No restriction	No restriction	No restriction	At least 3 m	At least 3 m
"Separated from" .2	Fore and aft	At least 6 m	At least 6 m or *one* bulkhead	At least 6 m	At least 6 m or *one* bulkhead	At least 6 m	At least 12 m or *one* bulkhead
	Athwartships	At least 3 m	At least 3 m or *one* bulkhead	At least 3 m	At least 6 m or *one* bulkhead	At least 6 m	At least 12 m or *one* bulkhead
"Separated by a complete compartment or hold from" .3	Fore and aft	At least 12 m	At least 24 m + deck	At least 24 m	At least 24 m + deck	At least 36 m	*Two* decks or *two* bulkheads
	Athwartships	At least 12 m	At least 24 m + deck	At least 24 m	At least 24 m + deck	Prohibited	Prohibited
"Separated longitudinally by an intervening complete compartment or hold from" .4	Fore and aft	At least 36 m	*Two* bulkheads or at least 36 m + *two* decks	At least 36 m	At least 48m including *two* bulkheads	At least 48 m	Prohibited
	Athwartships	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited	Prohibited

(Source: IMDG code Chapter 7.5)

[6] Based on information from Material Safety Data Sheet (MSDS) published by PT. Pertamina (Persero)

Vehicles with dangerous goods cargo should be arranged according to the requirements set out in Table 5.1. However, limited car deck spaces and limited RoPax ferry operations on some shipping routes make the regulation difficult to implement. The high demand for LPG and fuel oil and the limited delivery schedule are also significant obstacles to implementing the regulation.

5.1.5 Analysis of emergency/contingency plan

In November 1997, the IMO assembly adopted resolution A 852 (20) on “Guidelines for a structure of an integrated system of contingency planning for shipboard emergencies”. In accordance with the International Safety Management Code (SOLAS Chapter IX, 1994), all ships and the companies responsible for their operations, are required to maintain a Safety Management System. Most countries will have additional national and local regulations which require organizations to develop and maintain an emergency response plan covering their operations.

To complement these emergency response requirements, IMDG Code has an additional volume: about guidance on Emergency Response Procedures for Ships Carrying Dangerous Goods. The supplement includes directions for dealing with incidents involving dangerous goods cargo, materials or harmful substances (marine pollution) regulated under the IMDG Code. This guide is intended as support and guidance to all concerned parties in handling dangerous goods to develop emergency procedures and integrate them with the ship contingency plan.

The Guidance is used as a benchmark for all member states to develop codes of practice or guidelines that are in accordance with member state conditions. One example is the regulation issued by the Swedish Transport Agency. Some of its regulations concerning the transport of dangerous goods and safety on board have used the IMDG Code Volume: supplement as a reference in regulatory drafting. Things like this need to be done by regulators and operators in Indonesia. Until now some regulations issued by DGLT and PT. ASDP have not used the IMDG Code Volume: supplement as a reference. One example is the Director General of Land Transportation decree no. SK4608 / AP.005 / DRJD / 2012 annex II about Minimum Service Standards for Vehicle Loading. The regulation is regulated on minimum service standards. However, the regulation does not mention the handling of

dangerous goods in ports and on board ships. The same problem is also found in the operational technical guidelines published by PT. ASDP. These technical guidelines do not mention handling of vehicles with dangerous goods cargo.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

For archipelagic developing countries, especially Indonesia, domestic ferries play a significant role in the regular inland waterway transportation of numerous passengers and cargoes. The common ferry type used in developing-archipelagic countries is the RoPax ferry. RoPax ferries typically carry passengers, vehicles and cargo at the same time. There are many types of cargo carried by land transportation vehicles via domestic ferries and one type of cargo is dangerous goods. Dangerous goods are commonly known as hazardous materials and include flammable, explosive, radioactive, oxidizing, corrosive, toxic, pathogenic or allergenic substances.

The transport of dangerous goods between islands in Indonesia is done by means of domestic ferries, which simultaneously carry passengers between islands. By its nature, transport of dangerous goods by domestic ferry can be considered as one of the most dangerous maritime transport activities. A single accident involving a domestic ferry carrying dangerous goods and passengers at the same time can cause both environmental catastrophe and severe human casualties.

