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WORLD MARITIME UNIVERSITY

Dalian, China

**MONITORING RESPONSIBILITY AND MEASURES OF THE
RECYCLING COMPANY IN WATER POLLUTION
PREVENTION DURING THE PROCESS OF SHIP RECYCLING**

By

Tu Rui

The People's Republic of China

A research paper submitted to the World Maritime University in partial
Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

(MARITIME SAFETY AND ENVIRONMENTAL MANAGEMENT)

2017

DECLARATION

I certify that all the material in this research paper 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 research paper reflect my own personal views, and are not necessarily endorsed by the University.

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ABSTRACT

Title of research paper: **Monitoring responsibility and measures of the recycling company in water pollution prevention during the process of ship recycling**

Degree: **MSc**

With the increasing number of ships for recycling in recent years, the water environmental pollution caused by ship recycling has attracted more and more attention. As the owner of recycling facilities and the direct responsibility undertaker of the Hong Kong Convention, the Recycling Company should take effective measures to reduce the water pollution problems caused by ship recycling.

This paper first introduces the main recycling technology and the pollution that may be generated in the process of ship recycling, and then analyzes main responsibilities of the Recycling Company to prevent the water pollution under the Hong Kong Convention. After that, the paper analyzes the necessity of strengthening environmental safety management of the Recycling Company. Finally, it puts forward the corresponding solutions on how to strengthen the environmental safety management of the Recycling Company and prevent water pollution caused by ship recycling in terms of ISO14000.

Key words: Ship recycling, the Hong Kong Convention (the HKC), the Recycling Company, ISO 14000

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LIST OF ABBREVIATIONS

BC	Basel convention organization
BDI	Baltic Dry Index
DASR	Document of Authorization to conduct Ship Recycling
EEDI	Energy Efficiency Design Index
EU	European Union
EMS	Environmental management system
HKC	The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009
ICIHM	International Certificate on Inventory of Hazardous Materials
IHM	Inventory of Hazardous Materials
ILO	International Labor Organization
IMO	International Maritime Organization
IRRC	International Ready for Recycling Certificate
IRRC	The International Ready for Recycling Certificate
ISO	International Organization for Standardization
LDT	Light Displacement Ton
PCBs	Polychlorinated Biphenyls
PVC	Polyvinyl Chloride
PDCA	Plan, Do, Check, Action
RO	Recognized Organization
SRF	Ship Recycling Facilities
SRFP	Ship Recycling Facility Plan
SRP	Ship Recycling Plan
US	United States

Chapter 1 Introduction

“The process of tearing down a vessel has been labeled as ship scrapping, demolition, breaking and dismantling, and is currently announced under the less stigmatizing label of ship recycling” (Gabriela, 2016), and the label of ship recycling adopted by the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (hereafter referred to as ‘the Hong Kong Convention’ or the ‘HKC’).

Ships and other floating structures for recycling which refer to ships or other floating metal structures that have lost shipping capacity or use value usually contain some dangerous wastes and hazardous materials, such as various oils, asbestos products, polychlorinated biphenyls (PCBs), paint and so on. If they cannot be removed or disposed properly according to the rules of operation, it will be easy to cause water, air, soil and other pollution.

Ship recycling is the process in order to get the use of renewable raw materials for dismantling the hulk of the ship structure, including the removal of equipment, facilities and any other part. Ship recycling is the most effective way to recover components and materials of a ship for reprocessing and re-use, but the pollution generated from the process of ship recycling cannot be ignored (Shi, 2013). The process of dismantling will generate a lot of pollution sources, such as the water pollution source resulted from the remaining oil, ballast water, bilge water, the dismantling washing wastewater etc. The pollution is difficult to avoid in the process of dismantling. According to statistics, from 2006 to 2015, the ship recycling industry generated nearly 5.5 million tons of hazardous materials which have potential threat to the environment. These materials mainly include sludge, oil, paint, polyvinyl chloride (PVC) and asbestos (Liao, 2015).

At present, China, India, Bangladesh, Pakistan, Turkey are the five largest ship recycling countries in the world. The relevant data of the International Maritime Organization (IMO) shows that in recent years, the average annual amount of ship recycling in these five countries accounted for more than 95% of the global total amount (Ke & Song, 2016).

The actual amount of ship recycling is closely related to the world shipping market. When the shipping market booms, the ship owner will prolong the service period of old ships which are close to or more than the service life to increase capacity and operating profit. The owner will also continue to rely on the ship leasing to earn high rent, and is unwillingly to send the old ship to the ship recycling facility. While the shipping market turns down, the idle quantity increases, and the maintenance costs are so high that the ship owner will sell the idle ships which are still in service life to the recycling company and scrap in advance. Because of the particularity of ship recycling industry, its autoregulation is very weak. The total amount of ship recycling in the world always changes with global economy, shipping industry and other factors and often occur large fluctuations (Deng, 2009).

Since the international financial crisis in 2008, the global economic recovery has been slow and weak. The shipping industry continues to slump, and each index of international shipping market are fluctuated and continue downward (Cao, 2015). In 2016, the Baltic Dry Index (BDI), the global benchmark for the cost of shipping commodities, ran below 1300 and created the new low record at 290. In the context of excess capacity and unprofitable outlook, reducing transport capacity and production become the main direction of the marine market. Excess capacity has forced a large number of ships to retreat from the shipping market, especially with the prices of oil, iron ore and other commodities continuing to slump, forcing a large number of drilling platform, bulk cargo ship and oil tanker to lie idle. Continued disposal of idle ships is still the main management option of ship owner (Liu, 2016).

According to statistics, from 2009 to 2015, the total amount of ship recycling in five largest ship recycling countries were more than 55 million LDT (light displacement ton), and the annual recycling capacity was about 7.85 million LDT. Among them, from 2011 to 2015, the total amount in the five countries was nearly 47 million LDT, with an annual amount up to 9.4 million LDT (Cao, 2015). The total amount of ship recycling in the five countries from 2011 to 2015 is shown in figure 1.

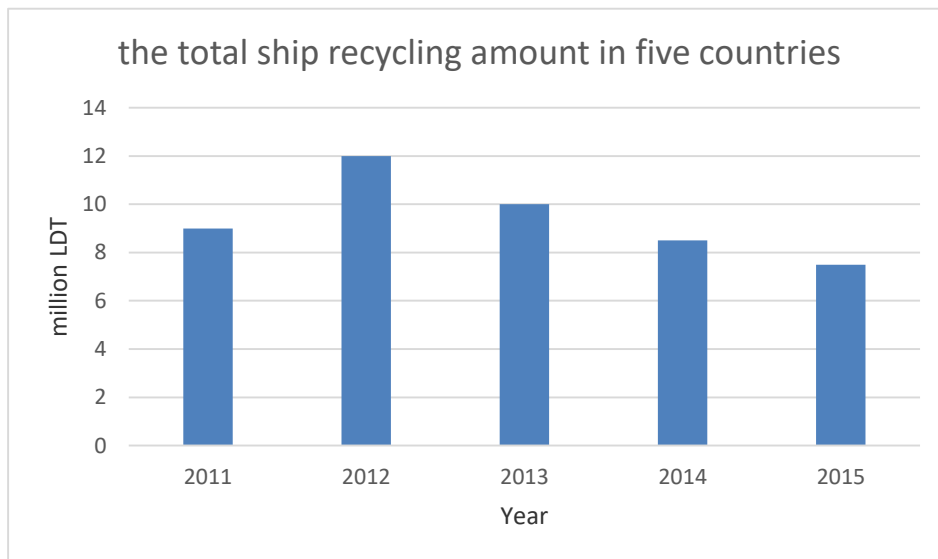


Figure 1: The total amount of ship recycling in the five main ship recycling countries
Source: Cao Changkui. (2015). *Present situation and influencing factors of merchant ship dissembling in the world*. Journal of Shanghai ship and shipping research institute

In 2015, although the global number of ship recycling and LDT declined significantly, the absolute amount of ship recycling is still considerable. In 2016, in order to cope with the depressed shipping market, some large international shipping companies began to try merger and restructuring. Coupled with the international community's great concern about Ballast Water Convention (the International Convention for the Control and Management of Ship's Ballast Water and Sediments) and the effectiveness of the Energy Efficiency Design Index (EEDI), etc., the low age trend of ships for recycling was obvious, as shown in figure 2, in which the bulk carrier continues to occupy a large proportion of scrapping. What is noteworthy is that the

container ship from 8000 to 12000 TEU has become the main navigable vessel of the canal under the influence of the Panama Canal expansion (CNSA, 2017). Some old traditional Panamax container ships have lost the advantages and the economic benefits decline leads to the significant increase in the number of container ships scrapped in 2016 (Ke & Song, 2016).

