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The management status and research of pollution prevention of ships for Jingtang Port areas

Chengwei Wang

WORLD MARITIME UNIVERSITY

Dalian, China

THE MANGEMENT STATUS AND RESEARCH OF POLLUTION PREVENTION OF SHIPS FOR JINGTANG PORT AREAS

By

WANG CHENGWEI

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DECLARATION

I certify that all the materials in this research paper that are not my own work have 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.

(Signature): Wang Chengwei

(Date): July 10, 2014

Supervised by:

Jiang Xin

Professor

Dalian Maritime University

Assessor:

Co-assessor:

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ABSTRACT

Title of Research Paper: **The Management Status and Research of Pollution Prevention of Ships for Jingtang Port area**

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The ocean is the cradle of human life. From ancient times to now, the ocean provides a wealth of resources for the development of human society and the global economy. Maritime transport is one of the most common and the most economic and efficient transport modes generally adopted by the human, nearly 80% of global trade relies on maritime transport to carry. It can be said that the shipping industry has made great contributions to the economic and trade exchanges around the world and social progress.

Considering the situation of the pollution prevention management in Jingtang Port and domestic and overseas theories of pollution prevention management (including government intervention theory and safety management theory, etc.) and practices, this paper gives study contents and conclusions. First, it introduces the types of ship pollution of the marine environment, causes and damage to the environment, human health and economic aspects. Second, it describes the Jingtang Port area of meteorological and hydrological data, the channel and anchorage conditions, ports, docks and ships, general situation of goods and sensitive areas. And then the paper analyses the current situation and other aspects of pollution prevention management of Jingtang Port area from the situation of emergency response resources and area departments, emergency response teams and other aspects. Finally, it finds out the shortcomings combining with their own professional knowledge according to the

complex condition of docks, the various types of ship, many low standard ships, the weak awareness of crews and other aspects, and offers recommendations of pollution prevention management of ship, effectively controls the ship pollution risk of the Jingtang Port area, enhances pollution prevention management level, and achieves the realization of clean marine environment and safety of life and property of people.

Keywords: ship; pollution prevention; emergency response

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LIST OF ABBREVIATIONS

MSA	Maritime Safety Administration
IMO	International Maritime Organization
CPC	Communist Party of China
MARPOL	International Convention for the Prevention of Pollution from Ship

Chapter 1 Introduction

1.1 Significance of the topic

The ocean is a huge ecological system on the earth after the biosphere. It plays a role in regulating continental climate and promoting the global water cycle and is the traffic between the coastal countries of the world shipping channel. It contains all kinds of natural resources, and is an important base for human access to energy，protein and industrial raw materials. Therefore, the protection of the marine environment and the prevention of marine pollution have become one of the focus of attention all over the world.

The Communist Party of China(CPC) explicitly proposed to protect the ecological environment in the 3rd Plenary Session of 18th CPC Central Committee. After that, Li Keqiang proposed the full implementation of maritime strategy, the development of marine economy and the protection of the marine environment in the Second Session of the 12th National Committee of the Chinese People's Political Consultative Conference. Therefore, to establish and perfect the emergency management system of ship pollution prevention and the precaution and emergency treatment for the significant pollution accident has become a cardinal task for prevention of pollution of maritime department.

Jingtang Port which is located in Beijing-Tianjin-Tangshan economic zone among

the networks and in the center of the Bohai economic rim, is an important coastal port designated by the state. The throughput of the port broke through 10,000,000 tons in 2001, entered the procession of national million tons port. The cargo throughput reached 105.41 million tons in 2009, which grew 38% compared to the same period of 2008 becoming the youngest port whose throughput was over one hundred million tons.

However with the increase of the number of ships in the harbor, the attendant problems have to draw our attention, namely, the problem of environmental pollution. Ship will directly or indirectly discharge substances or energy into the oceans and the atmosphere during the operation because the presence of the defect and loopholes situation of shipping management, which caused that the oceanic and atmospheric environment has been polluted, the quality of the marine environment has decreased, ecological environment has deteriorated and living and health condition of the coastal residents has been affected. Through the study of the status of anti pollution situation for Jingtang Port area, we can find problems and shortcomings in existing mechanisms, improve technical standard of ships in our area, train the crew pollution prevention consciousness, speed up the construction of emergency response team, improve the emergency resources, enhance pollution prevention work level and ensure port area waters clean without pollution.