One such accident caused by dangerous cargo, the burning of the Mutiara Sentosa RoPax ferry, occurred in May 2017. Based on preliminary investigations by NTSB, the cause of the ferry accident was an LPG cylinder in one of the vehicles in the car deck, which was not declared by the vehicle owner. This incident shows that dangerous goods are linked to RoPax ferry accidents in Indonesian waters. The causes of accidents range from low awareness of passengers and officers to the unavailability of adequate port infrastructure

Based on the analysis in chapter five, there are some problems in the transport and handling of dangerous goods cargo using RoPax ferry in Indonesian domestic waterways, such as:

1. Lack of comprehensive regulations governing dangerous goods transport and handling at ferry Ports and on board ferries
2. Handling procedures for dangerous goods are still local regulations and cannot be implemented properly by all officers in the field
3. Lack of officers at port authorities and RoPax Ferry that have not been certified or trained in dangerous goods handling
4. The quality and professionalism of Human Resources not supported by education and adequate skills, furthermore the distribution of Human Resources in sea transport is unequal, particularly in remote areas, small islands and border countries.
5. Lack of awareness of shippers, forwarding agents and passengers of the importance of following the procedures for transport of dangerous goods
6. Limited facilities owned by ferry ports in Indonesia, especially special parking facilities and temporary storage facilities
7. The number of vehicles is greater than the carrying capacity so ships cannot be accommodated and served by the ASDP, causing queues or congestion. Similarly, the parking area around the ASDP, particularly during Eid and holidays, cannot sufficiently accommodate vehicles

6.2 Recommendation

In the inland waterways of Indonesia, RoPax ferry safety issues, especially those related to dangerous goods handling, require technical assistance and the special attention of all stakeholders. Furthermore, for a sustainable transport system in Indonesia, the potential of the RoPax ferry as a multi-modal element is immense because RoPax ferry is the only mode of transportation that can transport dangerous

goods in large quantities and at an affordable price. Therefore, the safety factor in dangerous goods handling and transport needs to be given more attention. As a result of the conclusions drawn in this paper, the following recommendations as indicated in the following sub-sections.

6.2.1 Upgrading of regulations

Regulations governing the operation of transport of dangerous goods by domestic RoPax ferry need to be improved, especially those related to dangerous goods handling procedures at port and on board ferries. Some existing rules regarding operational procedures at ferry ports need to be improved by incorporating procedures concerning dangerous goods handling. Regulations and procedures that need to be developed and published in relation to dangerous goods handling in the domestic RoPax ferry operation are as follows:

1. Regulation about minimum service standards for vehicle loading of RoPax ferries
2. System and procedures for carriage of dangerous goods through domestic ferry transport
3. Land transport masterplan by DGLT, Ministry of Transportation
4. National port master plan by Ministry of Transportation
5. Blueprint of domestic ferry transportation by DGLT, Ministry of Transportation
6. The Director General of Land Transportation Decree No. SK.725/AJ.302?DRJD/2004 regarding the transport of dangerous goods on the road
7. Ship Operations Service Procedures (OPS-102) from PT. ASDP
8. Ship Operational Procedures (OPS-103) from PT. ASDP
9. Emergency procedures from PT. ASDP

6.2.2 Law enforcement

Although Indonesia has numerous regulations that cover dangerous goods handling in domestic RoPax operation, in reality there are many problems facing law enforcement, from monitoring and surveillance to prosecution. These problems come from several factors, for instance limited enforcement resources, lack of integrated regulations and lack of coordination. One example is the findings of the KNKT commissioner on the car deck of a RoPax ferry in the Bali Strait, who stated that the onboard ferry vehicle loading procedure did not meet the existing procedures. There is no strong lashing, no parking arrangement of vehicles in the car deck and the arrangement even tends to be messy. Therefore, it is necessary to enact a stricter regulation with strict action against the violation of existing procedures. PT. Pertamina and the Ministry of Energy and Mineral Resources also have to create stricter rules and penalties against distributors, agents and suppliers of their products that violate the rules, so they no longer violate existing regulations. This is evidenced by the number of vehicles carrying LPG cylinders that do not meet vehicle feasibility standards created by PT. Pertamina and the Ministry of Energy and Mineral Resources. PT. ASDP should also take firm action against port officers and ferry crews who do not comply with procedures of dangerous goods handling and loading/unloading process.