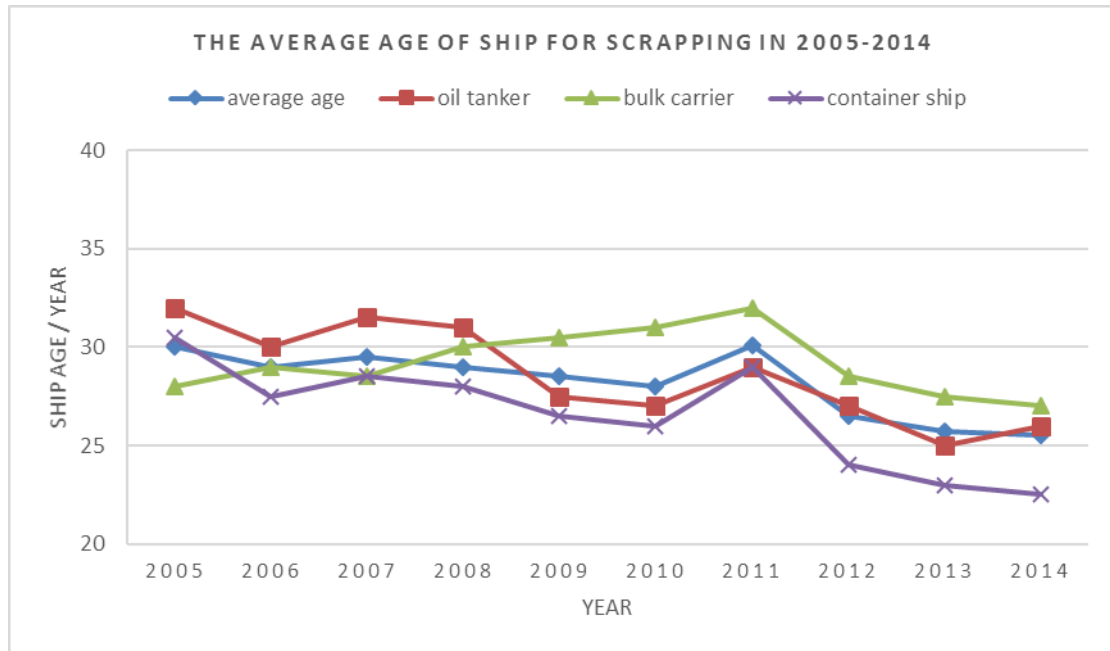


Figure 2: The average age of ships for scrapping from 2005 to 2014

Source: Ke Hua, Song Pei. (2016). *Review of the 2015 International Shipbreaking Market*. China Ship news

In view of the above reasons, the number of ships for recycling will remain in a high and stable state in the coming years. Because the water pollution may result from the operation process of ship recycling, the increase in actual recycling amount will easily lead to more potential water pollution, which puts forward higher requirements for the ship recycling facility and its corresponding responsible party. Therefore, it is necessary to accurately identify the possible pollution caused by ship recycling and take effective measures to reduce it.

Chapter 2 Possible water pollution in the process of ship recycling

2.1 Ship recycling technology and process at present

Ship recycling is a complex activity, and safe and environmentally sound practice is a result of numerous measures and factors. The typical process of ship recycling in the current recycling industry is divided into pre-cleaning of ship, oxygen and explosion test, demolition of the superstructure and the main engine room equipment, demolition of ship bottom, etc. (Xu, 2009) Dismantling operations are usually made by cutting, which produces flame and uses a large amount of electrical equipment. Therefore, it must be pre-cleaning of the cabin before dismantling, including removing the obstacles and eliminating remaining oil residue, sludge and other materials, to make sure that the cabin residue does not affect the use of dismantling equipment, and avoid the combustion or explosion of electrical equipment because of exposure to fire. At the end of the clean-up, the explosion test must be carried out before the dismantling begins, the air and residue conditions in the cabin shall be checked and make sure that they are in the safety scope, then the dismantling work can be carried out (Song, 2008). The process is shown in figure 3.

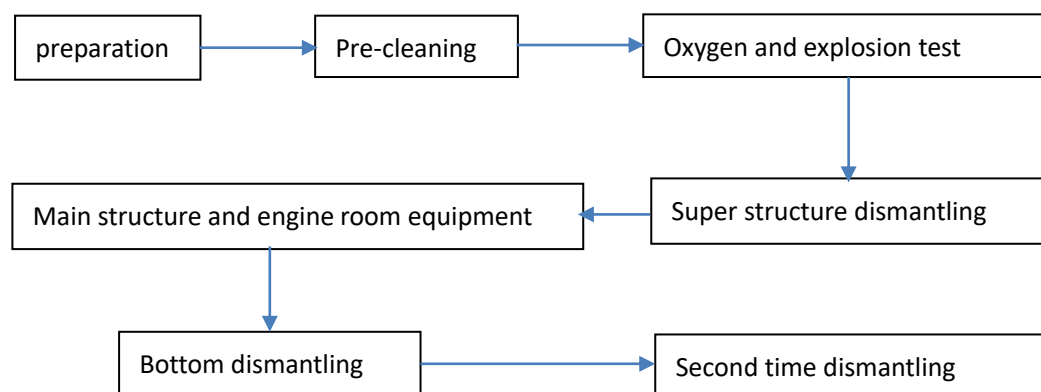


Figure 3 :The typical process of ship recycling

Source: Liang Zhuoquan. (2012). *Researches on the anti-pollution technology & procedure for ship recycling*. Guang Dong shipbuilding

At present, there are three main kinds of ship recycling technology, dismantling vessel on beach, dismantling alongside wharf and boat yard for dismantling.

Dismantling vessel on beach refers to the use of the tidal range, when at high tide, the ship beached; at low tide, dismantle the ship on the beach. In India, Bangladesh and other countries in South Asia, due to the labor costs and the low technical requirements for dismantling, most of them use the method of 'dismantling vessel on beach'. This method usually discharges the oily wastewater directly, and the waste oil spills into the sea and beach, the asbestos and glass fiber, heavy metals, PCBs and other toxic and hazardous waste are directly abandoned on the beach, and then pollute the ocean with the tides, causing immeasurable impact to the beach and ocean (Rousmaniere, 2007).

The Hong Kong Convention does not expressly forbid dismantling vessel on beach, some countries, organizations or specialized agencies have different interpretation of the green ship recycling because of consideration of geopolitical, economic interests and other factors (Shi, 2013). At present, more and more international organizations, governments, non-governmental organizations and professional organizations actively call for a global regulation to prohibit dismantling vessel on beach and pushing green ship recycling. In 2015, the Norway ship-owners Association made an explicitly proposal that forbids the ship owners in Norway to send their ships to the ship recycling facility which does not fulfill the safety and environmentally sound requirements (Liao, 2015).

Dismantling alongside wharf refers to the ship docks at the water area at the apron of wharf or those lie at anchor. In the dismantling process, the hull is cut into several segments and hoisted to the shore with a crane, and then further decomposition is conducted on shore, which require different kinds of recycling materials. Because of the equipment limitations in wharf, the dismantling cannot be accomplished at one time. The first stage of dismantling is conducted on water: the hulk is divided into

several large pieces, hung to the land with large hoisting equipment, and then transferred to the second area for dismantling, where it will continue to be split into smaller pieces, with further separation equipment available (Song, 2008). In the whole operation process, through the use of equipment, energy, manpower, dismantling the ship to waste steel and old equipment, the noise, waste, emissions generated from the process will impact the environment. This kind of operation is mainly applied in China, which is more advanced than South Asia in the dismantling technology and process, environmental protection facilities, labor protection and production efficiency. But there are some other problems, such as the difficult operation, complex production process, additional production machine, high security risks and so on (Liang, 2012).

Boat yard for dismantling is the way in which the dismantling process is conducted in the dock after the ship enters into it. It is mainly used in Europe, US and other advanced countries. The most prominent advantage is environmental protection and efficiency, which can greatly avoid the environmental protection issues and safety hazards existing in current shipbreaking industry. It has better effect of environmental protection and safety prevention, but the construction cost is higher than other methods (Song, 2008). Because of the high cost and requirement of technology, although it is safer and more environmentally friendly than the other two methods, it has not been used widely by shipping recycling industry. In China, some new large companies have gradually taken this method. According to the statistics, the market share of the three kinds of dismantling methods is shown in figure 4. The dismantling on beach takes up the largest proportion, followed by dismantling alongside wharf, and the last one is boat yard for dismantling.