6.2.3 Construction of suitable RoPax ferry

Varying draughts, bad weather, excessive current, and little space on the car deck are the limitations of the RoPax ferries in Indonesia. With an objective of ensuring ferry safety and considering the limitations and the potentiality of the inland waterways as a complementary element of inter-modality, the development of RoPax ferry design is an essential task. Improvement of car deck design in RoPax ferries with respect to the segregation of vehicles carrying dangerous goods will increase the safety factor of the ship and reduce the risk of accident. Technical assistance in designing RoPax ferries for Indonesian inland waterways is essential.

6.2.4 Upgrading maritime education

The educational facilities and curriculum of the deck personnel and port officers should be upgraded and should be more practical. The Ministry of Transportation

should conduct more training and short courses on dangerous goods handling for port authorities. In addition, PT. ASDP and the Ministry of Transportation should also increase the number of qualified personnel as outlined in chapter 4 of the "Revised Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas". Based on paragraph 4.1 on the guidelines, it is explained that:

"The regulatory authority may establish minimum requirements for training and, where appropriate, qualifications for each person involved, directly or indirectly, in the transport or handling of dangerous cargoes"

Moreover, in paragraph 4.3.1, it is also explained that:

"Every person engaged in the transport or handling of dangerous cargoes should receive training on the safe transport and handling of dangerous cargoes, commensurate with his responsibilities"

6.2.5 Technical cooperation with local government

The lack of facilities owned by the current crossing ports requires PT. ASDP and Ministry of Transportation to coordinate and cooperate with local governments to improve existing facilities, especially facilities related to dangerous goods handling in ports. Chapter 3 (paragraph 3.1.4) of the "Revised Recommendations on the Safe Transport of Dangerous Cargoes and Related Activities in Port Areas the guidelines, indicates that:

"The regulatory authority should also encourage the upgrading of existing facilities to meet such requirements"

For example, the limited vehicle parking area in the port can be extended by renting/acquiring private or government owned space outside the harbour area to be used as a special parking area for vehicles carrying dangerous goods.

6.2.6 Establishment of domestic waterways transport information system

A domestic waterways transport information system and a central database should be established to support inland waterways transportation in Indonesia. The

information system should contain an up-to-date ferry schedule, weather information, and delay information. This information system could also be used by passengers and shippers to charter special vessels to transport dangerous goods cargoes, so all dangerous cargoes will be transported by one special ship and not mixed with other cargoes. Moreover, this information system will contain the ferry schedule and information in case of delay, so shippers and drivers of vehicles with dangerous cargos could postpone their departure to the port and avoid the queue of vehicles in the port parking area.

6.2.7 Awareness building

Most RoPax ferry accidents associated with dangerous cargo are due to the low awareness of passengers. Awareness building activities should be taken in these areas through the local administration, Ministry of Transportation, PT. ASDP Indonesia Ferry, electronic media and newspapers and through educational institutes. Non-governmental Organizations (NGO) should also be involved with the awareness building programs.

Finally, further work is required to establish standard operating procedures for handling dangerous goods. Two detailed standard operating procedures are required, namely standard operating procedures at ferry ports and standard operating procedures for on board ferry loading and unloading. Both standard procedures require more in-depth analysis since both areas have different characteristics.

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APPENDICES

Appendix A: WMU Research Ethics Committee Protocol

WORLD MARITIME UNIVERSITY

WMU Research Ethics Committee Protocol

Name of principal researcher:	Fariz Maulana Noor
Name(s) of any co-researcher(s):	
If applicable, for which degree is each researcher registered?	
Name of supervisor, if any:	Prof. Michael Ekow Manuel
Title of project:	Dangerous Goods Transportation in Inland Waterways – Case Study Indonesia
Is the research funded externally?	No
If so, by which agency?	
Where will the research be carried out?	World Maritime University, Malmo, Sweden PT. ASDP Indonesia Ministry of Transportation Republic Indonesia
How will the participants be recruited?	By email and By Phone
How many participants will take part?	10 - 20
Will they be paid?	No
If so, please supply details:	
How will the research data be collected (by interview, by questionnaires, etc.)?	By Interview and Questionnaires
How will the research data be stored?	Digital Data and Form
How will the research data be disposed of?	Electronic files will be deleted from all media
Is a risk assessment necessary? If so, please attach	No

Signature(s) of Researcher(s): Date: 13/07/2017

Signature of Supervisor: Date: 13/07/2017

Please attach:

- A copy of the research proposal
- A copy of any risk assessment
- A copy of the consent form to be given to participants
- A copy of the information sheet to be given to participants
- A copy of any item used to recruit participants

Appendix B: Declaration Confidentialy

Declaration Confidentialy

I.....
of .....

have agreed to participate in this research project voluntarily.