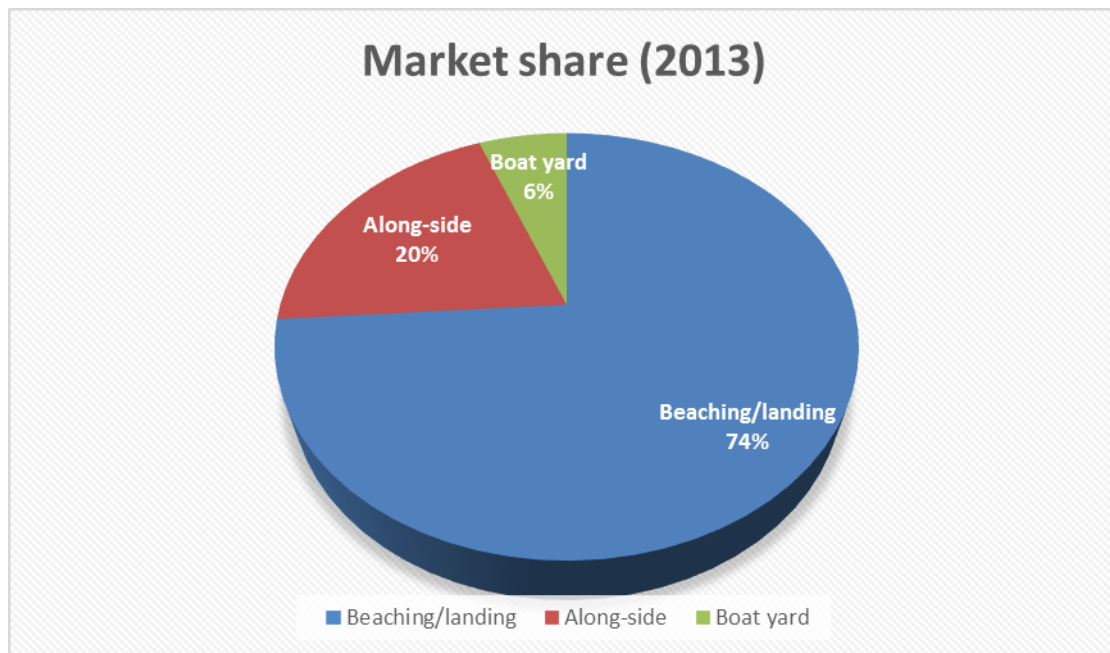


Figure 4: The market share of three different dismantling methods in 2013

Source: Ke Hua. (2014). *The global Shipbreaking industry in 2014*. China Ship news.

The special requirements of ship recycling industry demand that the enterprise site have convenient water traffic conditions, allowing the ship to easily enter into ship recycling facilities. The specificity of recycling site selection leads to the result that no matter what kind of recycling method mentioned above is used, it can still be inevitable to cause environmental pollution in nearby waters in the operation process of recycling.

2.2 The main water pollutants generated in the process of ship recycling

From the analysis of ship recycling process, the water pollution caused by ship recycling can be divided into the following three categories: the pollutant from the ship itself, such as the residual oil, ballast water; the pollutant generated from human operation, such as the waste fire-water, the cleaning water; the pollutant from the shore, such as the little solid garbage abandoned on beach, as shown in figure 5.

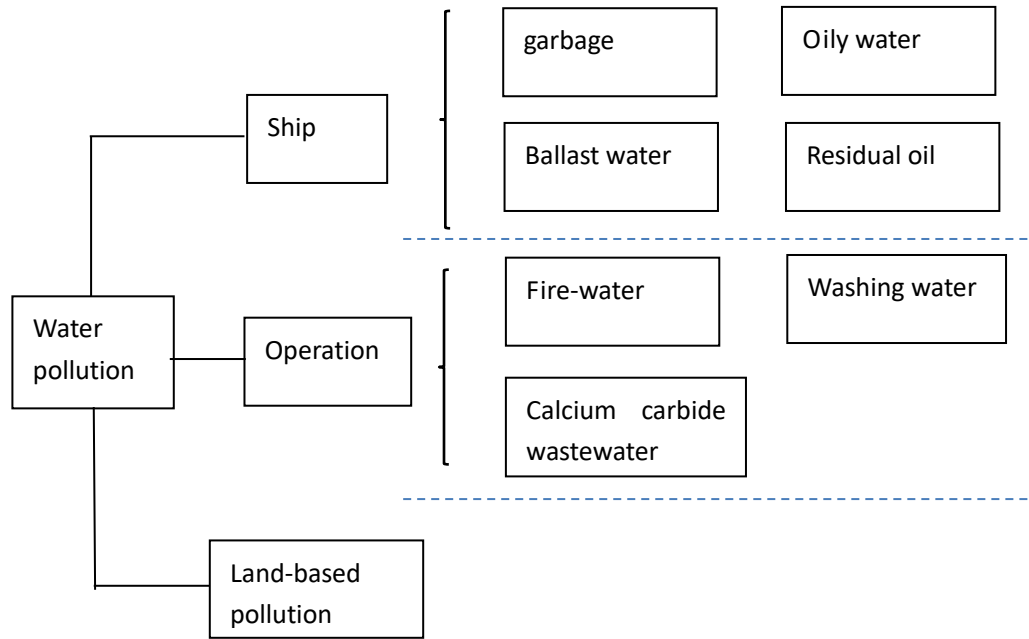


Figure 5: The main water pollution from ship recycling
 Source: by author, on the basis of the context.

2.1.1 Pollutants from ship

Residual fuel oil. When the ship sails into the ship recycling facility, there is still some fuel oil in the ship's fuel tank to ensure the normal operation of the ship. In general, residual fuel oil remains in the fuel tank when it arrives at the dismantling site. If the fuel is not treated properly before dismantling, the fuel may leak and cause water pollution. In addition, in the production process of ship recycling, the residual crude oil, fuel oil, lubrication oil, hydraulic oil and other oil in tank, pump or the pipe system also can lead to water pollution. When the wastewater containing petroleum enters the water, the harm is obvious. It not only affects the growth of marine organisms, but also decreases the self-purification ability of the ocean and affects the coastal environment. According to statistics, ship recycling in worldwide will generate 400000~1300000 tons of waste oil each year, therefore, the risk of oil pollution in the process of ship recycling cannot be ignored (Guo, 2010).

Oily bilge water. The oil and lubricating oil drain or leak from equipment or facilities in the ship engine room, such as the main engine, auxiliary engine, oil tank, oil pump, oil separator, oil cooler, oil filter, stern shaft sealing device and piping system. The fuel oil or lubricating oil leakage during the maintenance of machine and equipment, or the oil spill caused by the operation, some of these oils will inevitably inflow of bilge. In addition, cooling water, ballast water, fire water and fresh water daily suspected system will lead a part of sea water or fresh water into the bilge, the oil and water mixed into the bilge and become oily bilge water in the engine room. The oily bilge water exists in the vessel for breaking up inevitably. This kind of wastewater has a higher concentration of petroleum, nearly 2000mg/L, and cannot be discharged directly.

The ballast water. Ballast water is pumped into the ballast tank of a ship to maintain the balance and the stability of the ship. In general, a ship with 10 thousand LDT needs 300-450 Tons ballast water, and 40-50 thousand LDT needs 1000-1200 Tons ballast water (Liao, 2015). The discharge of ballast water will give rise to the introduction of invasive marine species into new environments, such as bacteria, viruses, algae, software animal and fish. If the ballast water is discharged directly, it will cause the water pollution near the recycling facility. The invasion of alien species brought by the ballast water from imported old vessel for breaking up has gradually attracted people's attention.

Garbage on board. After the ship sails to the recycling facility, some garbage would exist on the ship. If it is dropped directly into the sea, it will also have adverse effects on water environment.

2.2.2 Pollutants from human operation

Improper handling of ship recycling may lead to a lot of problems. The engine room

washing water, the cargo oil tanker washing water contain some petroleum substances, and the oily waste water cannot be discharged directly, either. The oil leakage may occur during the dismantling process and cause the oil pollution accident, especially in the process of dismantling waste oil tanker. If the operation is not standardized, it will easily lead to significant pollution accident.

The fire-water. As the cutting operations during the dismantling process require the use of acetylene, liquefied natural gas, oxygen and other mixed gas, and the cutting process can produce high temperature, while the paint, residual sludge are flammable, therefore, in order to avoid the fire accident caused by the high temperature in the cutting parts during the operation process, fire-water is used to lower the temperature. Statistics show that dismantling 10 thousand LDT needs 100-150 Tons fire-water (Liao, 2015).

Calcium carbide wastewater. The ship dismantling of 1 LDT needs calcium carbide 1kg, oxygen 12kg, water 10kg, generate carbide slag 1kg. At the beginning of 1990s, some recycling facilities use the calcium carbide to generate acetylene gas. The process will produce calcium carbide wastewater and carbide slag, and may be associated with hydrogen sulfide, phosphine and other harmful materials. Nowadays, this kind of process has been eliminated in large companies (Shi, 2012).

2.2.3 Land-based pollution

Land-based pollution includes the pollution caused by tide and rain. Due to the special geographical location of the Ship Recycling Facility, they are mostly located nearby the sea or river. Because of the limit of dismantling technology and process, most of the operation is for outdoor operation. For dismantling on the shore, the variety of pollutants may drip on the ground in the process of operation. The heavy metals, such as Cadmium (Cd), Mercury (Hg) and lead (Pb) which are contained in waste batteries,

old instruments and paint may directly pollute soil. In addition, some small solid waste will be abandoned on shore directly and cannot be cleaned immediately. With the tide and rain, the contaminated soil and solid trash will be carried into the water by the waves or the rain, and lead to water pollution near the recycling facility. Especially after the rainstorm, the initial rainfall of 15-20 minute, the pollutant concentration is higher than the other time (Xu, 2009).

Chapter 3 The requirements for ship recycling company responsibilities in Hong Kong Convention

3.1 The basic condition of the Hong Kong Convention

In order to reduce the environmental pollution caused by ship recycling, the International Maritime Organization (IMO), the International Labor Organization (ILO) and the Secretariat of the Basel Convention (BC) have formulated the guidelines for scrapping respectively from their different functions. But because of the voluntary implementation of national guidelines, they cannot be implemented very well. In May 11, 2009, the IMO held the convention conference in Hong Kong, and finally adopted the Hong Kong Convention (Zhou, 2010).

The Hong Kong Convention is the first international maritime convention to solve the issues related to ship recycling, filling the gap in the field of ship management, which realizes the safe and environmentally sound recycling of ships from propose to compulsory. Once the convention enters into force, it will provide practical and mandatory rules for the recycling of waste ships worldwide and play an active role in the sustainable development of the shipbuilding industry and related industries. The Hong Kong Convention consists of the preamble, main text, one annex and seven appendixes.

There are 21 Articles in the Convention, including general obligations, definitions, application, controls related to ship recycling and the facilities, survey and certification of ships, inspection of ships, technical support and cooperation and information communication between contracting states and so on. In addition, according to the provisions of article 17 of the convention, the HKC will entry into

force 2 years after the date on which meeting the following three conditions: ratification by 15 countries; the total gross tonnage of merchant fleet in the 15 countries more or equal to 40% of the world's merchant shipping; the maximum annual ship recycling volume in the 15 countries in the last 10 years not less than 3% of its total merchant gross tonnage (Zhou, 2010).

The Annex of the Hong Kong Convention is the Regulation for Safe and Environmental Sound Recycling of Ships (Regulation for Recycling of Ships). The regulation adopts the manage method of 'from Cradle to Grave', through the flag state control, port state control, inspection and certification system and other execution mechanisms to ensure that the Convention can be implemented and reach to a higher control level. Regulation for Recycling of Ships has 25 regulations, divided to 4 chapters (Zhou, 2010). The first chapter is the general provisions, mainly about the definition and boundary of relevant concepts. The second chapter is the requirements for ships, mainly including: The Inventory of Hazardous Materials (IHM) should be updated and maintained from the start of ship design and construction to the operation and dismantling period; develop the Ship Recycling Plan before dismantling; the survey and certification in different periods and so on. The third chapter is about the requirements for ship recycling facilities, mainly including the control, approval, general requirements of recycling facilities, and the accident prevention, personnel safety and training and so on. The fourth chapter is about the provisions of the reporting system, including: notification and report before recycling and the reports after completion of recycling (Zhao & Chen, 2014).

In addition, there are seven appendices in Hong Kong Convention, Appendix 1 and Appendix 2 are the core elements of the Convention on the control of hazardous materials. Specifically, Appendix 1 is to prohibit the installation and use of the material in the ship, the Appendix 2 is the list of items for the IHM, if the ship installed or used the substances in the list, it needs to be recorded in the appendix of the International Certificate on Inventory of Hazardous Materials (ICIHM). Appendix

3 to Appendix 7 are the format of the relevant certificates (Zhou, 2010). The main structure of HKC is shown in figure 6.

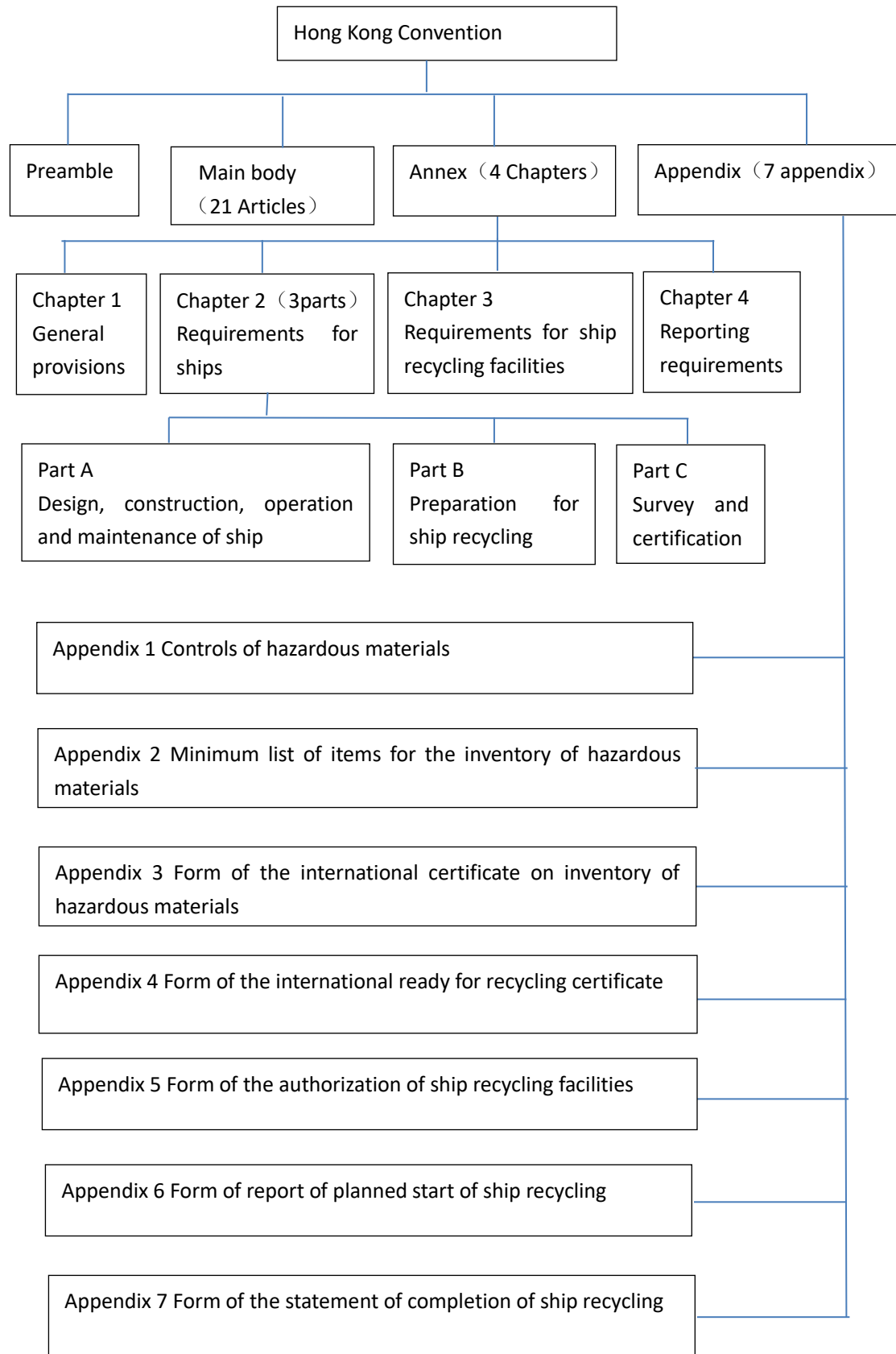


Figure 6: The main structure of HKC

Source: By the author, on the basis of the HKC

In order to promote the effective implementation of the Hong Kong Convention, the Marine Environment Protection Committee (MEPC) has formulated and adopted 6 guidelines, which act as instructions for the operation of the supplementary provisions (Niu, 2015). The 6 guidelines are shown in table 1.

Table 1: The relevant guidelines on ship recycling

Guidelines	Resolution number	Adoption time
guidelines for the development of the Ship Recycling Plan	MEPC.196(62)	July, 2011
guidelines for the development of the Inventory of Hazardous Materials	MEPC.197(62)replace the MEPC.179(59)	July, 2011 May, 2013 revised
guidelines for safe and environmentally sound ship recycling	MEPC.210(63)	March, 2012
guidelines for the authorization of Ship Recycling Facilities	MEPC.211(63)	March, 2012
guidelines for survey and certification	MEPC.222(64)	October, 2012
guidelines for inspection of ships	MEPC.223(64)	October, 2012

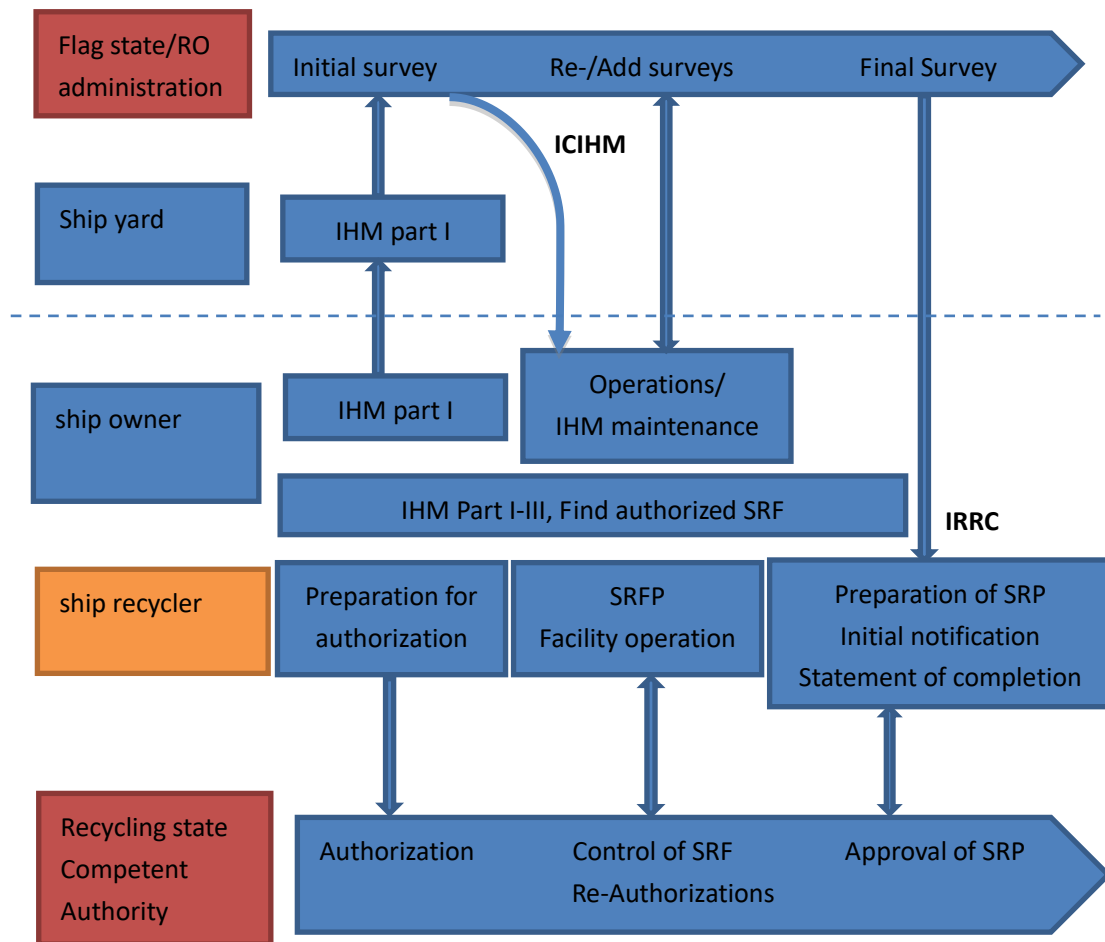
Source: Niu Zhibin. (2015). Study on the Countermeasures of the Convention implementation in China. *Tianjin Navigation*.