I confirm that I have been made aware of the objectives and purpose of the research and assured of the confidentiality of the interviews.

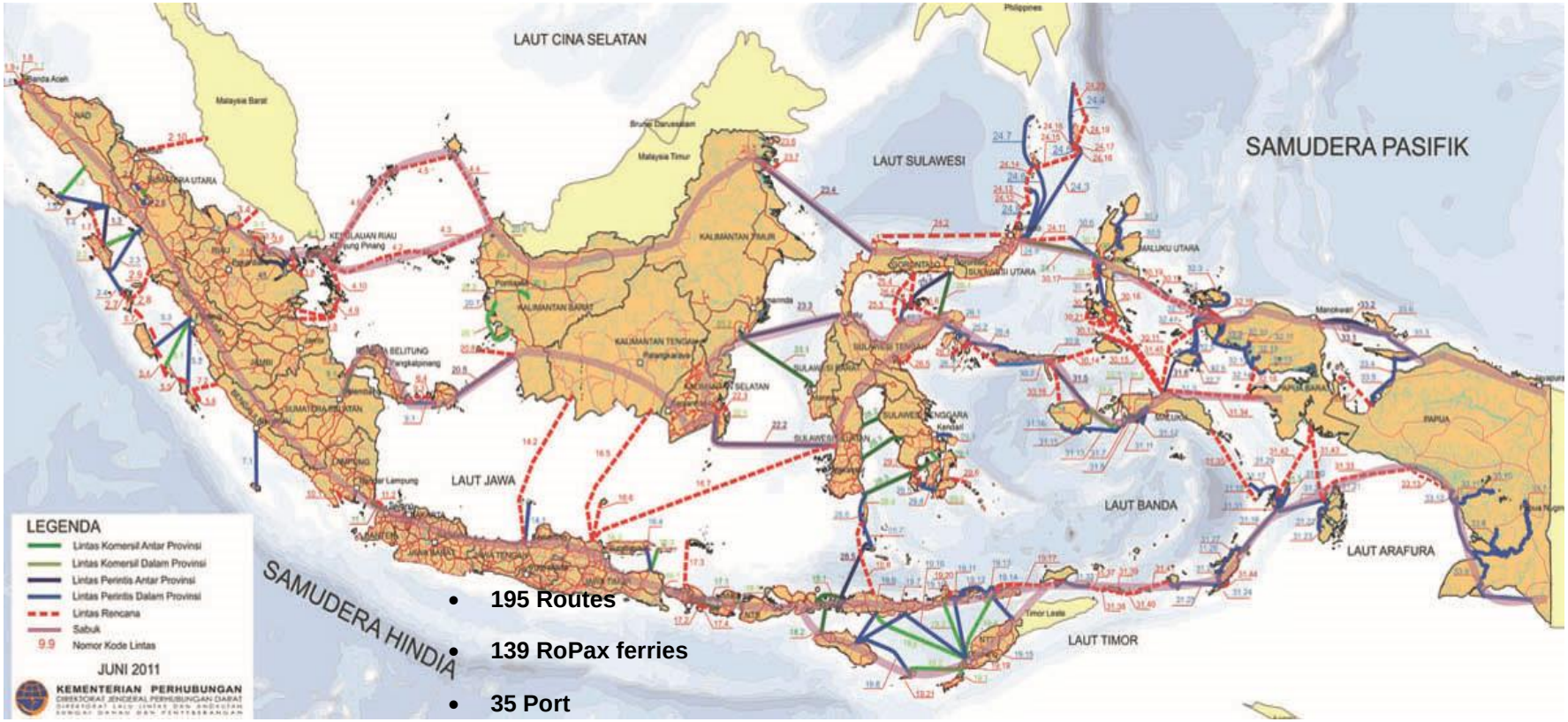
I agree / diasgree with having the interview voice-recorded.

Pursuant to the above, I give permission for the appropriate use of the information gained from the interview in subsequent publications and writings related to the research.

Signed:

..... Date: .....