3.2 The monitoring responsibility of the Recycling Company in Hong Kong Convention

3.2.1 The different stakeholders in the Hong Kong Convention

As has been analyzed before, the Hong Kong Convention adopted the ‘from cradle to grave’ model for the management of ships. The Hong Kong Convention introduced the concept of preventing environmental pollution into the whole life cycle of the ship, from construction, operation to dismantling. The hazardous and harmful substances which were installed or used on the vessel in the stage of construction, operation and dismantling should be reflected in the relevant normative documents, and examination and approval by the flag state, port state and the relevant competent authorities about the ship recycling. In this way, harmful materials are controlled from all aspects, which have obvious effect for the prevention of environmental pollution caused by ship recycling.

The whole life cycle management style involves the marine products suppliers, shipyards, ship owners, recycling companies and other stakeholders. The Hong Kong Convention sets out detailed rights and obligations to all interested parties, to form a complete chain of obligations, in order to better implement the life cycle management style, so as to realize the safe and environmentally sound recycling of ships. According to the relevant requirements for different stakeholders in Hong Kong Convention, the relationship and their obligations are shown as figure 7.



The meaning of abbreviations in the figure:

RO: Recognized Organization

IHM: Inventory of Hazardous Materials

ICIHM: International Certificate on Inventory of Hazardous Materials

SRF: Ship Recycling Facilities

SRFP: Ship Recycling Facility Plan

SRP: Ship Recycling Plan

IRRC: The International Ready for Recycling Certificate

Figure 7 :The stakeholders and their obligations

Source: By author, on the basis of HKC

3.2.2 Monitoring responsibilities of the Recycling Company

According to figure 7, there are many different roles in ship recycling management, each of which has its own obligations of preventing the environment pollution. Among these stakeholders, the ship recycler has the most direct and important responsibility of the environment pollution prevention. In Hong Kong Convention, there are two different definitions relating to the ship recycler, Ship Recycling Facility and Recycling Company.

“Ship Recycling Facility means a defined area that is a site, yard or facility used for the recycling of ships.” “Recycling Company means the owner of ship recycling facility or any other organizations or persons who have assumed the responsibility for operation of the ship recycling activity from the owner of the Ship Recycling Facility and who on assuming such responsibility has agreed to take over all duties and responsibilities imposed by this Convention.” (Hong Kong Convention, 2009)

There are a lot of requirements for ship recycling facilities in Hong Kong Convention and guidelines while not the relevant requirements for recycling companies, the provisions relating to the Ship Recycling Facility in Hong Kong Convention are shown in table 2.

Table 2: The relevant provisions of SRF in the HKC

The HKC	Provisions	Title
Text of HKC	Article 6	Authorization of SRF
ANNEX	Chapter 2/ Part B	Preparation for ship recycling
ANNEX	Chapter 3	Requirements for SRF
ANNEX	Chapter 4	Reporting requirements

Source: by the author, on the basis of the HKC.

However, through the definition we can see that, the Recycling Company is the owner

of the Ship Recycling Facility, and the ship recycling facility is only an objective existence of the site, yard and facility, which has no independent capacity to meet the requirements of the Convention. All the relevant responsibilities and duties assigning to the Ship Recycling Facility should be fulfilled by the Recycling Company, the direct obligators of it. Therefore, all the requirements about the Ship Recycling Facility can be seen as the responsibilities of the Recycling Company. Then at first, it is necessary to analyze the specific requirements for ship recycling facilities in the Hong Kong Convention.

3.2.2.1 The management of the Ship Recycling Facility

The state parties of the Hong Kong Convention are required to establish a mechanism to ensure the recycling facilities comply with the applicable requirements and standards of the Convention, including the standards in its annex. At the same time, each contracting state shall appoint one or more competent authorities and contract points for matters pertaining to the operation of the ship recycling facilities under the jurisdiction of the state. The ship recycling facilities dismantling ships bound by the Hong Kong Convention should obtain the approval of the contracting party in accordance with the provisions of the Convention guidelines. The competent authorities of the contracting parties conduct the document verification and on-site inspection of the recycling facilities according to the Convention, issued a Document of Authorization to conduct Ship Recycling (DASR) which meet the relevant requirements. The Hong Kong Convention provides a time limit for the approval certificate, which shall not exceed 5 years, at the same time, stipulates that the contracting party shall set conditions for the revocation, suspension, amendment and renewal of certificates. If the ship recycling facilities cannot meet the requirements of the Convention no longer due to accidents or other conditions, then the recycling facilities should notify the parties promptly, the parties should take the relevant measures to suspend and revoke the authorization certificate, or requiring for

correction (Xu, 2010).

In addition to the requirements about the authorization certificate of ship recycling facilities, the Hong Kong Convention provides other requirements, such as ship recycling facility plan (SRFP), prevention of adverse influence to human health and environment, safe and environmentally sound management of hazardous materials, emergency preparedness and response, worker safety and training, the requirements of reporting. The Hong Kong Convention requires contracting parties through domestic legislation to ensure ship recycling facilities in accordance with the provisions of the Convention for the safe and environmentally sound way of design, construction and operation. Through the establishment of approval mechanism, based on the requirements of the Convention to inspect the documents and facilities, approval of the recycling facilities and permit them to engage in recycling work.

In summary, recycling companies should actively cooperate with the competent authorities in accordance with the requirements of the Hong Kong Convention, inform the specific situation of recycling facilities truthfully to the competent authority, acquire the authorization of ship recycling facilities in the situation that the environmental protection and safety meet the relevant requirements. Once the facilities may cause pollution and no longer meet the requirements, recycling companies should also reflect the real condition and rectification in time, in order to meet the requirements of the Convention, from the original to prevent the pollution accident.

3.2.2.2 Responsibility for IHM management

Control of hazardous materials is the core of the Hong Kong Convention, and has a positive effect to prevent the water pollution from ship recycling. According to the requirements of the Convention, every ship shall be provided with an inventory of

hazardous materials (IHM). The IHM should be made in detail according to the actual situation of each ship and the relevant guidelines of the Convention. It should at least specify the hazardous materials in Appendix 1 and 2 of the Hong Kong Convention, and the hazardous materials in ship structure and equipment and their locations and approximate quantities (Xu, 2010).

The IHM is composed of three parts. Part I is mainly about the use of toxic and harmful substances in Appendix 1 and 2 of the Convention, and the ship owner has the duty to update it in the whole process from construction to recycling; Part II is the waste generated in the process of ship operation; Part III is for the stores. Part II and Part III can be listed before the ship recycling. The IHM has been in close contact with the ship since the construction of the ship, and the provisions of IHM will have an important influence on the shipping shipbuilding, shipping and ship repairing industry. During the whole operation, Part I of IHM should be updated and properly preserved, reflecting the change of hazardous material on board (Lin & Chen, 2014).

Before sending the ship to ship recycling facilities, the ship owner should ensure that Part I of IHM is kept up-to-date, and specify the relevant conditions of Part II and Part III (Li, 2010). Before ship recycling, the recycling facility should take appropriate measures to eliminate or reduce the harmful substances early according to the contents in IHM, and formulate recycling plan in accordance with the actual situation of the ship to ensure that all harmful substances on board are monitored and handled effectively during the actual recycling process, so as to avoid pollution to nearby waters.