Appendix C: Indonesia Domestic RoPax Ferry Route Network



Source: PT. ASDP Indonesia Ferry (Persero)

Appendix D: Picture of Levina 1 Fire Incident

Source: www.korantempo.co.id and NTSB report

Appendix E: Dangerous Goods Cargo onboard Levina 1 RoPax Ferry

LPG cylinder onboard Levina 1

Soda water can and gas stove

Appendix F: Picture of KM. Mutiara Sentosa Fire Incident

Source: http://harian.analisadaily.com/

Appendix F: Form Survey for Ferry Port Officer

(In English Language)

FORM OF PERCEPTION SURVEY ON TRANSPORT AND HANDLING OF DANGEROUS GOODS IN DOMESTIC PORT FERRY
RESPONDENT : FERRY PORT OFFICER

Survey Location : ..... Date of Survey : .....
Surveyor Name : .....
Port : .....
Rute : .....

II. Perception of Service of Dangerous Cargoes

1. **Dangerous Cargoes Handling at Ferry port**
   How do you think, the handling of dangerous cargoes at the port?
   1) Good 2) Moderate 3) Bad

   What aspects need to be improved on the handling of dangerous goods?
   1) .....
   2) .....
   3) .....
   4) .....
   5) .....

2. **Dangerous Cargoes Handling at ROPAX Ferry**
   How do you think, the handling of dangerous cargoes on the ship?
   1) Good 2) Moderate 3) Bad

   What aspects need to be improved on the handling of dangerous goods?
   1) .....
   2) .....
   3) .....
   4) .....
   5) .....

3. **How the procedure of Dangerous Cargoes handling and management at port di Pelabuhan ?**
   (bisa gunakan lembar/kertas tersendiri)

II. General Information of Respondent

1. **Sex** 1) Man 2) Woman
2. **Education** 1) SD (Elementary School) 3) SMA (High School)
   2) SMP (First Intermediate School) 4) Sarjana (S1/S2/S3) (Bachelor)
3. **Age** ..... Years old
4. **Position** .....

(In Indonesia Language)

FORMULIR SURVEY PERSEPSI TENTANG PENGANGKUTAN DAN PENANGANAN BARANG KHUSUS DAN BARANG BERBAHAYA DI PELABUHAN PENYEBERANGAN

RESPONDEN : PETUGAS PELABUHAN PENYEBERANGAN

Lokasi Survey	:	Hari/Tanggal Survey	: .....
Nama Surveyor	:	Jam Survey	: .....
Pelabuhan	:		
Rute	:		

I. Persepsi Tingkat Pelayanan Penanganan Barang Khusus dan Barang Berbahaya

1. Penanganan Barang Khusus dan Barang Berbahaya di Pelabuhan Penyeberangan

Menurut anda, bagaimana penanganan barang khusus dan barang berbahaya di pelabuhan?

1) baik 2) sedang 3) buruk

Aspek apakah yang perlu ditingkatkan pada penanganan barang khusus dan barang berbahaya ini?

1) .....
2) .....
3) .....
4) .....
5) .....

2. Penanganan Barang Khusus dan Barang Berbahaya di Kapal Penyeberangan

Menurut anda, bagaimana penanganan barang khusus dan barang berbahaya di kapal penyeberangan ?

1) baik 2) sedang 3) buruk

Aspek apakah yang perlu ditingkatkan pada penanganan barang khusus dan barang berbahaya ini?

1) .....
2) .....
3) .....
4) .....
5) .....

II. Data Umum Responden

1.	**Jenis Kelamin**	1) Laki-laki	2) Perempuan
2.	**Pendidikan**	1) SD 2) SMP	3) SMA 4) Sarjana (S1/S2/S3)
3.	**Usia**	..... tahun	
4.	**Jabatan**	.....	

Appendix G: Form Survey for Truck/Vehicle Driver

(In English)

FORM OF PERCEPTION SURVEY ON TRANSPORT AND HANDLING OF DANGEROUS GOODS IN DOMESTIC PORT FERRY
RESPONDENT : DRIVER OF TRUCK WITH DANGEROUS GOODS

Survey Location : ..... Date of Survey : .....
Surveyor Name : .....
Port : .....
Rute : .....