3.2.2.3 Responsibility for ship recycling plan making

The ship recycling plan (SRP) in Hong Kong Convention contains information about all stages of ship design, construction, operation and recycling. It is the guidance and

comprehensive document before ship recycling. The Convention requires the ship recycling facility should formulate SRP for the specific recycling work before actual operation. This plan mainly includes reflecting to establish, maintain and monitor 'safe-for-entry' and 'safe-for-hot work' conditions and how to manage the type and quantity of all materials including the materials listed in IHM. And the SRP should be approved by the competent authority. (Xu, 2010)

With respect to the Recycling Company, it should actively cooperate with the ship owner before ship recycling, develop the recycling plan according to the specific situation of harmful substances on the ship, and submit the plan to the competent authorities of recycling. Making recycling plan can not only help recycling company to obtain comprehensive information on the ship before recycling operation, but on the other hand, provides a practical basis to the competent authority for supervision and inspection of recycling facilities to see whether they are in strict compliance with the approved recycling plan.

3.2.2.4 Responsibility for the management of ship recycling workers

Article 22 of the Hong Kong Convention stipulates the specific training process of recycling workers, covering all workers in recycling facilities, including contractors and employees. The training should be conducted by qualified personnel, and the recycling facility should provide initial training and update training and have corresponding review. Participants' understanding and mastery of the training they receive should be assessed, reviewed regularly, and appropriate changes made as appropriate, and a written record in place (Li, 2010).

These specific provisions of ship recycling workers in Hong Kong Convention have its practical significance. On the one hand, it can supervise the recycling facilities to carry out training activities timely, on the other hand, it can restrain the ship recycling

workers actively participate in various training, so as to improve the professional skills and quality of workers, reduce the accidents or environment pollution caused by human errors in the recycling operation process.

In the process of ship recycling, recycling company through the training of workers, further strengthens the worker's awareness of environmental protection. Through the supervision and control in the actual process, it ensures that relevant personnel operate according to the recycling plan, and thus reduces the pollution of water environment caused by human factors.

3.2.2.5 Responsibility for the mandatory reporting

Ship recycling operation has high risk and high pollution. In order to achieve the purpose of prevention in advance, the Hong Kong Convention stipulates mandatory reporting system. Under the system, recycling facilities should submit the initial notification and statement of completion. Specifically, when the recycling ships in accordance with requirements of the Convention to accept inspection and certification by the competent authorities achieved the International Ready for Recycling Certificate (IRRC), recycling facilities should report the starting time of the SRP to the competent authorities. After receipt of the report, the competent authority should carry out survey of the ship according to the SRP, and check whether the ship carries ICIHM and RRC. After the approval, the SRF can formally launch ship recycling operations. At the same time, the ship owner shall report the situation to flag states. When the ship recycling is over, the SRF should issue the statement of completion and report to the competent authorities (Xu, 2010). The report should include a statement on whether environmental damage and personal safety have occurred in the recycling process.

To sum up, the requirements of SRF in Hong Kong Convention are comprehensive

and rigorous. As the owner of SRF and the corresponding responsibility undertaker, the Recycling Company should fulfill the requirements of the relevant responsibility, actively apply for authorization, timely reporting, strengthen worker training, and strengthen the recycling process supervision. It should also strictly monitor and control from all aspects, and assume the responsibility entrusted by the Convention, to reduce the water pollution cause by ship recycling. As shown in figure 8.

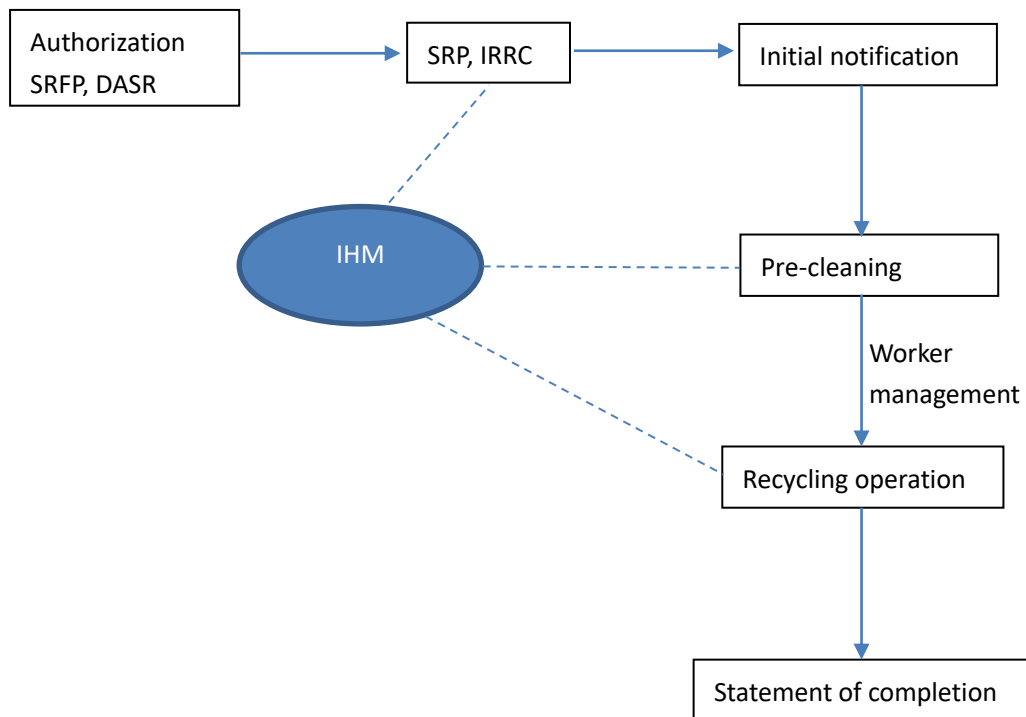


Figure 8: The main responsibilities of SRF

Source: by the author, on the basis of HKC

Chapter 4 The current situation of the ship recycling industry and the future development trend

4.1 The current situation of the ship recycling industry

According to the analysis in chapter 2 we can know that the water pollution resulting from ship recycling is serious. Although there are some provisions in Hong Kong Convention to regulate the rights and obligations of recycling facilities, in practice, ship recycling facilities are difficult to fully carry out the work in accordance with the requirements of the convention. In addition, a large number of ships for recycling flow into the recycling facilities which have poor environmental conditions, and the resulting pollution problems cannot be ignored. There are mainly two reasons resulting in this consequence.

4.1.1 The need to raise global awareness of environmentally sound recycling of ships

Because of the downturn of the shipping market, shipping companies or ship owners very concern about the price movements of ships for recycling, and strive to maximize profits during the slump market. Therefore, a large number of ships for recycling flow into the areas with high recycling price, but whether recycling in an environmentally sound way has not been valued yet (Puthucherril, 2010). The level of existing ship recycling facility is uneven, and some illegal small facilities, due to financial, technical and other reasons, rarely take measures to control environmental pollution caused by ship recycling; even some large facilities are also likely to discharge toxic and harmful material for economic interests, and do not pay attention to the protection of the environment. The pollution from ship recycling has a serious

impact on the surrounding environment and the residents' life (Wang, 2014).

The non-governmental organization shipbreaking platform said in its latest quarterly in South Asia that total 196 ships were sent to recycling facilities in the first quarter of 2017, and 65% of the ships were sent to India, Bangladesh and Pakistan, where ships were mainly dismantled on beach. The other two major ship recycling countries are Turkey and China, respectively received 36 ships and 28 ships. The remaining 4 ships were sent to other parts of the five main countries of the ship recycling (John, 2017), as shown in figure 9.

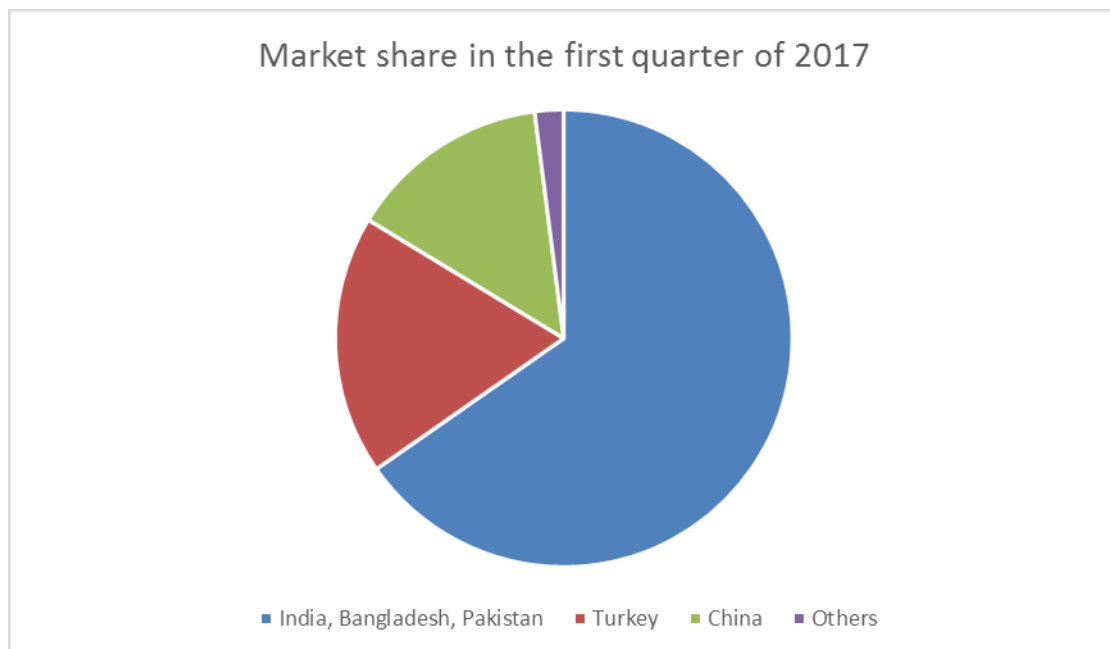


Figure 9: The market share of ship recycling in the first quarter of 2017

Source: Audit by author, from the World Wide Web:

http://www.ship.sh/news_detail.php?nid=25264

The report showed that half of the ships were sent to South Asian countries in the first quarter, including many ship recycling facilities that suffered casualties. They adopt the measure that dismantle ship on beach and the price is cheaper than others, but the dismantling process is dangerous and will cause pollution. The Alang beach in India

is the most popular recycling facility in the first quarter of 2017, which has dismantled 69 ships. Although ship recycling facilities in Alang said that compared with Bangladesh and Pakistan, their recent technology and other conditions have improved, the overall risk of recycling on beach still exists (John, 2017).