I. Characteristics and Origin-Destination of Cargoes

1. Origin of Dangerous Cargoes
   City .....
   County .....
2. Destination of Dangerous Cargoes
   City .....
   County .....
3. Type of Dangeous Cargoes
4. How Many weight ? ..... Kg

II. Perception of Service of Dangerous Cargoes

1. **Dangerous Cargoes Handling at Ferry port**
   How do you think, the handling of dangerous cargoes at the port?
   1) Good 2) Moderate 3) Bad

   What aspects need to be improved on the handling of dangerous goods?
   1) .....
   2) .....
   3) .....
   4) .....
   5) .....
2. **Dangerous Cargoes Handling at ROPAX Ferry**
   How do you think, the handling of dangerous cargoes on the ship?
   1) Good 2) Moderate 3)Bad

   What aspects need to be improved on the handling of dangerous goods?
   1) .....
   2) .....
   3) .....
   4) .....
   5) .....

III. General Information of Respondent

1. **Sex** 1) Man 2) Woman
2. **Education** 1) SD (Elementary School) 3) SMA (High School)
   2) SMP (First Intermediate School) 4) Sarjana (S1/S2/S3) (Bachelor)
3. **Age** ..... Years old

(In Indonesia Language (Bahasa))

FORMULIR SURVEY PERSEPSI TENTANG PENGANGKUTAN DAN PENANGANAN BARANG KHUSUS DAN BARANG BERBAHAYA DI PELABUHAN PENYEBERANGAN

RESPONDEN : PENGANGKUT BARANG KHUSUS DAN BARANG BERBAHAYA

Lokasi Survey	:	Hari/Tanggal Survey	: .....
Nama Surveyor	:	Jam Survey	: .....
Pelabuhan	:		
Rute	:		

I. Karakteristik dan Asal-Tujuan Perjalanan

1. Dari mana Anda memulai perjalanan ini ?
   - Kecamatan .....
   - Kota/Kabupaten .....
2. Tujuan akhir perjalanan Anda kemana ?
   - Kecamatan .....
   - Kota/Kabupaten .....
3. Jenis barang apa yang anda bawa ? .....
4. Berapa berat barang yang anda bawa ? ..... Kg

II. Persepsi Tingkat Pelayanan Penanganan Barang Khusus dan Barang Berbahaya

1. **Penanganan Barang Khusus dan Barang Berbahaya di Pelabuhan Penyeberangan**

   Menurut anda, bagaimana penanganan barang khusus dan barang berbahaya di pelabuhan?

   1) baik 2) sedang 3) buruk

   Aspek apakah yang perlu ditingkatkan pada penanganan barang khusus dan barang berbahaya ini?

   1) .....
   2) .....
   3) .....
   4) .....
   5) .....

2. **Penanganan Barang Khusus dan Barang Berbahaya di Kapal Penyeberangan**

   Menurut anda, bagaimana penanganan barang khusus dan barang berbahaya di kapal penyeberangan ?

   1) baik 2) sedang 3) buruk

   Aspek apakah yang perlu ditingkatkan pada penanganan barang khusus dan barang berbahaya ini?

   1) .....
   2) .....
   3) .....
   4) .....
   5) .....

III. Data Umum Responden

1. **Jenis Kelamin** — 1) Laki-laki 2) Perempuan
2. **Pendidikan** — 1) SD 2) SMP 3) SMA 4) Sarjana (S1/S2/S3)
3. **Usia** ..... tahun