However, the Hong Kong Convention does not prohibit the ship dismantling on beach. This method is harmful to the environment, the simple process and poor facilities always lead to the personal injury accidents and pollution accidents. All kinds of waste are discharged anywhere, ship breaking workers basically carry out the work with bare hands, and the most advanced labor appliance is a blowtorch. There is no doubt that harsh working environment caused the serious environmental damage. In fact, some ship owners have realized the adverse impact of the ship dismantling on beach, but because of cost consideration, they still send their ships to the ship recycling facilities on beach, so the dismantling on beach still can continue. (Tang, 2014)

4.1.2 The need to increase investment in environmentally sound ship recycling facility

The environmentally sound recycling of ships means the ship company should increase investment in environmental protection and safety assurance, establish treatment facilities of sewage, asbestos and other hazardous materials, purchase more advanced equipment, and strengthen personnel training and management. The data shows that a large number of ships for recycling flows into South Asian countries, the other recycling countries with higher cost because of the higher investment in safety and environment don't have enough competitiveness in the purchase market of ships for recycling. (Tang, 2014)

The Hong Kong Convention norms and constraints on the whole process of ship

design and construction, operation and recycling. The purpose is to ensure that the recycling of ships after decommissioning will not cause harm to the environment and personnel, and promote the scientific recycling of ship. In order to ensure that the ship and its structure, products, equipment, systems, accessories, layout and materials meet the requirements in Hong Kong Convention and related guidelines, shipyards, shipping companies and recycling companies are necessary to carry out industrial upgrading, among them, the requirements to recycling companies are higher than others, which need to improve in all aspects of system and procedure, training, equipment, infrastructure, safety etc. In order to implement the Hong Kong Convention, recycling companies must invest large sums of money and a lot of time for industrial upgrading, coupled with the uncertainty of the time of the Convention entry into force, it will bring enormous business risk to the recycling company. Therefore, the effective implementation of Hong Kong Convention should be comprehensively supported by recycling companies (Wang, 2014).

4.2 The future development trend of ship recycling industry

The Hong Kong Convention is the first regulation of ship recycling which can be applied globally, it has taken a meaningful step in the establishment of the legal system of ship recycling. The Convention set up a series of system to maximize the safe and environmentally sound management in ship recycling industry. If the Hong Kong Convention enters into force in future, it will eliminate a large number of recycling facilities which do not meet the requirements, create a more equitable international competitive environment for the development of ship recycling industry.

“In 2008, the Council of the European Union launched the EU Strategy on Better Ship Dismantling followed by a proposal for the Regulation on Ship Recycling (commission of the European communities, 2007, 2008; Council of the European Union, 2009). Regulation 1257/2013 on ship recycling entered into force on

December 30, 2013” (Gabriela, 2016). Although the Hong Kong Convention has not entered into force yet, its principle characters have been incorporated with EU Regulation 1257/2013 on ship recycling. The EU Regulation has more strict requirements on hazardous materials than the Hong Kong Convention, and explicitly forbids the beaching recycling method (Gao, 2016). The entering into force of the EU Regulation indicates that the concept of environmentally sound recycling of ships will be paid to more and more attention.

In the context of a green wave sweeping across the global, in the situation that each government strengthens legislation and supervision to protect and improve domestic environment, the environmentally sound recycling of ships will become the development trend of ship recycling industry. Therefore, the Recycling Company should take measures to improve its management level, so as to minimize the pollution caused by ship recycling.

Chapter 5 Suggestions for the monitoring measures of the Recycling Company

In accordance with the requirements of the Convention, recycling facilities should conduct the recycling operations after acquiring the authorization by competent authorities. The main requirement of authorization is to develop a set of management systems, procedures and technology, to ensure that there is no health risk to the workers or personnel near the recycling facility. It can prevent, reduce and minimize the adverse effects on the environment as much as possible, and on this basis, make the actual situation in recycling facilities meet the requirements of the system, procedures and technology.

The development of environmentally sound recycling of ships is not only a kind of state responsibility, but also the social responsibility of ship recycling industry. In the external environment, hopes are placed on countries all over the world to regulate the shipping business, and mandatory ships for recycling must be handed over to the authorization recycling facilities; policy and financial support should be in place to support the large and medium-sized green recycling facilities, and phase out backward small recycling facilities. As for the recycling facility itself, it should take environmental protection as a starting point, pay attention to environmental problems in the whole industry chain, explore and form the pollution prevention ship recycling process and procedures according to their actual specifications and requirements of regulations, and establish the master plan of the pollution prevention from ship recycling. Therefore, if the funds are sufficient, the ship recycling company can introduce the management system concept of ISO 14000 (International Organization for Standardization), and establish environmental protection system and effectively prevent water pollution caused by ship recycling.

5.1 ISO14000

In June 1993, The ISO/TC207 Environmental Management Technical Committee was formally established after adequate preparation, and launched the ISO14000 environmental management standards in 1996(Qin, 2014). Its purpose is to regulate the global environmental behavior of enterprises and various organization of the activities, products and services, save resources, reduce environmental pollution, improve environmental quality, and ensure sustainable economic development. At present, the ISO 14000 series standards have been adopted by many countries (Li, 2016).

ISO14000 environmental management system consists of five elements: environmental policy, planning, implementation and operation, inspection and corrective actions, and management review. The implementation of environmental management standards can regulate the environmental behavior of enterprise and social organizations, reduce the environmental pollution caused by human activities, save resources as much as possible, improve the quality of the ecological environment, coordinate the environment and economic development, and promote the sustained development of the economy (Dong, 2004). The ISO 14000 standard series involve environmental management system, environmental behavior evaluation, life cycle assessment and so on, as shown in table 3.

Table 3: The distribution standard number of the ISO14000 series of standards

Sub-technical Committee	Name	Standard Number
SC1	Environmental Management System (EMS)	14001-14009
SC2	Environmental Audit (EA)	14010-14019
SC3	Environmental Label (EL)	14020-14029
SC4	Environmental Behavior Evaluation (EPE)	14030-14039
SC5	Life Cycle Assessment (LCA)	14040-14049
SC6	Terms and Definitions (T&D)	14050-14059
WG1	Environmental Indicator in Product Standard	14060
*	Spare	14061-14100

Source: Li Pei. (2007). *Study on the Establishment and censorship of the ISO14001 Environmental Management System Referring to Construction Companies*. The unpublished document of master degree. Chongqing University, Chongqing, China.

Environmental management system (EMS) , the main part of the whole management system, can be used to formal and implement the environmental policy, and manage its environmental factors. After establishing and implementing the EMS in enterprise, it can prevent and control the whole process of environmental problems existing in their own production and operation, identify problems and solve them in time (Qin, 2014). It is conducive to enhance the overall awareness of safety and environmental management, improve the overall quality and level of environmental management. From the post governance of the environment to the prevention and control in advance, it can resolve the environmental pollution accident factors from the source, form a temporary solution to a permanent cure, so as to optimize the environment, effectively reduce the risk of environmental pollution accidents, avoid huge economic losses, and improve the image and efficiency of enterprises.

5.2 Establishing and implementing the EMS in recycling companies

EMS should be formulated in accordance with the requirements of the Convention, the relevant guidelines and domestic regulations. A complete EMS of the Recycling Company is a set of documented management systems and methods, mainly includes the implementation of environmental pollution prevention and disposal measures, recycling process safety supervision, waste water and disposal management etc. These works are very important for recycling companies, and the related company can achieve the standards and requirements of governments and international organizations.

Documentation is an important basic job of building and maintaining an EMS, including many aspects with different functions, the water pollution prevention is just one aspect of the whole EMS. This research dissertation just focuses on the relevant content about the water pollution prevention in EMS, including water pollutant management, recycling process monitoring and the emergency preparedness and response.

5.2.1 Management measures for water pollutants

As has been analyzed in Chapter 2, the water pollutants from ship recycling mainly include three aspects, the pollutants generated from ship itself, the pollution from operation and the land-based pollution. Therefore, it is necessary to formulate separate management measures according to the categories of pollutants, and explicit them in the EMS. At the same time, reasonable recycling operation procedures should be formulated to avoid pollution caused by human factors.