Appendix G: Form of Dangerous Goods Handling Procedure / Timeline

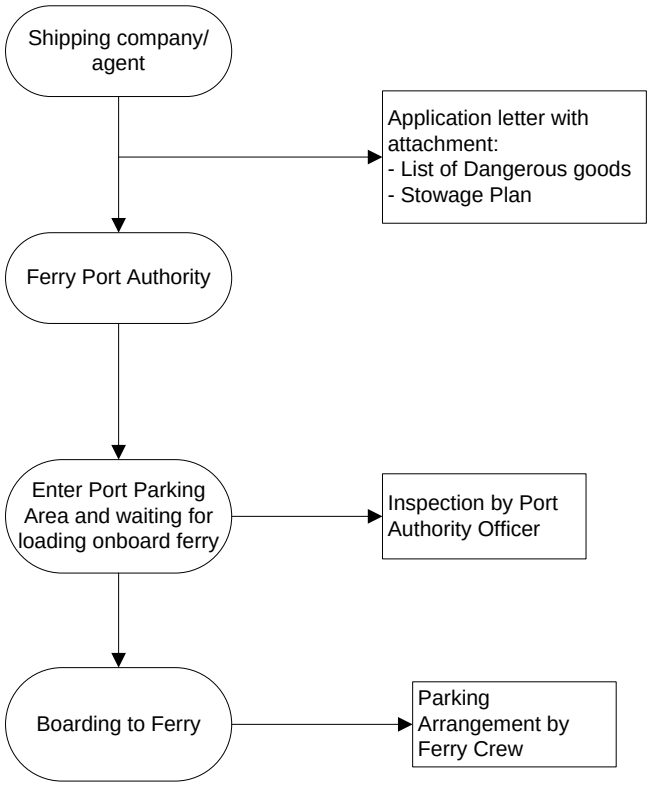
PROCEDURES OF TRANSPORTATION AND HANDLING OF DANGEROUS CARGOES

No	Type of Cargoes	Arrived in Parking Area	From Parking Area to Ship (Ferry)	Inside the Vessel	From Ship to Parking Area of Destination Port
		Time (PM/AM)	Duration	Time (PM/AM)	Duration
2.1	Bahan atau barang peledak (explosive)				
2.2	Gas yang dimampatkan, dicairkan atau dilarutkan dengan tekanan (compressed gases, liquified or dissolved under pressure)				
2.3	Cairan mudah menyala atau terbakar (flammabel liquids)				
2.4	Bahan atau barang padat mudah menyala atau terbakar (flammable solids)				
2.5	Bahan atau barang pengoksidasi (oxidizing substances)				
2.6	Bahan atau barang beracun dan mudah menular (toxic and infectious sunstances)				
2.7	Bahan atau barang radioaktif (radioactive material)				
2.8	Bahan atau barang perusak (corrosive substances)				
2.9	Bahan atau zat berbahaya lainnya (miscellaneous dangerous)				

Appendix H: Survey's result of Dangerous Goods Handling Procedur

no	Type of Cargo	Arrive at Ferry Port	In Parking Area	Onboard Ferry
1	Explosive	-	-	-
2	Compressed gases, liquefied Or dissolved Under pressure	Like other Vehicle (No segregation)	Parking in the same area (No Segregation)	No Segregation onboard ferry (vehicle arrangement based on ship stability data)
3	Flammable liquids	Like other Vehicle (No segregation)	Parking in the same area (No Segregation)	No Segregation onboard ferry (vehicle arrangement based on ship stability data)
8	Flammable solids	Like other Vehicle (No segregation)	Parking in the same area (No Segregation)	No Segregation onboard ferry (vehicle arrangement based on ship stability data)
9	Toxic and infectious substances	Like other Vehicle (No segregation)	Parking in the same area (No Segregation)	No Segregation onboard ferry (vehicle arrangement based on ship stability data)
10	Radioactive material	-	-	-
11	Corrosive substances	Like other Vehicle (No segregation)	Parking in the same area (No Segregation)	No Segregation onboard ferry (vehicle arrangement based on ship stability data)
12	Miscellaneous dangerous	-	-	-

Appendix I: Procedure for vehicle with dangerous goods in Merak Port and Ketapang Port



Source: Merak Port Authority

Appendix J: LPG Material Safety Data Sheet

PERTAMINA *Material Safety Data Sheet*

1. CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Product Name: **LPG (Liquefied Petroleum Gas)**

Tradenames / Synonyms: elpiji

MSDS Code: LPG-mix-001-PTM

Date: May 1, 2007 Revised: 0

Manufacture: PERTAMINA, Indonesia

Distributor: PERTAMINA, Direktorat Pemasaran & Niaga
unit Gas Domestik
Gedung Utama Pertamina Lt 12
Jl. Medan Merdeka Timur 1A, Jakarta 10110, Indonesia
Phone: 62-21-3815137,- 3815569
Facs.: 62-21-3846943,-3843773

Product Information: PERTAMINA, Pemasaran Gas Domestik
Phone: 62-21-3815137,- 3815569
Facs.: 62-21-3846943,-3843773

Medical Emergency: 62-21-3815964

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS Number	
1. Ethane	74-84-0	0.2 % Max.
2. Propane	74-98-6	97.50 % (C3 + C4) Min.
3. Iso-butane	75-28-5	
4. N-butane	106-97-8	
5. Pentane and heavier	68476-43-7	Traces
6. Ethyl Mercaptan	67-56-1	50 ml/100 AG Min.

* Pentane as n-Pentane

3. HAZARDS IDENTIFICATION

3.1. EMERGENCY OVERVIEW:

Health Hazards: Danger, may cause cardiac sensitization, asphyxiant gas, overexposure may cause depression, liquid material may cause frostbite and freeze burns.

Flammability hazards: Extremely flammable, forms explosive mixtures with air, may cause flash fire.

Appearance / Odor: Vapor and Liquid are colorless, contain stanching agent
OSHA Hazard Determination: 800 - 1000 ppm 8-hour TWA
HMIS Rating: Health: 1; Flammability: 4; Reactivity: 0

3.2. POTENTIAL HEALTH EFFECTS

Pri

mary Route of Exposure

10. STABILITY AND REACTIVITY

Chemical Stability: Stable
Incompatibility with Other Materials: Oxygen and strong oxidizing agents
Hazardous Polymerization Occur: Will not occur
Decomposition : Deficient primary and secondary air can produce carbon monoxide
Carbon oxides formed when burned

11. DISPOSAL CONSIDERATIONS

Waste Disposal: Insure conformity with all applicable disposal regulations

12. TRANSPORTATION INFORMATION

Shipping Name: Liquefied Petroleum Gas

Hazard Class: 2.1 (Flammable Gas)
Packing Group: Not Applicable
Marking: Liquefied Petroleum Gas
Labels required: Flammable Gas

13. REGULATORY INFORMATION

There may be specific regulations at the local, regional or state/provincial level that pertain to this product.

14. OTHER INFORMATION

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Appendix K: Solar Biodiesel Material Safety Data Sheet

PT. PERTAMINA (PERSERO) Directorate of Marketing and Business	Date of Construction : June 2007 Date of Revision : - Page : 1 of 8

MATERIAL SAFETY DATA SHEET (MSDS)

1. MATERIAL IDENTIFICATION

PRODUCT NAME : **BIOSOLAR**
OTHER NAME : BIO DIESEL FUEL
MANUFACTURER : PT. PERTAMINA (PERSERO)
Jl. Medan Merdeka Timur No.1A
Jakarta Pusat - Post Code 10110
Telephone : 021-79173000
SMS (021) 71113000
Pertamina Contact Centre (PCC) :
Faksimile : (021) 7972177
Email : pcc@pertamina.com

Emergency Telephone Number within 24 hours : 021-3816732
MSDS Information Telephone Number : 021-3815578 / 3815504

2. MATERIAL COMPOSITION / IDENTITY INFORMATION	Hydrocarbon and FAME 812

3. HAZARD IDENTIFICATION	**Hazard Communication Standard :** OSHA 29 CFR 1910, 1200 (hazardous) **Exposure Effects :** Irritation to the respiratory tract, dizziness, nausea, and unconsciousness. Repeated contact with the skin for a long time can cause skin irritation or more serious skin defects. It is reported by a study that this product can cause skin cancer in poor conditioned hygiene strengthened by repeated long exposure of strong sunlight **Emergency Response Data :** Combustible liquid

4. FIRST AID METHODS	**Eye Contact :** Flush the eyes continuously with copious amount of water. If irritation persists seek medical advice. **Skin Contact :** Wash the contacted part with water and soap. Wash the contaminated clothes before being worn again.

14. TRANSPORTATION INFORMATION	**USA DOT :** SHIPPING NAME : DIESEL FUEL HAZARD CLAS & DIV : Combustible Liquid ID NUMBER : NA 1993 ERG NUMBER : 128 STCC : 4915112 PACKING GROUP : PG III DANGEROUS WHEN WET : None POISON : No PLACARD (s) : Combustible **RID / ADR :** HAZARD CLASS : 3 HAZARD SUB CLASS : 31(c) LABEL : 3 DANGER NUMBER : 30 UN NUMBER : 1202 **IMO :** HAZARD CLASS & DIV : 3.3 ID/UN NUMBER : 1202 PACKING GROUP : PG III SHIPPING NAME : Diesel Fuel **ICAO / IATA:** HAZARD CLASS & DIV : 3 ID/UN NUMBER : 1203 PACKING GROUP : PG III LABEL(s) : Combustible Liquid