5.2.1.1 Pollutant management of the ship itself

The recycling facility should ask for the IHM before purchasing the ship, clear the species, quantity and location of pollutants existing in the ship structure or entrainment, and pay more attention to the materials listed in IHM in the actual operation process, and make sure that the hazardous material isn't discharged to water (Liang, 2012).

Residual oil, sludge, oily bilge water should be recovered and must not be discharged into the sea or inland waters. In the process, first, transfer the residual oil, sludge, oily water to the receiving and processing facilities on shore; second, the residual oil and sludge will be handed over to professional institutions for recycling, oily bilge water must be treated through the oil-water separation equipment and discharged after reaching the standard, oil spill prevention measures must be well done in the cleaning process (Qiu, 2015).

Ballast water must be sterilized by Entry-Exit Inspection and quarantine authorities before it can be discharged. Avoid biological invasion of alien species as a threat to the local aquatic ecosystem.

Garbage on board should be collected and sent to the shore to be dealt with by specialized waste disposal agencies before ship recycling. It is forbidden to throw garbage directly to the sea or inland water.

5.2.1.2 Pollution from operation

After pre-cleaning, the dismantling of the hull shall be carried out strictly in accordance with the established SRP. The upper part of the hull is dismantled first, from top to bottom, from the inside to the outside, dismantling in a planned and systematic way, maximize control over the pollution that occurs during the dismantling process. Oil-bearing parts should be dismantled on shore to reduce the

chance of contamination. For example, the bottom of the ship and the oil tank should not be dismantled in water but should be pulled ashore and dismantled, and the dismantling site must be cleaned up immediately after the completion to prevent water pollution (Qiu, 2015).

The reliable oil fence should be laid around the ship during the process to prevent the floating oil and paint and the oil spill in sudden accident, and the pollutants should be cleaned up immediately. Prepare adequate emergency equipment for oil pollution prevention. If it is unavoidable to dismantle oily components in the water, the oil fence shall be used to enclose the whole bottom of the engine room to prevent oil spill.

The fire-water produced in the operation of cutting steel plate and the washing water should also be collected and discharge after centralized treatment.

5.2.1.3 Land-based pollution

In order to avoid the pollution caused by tidal, the land dismantling site shall be maintained as clean as possible. In the dismantling process, the oil stains and tiny solid particles remaining on the site should be cleared in time to ensure that the pollutants on recycling site which may flow into water with tide are reduced to a reasonable range. In addition, the initial rainwater in the open ship recycling site must be collected into the wastewater treatment facilities in the recycling facility, cannot be discharged into the sea or inland water directly.

5.2.2 Recycling process monitoring

The recycling process monitoring includes two aspects, one is the monitoring of operator, to avoid the safety and pollution incidents caused by incorrect operation; the

other one is the monitoring of the pollutant generated from ship recycling, recording the whereabouts of the pollutants.

Whether the recycling process meets the operational requirements related to the production and environment safety, recycling facilities should establish the monitoring system to ensure that the operating personnel operate strictly in accordance with requirements of SRP and EMS, in order to reduce the environmental pollution due to improper operation.

Establish pollutants tracking mechanism during the recycling process, supervision of the recycling process and real-time control the quantity and whereabouts of pollutants, and truthfully record the whereabouts of each category of pollutants. The record can be used to look at the condition of pollutant generation, reception and treatment, provide data reference on how to improve technology and reduce pollution.

5.2.3 Development of the emergency preparedness and response procedures

Ship recycling facilities should develop emergency preparedness and response procedures according to the Hong Kong Convention, therefore, emergency response procedures should be clearly defined in EMS. The procedure should include two parts, one is the emergency response power of the recycling facility itself and the response measures, the other one is the contacting procedure with outside institutions. The emergency response during the ship recycling is mainly the oil spill accident.

Each ship recycling facility should be equipped with adequate oil spill emergency equipment according to the actual situation and relevant requirements, and record them in the procedure, such as oil fence length, total capacity of oil recovery machine, oil trawl number, quantity of oil absorbing material and cabin capacity of float recovery ship.

When oil spill accident occurs, effective measures should be taken first to prevent the spread of oil spills. Then, according to the oil spill place, actual condition, weather and sea conditions, adopt the method of mechanical recovery and recycle the oil spills. When oil spills cannot be recycled by physical means, chemical oil dispersants, combustion or sedimentation can be used to dispose of spilled oil directly. Some surfactants on chemical dispersants are toxic to microorganisms and need to be approved by relevant departments before use.

Meanwhile, when a major oil spill occurred, the case must be reported to the competent authorities in a timely manner, so that relevant authorities can take corresponding countermeasures in time to reduce and eliminate the adverse effects of pollution accidents, not only reduce the loss to society but also reduce the direct loss and indirect loss of the ship recycling facility itself. Therefore, the contact information of relevant agencies should be listed in the EMS document, so as to contact them timely when an accident occurs.

5.3 Implementation and effective maintenance of EMS

The establishment and implementation of EMS should establish the idea of continual improvement, and constantly revise and improve the system. Under the guidance of the environmental policy, conduct the PDCA (plan, do, check, action) activities endlessly, keep a dynamic spiral cyclic process, as shown in figure 10. After establishing the EMS, the recycling company should inspect the existing problems through the actual operation, then adopt corrective action and revise the EMS immediately. Through continual improvement to maintain the effectiveness and applicability of EMS.

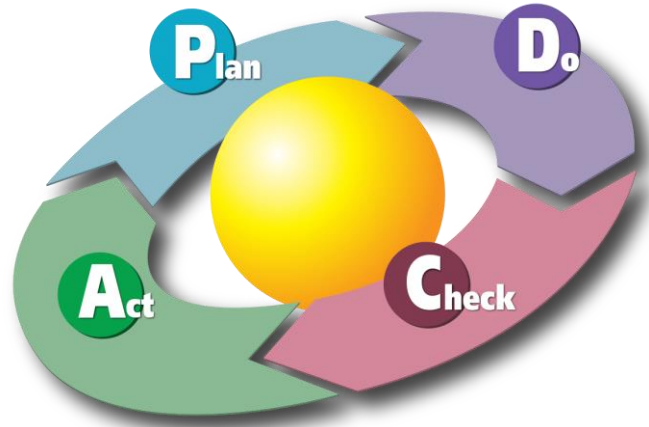


Figure 10: The PDCA model

Source: from the World Wide Web: <https://en.wikipedia.org/wiki/PDCA>

Environment and safety management level directly determine the impact of Ship Recycling Facility on the environment, through the EMS to strengthen the operational control procedures, prevention from the decision-making stage, effectively reduce the possibility of environmental pollution. The Recycling Company, through the establishment of EMS, strengthens the monitoring of the actual operation, and provides adequate emergency protection. It can maximize the control of water pollution caused by ship recycling. In addition, if the Recycling Company establishes an effective EMS, it helps to the ship Recycling Facility which belongs to the Recycling Company to obtain authorization more easily. In the trend of development of green ship breaking industry, ship recycling facilities which cannot meet the environmental requirements will be eliminated by the market in future. Therefore, the establishment and implement of the EMS can make the Recycling Facility meet the requirements of the Convention and regulations as far as possible, to avoid be eliminated because of the unstandardized operation and environment pollution.

Chapter 6 Conclusion

Ship recycling is a complicated and high pollution risk work. With the sustained downturn of shipping industry, the number of ships for recycling remains at a high level, the pollution caused by ship recycling has attracted more and more attention. Due to the special geographical location of the Ship Recycling Facility, the water pollution problems brought by ship recycling cannot be ignored, and the existing three main ship recycling methods cannot avoid water pollution completely.

Under the existing recycling technology, the Hong Kong Convention explicitly defines the responsibility of ship recycling facilities, including the responsibility of water pollution prevention. Because the Ship Recycling Facility is only an objective existence of recycling activities sites and facilities, and does not have the ability to perform its duties independently, according to the definition in Hong Kong Convention and the actual situation, the responsibility it has been given should undertake by recycling companies. Therefore, the Recycling Company should assume the monitoring responsibility to prevent water environment pollution cause by ship recycling.

The Hong Kong Convention does not explicitly prohibit recycling on beach, coupled with the weak environmental awareness of some ship owner, resulting in a large number of ships flowing into the recycling site with poor facility condition. With the increasing awareness of environmental protection in the world, environmental protection requirements for the Ship Recycling Facility will be higher and higher, while once the Hong Kong Convention enters into force, the Ship Recycling Facility with poor conditions will be phased out gradually. So, the Ship Recycling Facility should take measures early to strengthen environmental management to avoid being eliminated.

The ISO 14000 series standard is an environmental management strategy adopted by many companies around the world. As the owner of Ship Recycling Facility and the responsibility undertaker of the Convention, the Recycling Company can refer to the management mode of ISO 14000, combined with the actual situation and the requirements of the Convention, to establish and maintain the effective operation of EMS. Through the classified management of water pollutants and the monitoring of recycling process to reduce the waste discharge, it can enhance the environment management. In addition, emergency response procedures should be established to ensure timely response to pollution accidents and prevent water environmental pollution caused by accidents.

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