1.2 Ship pollution prevention research status at home and abroad

1.2.1 Abroad research

In 1954, the British government called for the prevention of marine pollution conference in London, which formulated and adopted the Marine International Convention on Oil Pollution Prevention in 1954 (the 1954 Oil Pollution Convention).

The Convention entered into force on July 26, 1958, and kept by the British government. But with the sustainable rapid development of economy, the quality requirements of the marine environment are gradually improved, the regulations of various pollutants discharge vessel are more stringent, so the International Maritime Organization held the international conference on the prevention of marine pollution from 8 October to 2 November 1973, and adopted the 1973 International Convention for the prevention of pollution, instead of 1954 Oil Pollution Convention. In contrast, it not only expanded the scope of application and improved the anti-pollution technology, but also wrote no preferential terms in the convention,and adopted the "tacit acceptance procedure" for the technical amendment， which is a great progress in international legislation to prevent pollution from ships. The Convention includes the five annex and two protocols(Yin, 2010).

In addition to countries in the world take part in the International Convention for the prevention of pollution, and developed to adapt their national anti-pollution regulations. The United States formulated the 1990 Oil Pollution Act on March 24, 1989.

Research on pollution management of Germany and France and other European countries has revealed the following five points:

(1) The government is responsible for pollution management, the maritime sector, environmental protection departments and the Department of port administration should work in cooperation with a due division of labour.

(2) we should improve the system of supervision, the competent departments supervise each other.

(3) The popularity of ship standardization should speed up.

(4) we should improve shore receiving system.

(5) we should raise the awareness of environmental protection and the legal consciousness of all the people.(Jiangsu MSA,2009)

1.2.2 Research status at home

China has successively promulgated the “Marine environmental protection law of the People's Republic of China”, “Criteria of Disposal on Ships Pollutants of the P.C.C.”, “Regulations of the People's Republic of China on the control over dumping wastes into the sea waters” and other laws and regulations.

“The prevention of Marine pollution management regulations of the People's Republic of China” promulgated in 1983 has played an important role in the prevention of pollution from ships. The new introduction of the " Regulations on Administration of Prevention and Control of Pollution to the Marine Environment by Vessels" has been adjusted and modified on the frontal regulation to make it more responsive to 2000 re-enactment of the new " Marine Environmental Protection Law "and MARPOL convention. The most important purpose is "giving priority to prevention, combining prevention with control: both modest advance and does not affect the development of productive forces". It is mainly reflected in the following four aspects :

(1) Strengthening duties of the administrative authority to prevent the ship and its associated pollution of the marine environment of the operating activities.

(2) Adding management regulations for the ship and the relevant operations to prevent pollution of the marine environment.

(3) Increasing the provision of pollution accident emergency disposal and processing aspects of the investigation.

(4) Perfecting the provisions of compensation for the pollution accident damage.(Bai & Liu 2010)

At present, in the prevention of marine pollution from ships, China has initially formed a multi-level legal framework which contains the constitution, laws and regulations and relevant international conventions. It plays an extremely important role in the prevention of marine pollution from ships , protection of the marine environment and ecological balance, and promotion of social harmony and marine industry development. But at present, the relevant domestic laws and regulations about ship pollution prevention are not perfect, which mainly concentrate on the prevention of pollution from ships oil and garbage. Regulations to prevent other types of pollution and oil pollution emergency response and other aspects of civil liability for oil pollution damage are still far from perfect.

Chapter 2 Summary of Ship Pollution Prevention Management Core Concepts and Theoretical basis

2.1 Types and causes of pollution from ships

The definition of marine pollution:

The United Nations group of experts on marine pollution define the marine pollution as: “Human directly or indirectly discharge certain substances or energy into the marine environment which lead to damage to biological resources, endanger human body health, prevent the fishery activities and damage to the use of water quality and environmental quality and so on.” Ship pollution for the marine environment include the following aspects:（Zhuang, 2009）

(1) Oil Pollution ;

(2) Pollution by Noxious Liquid Substances in Bulk ;

(3) Sewage pollution ;

(4) Garbage pollution ;

(5) Air pollution;

（6）Foreign biological pollution carried by ballast water.

Marine pollution has a certain particularity: First, there are lots of pollution sources and pollutants generated in related activities on land and in oceans by human will be directly or indirectly discharged into the sea. "Chinese marine environment quality bulletin" shows that: the total wastewater discharged into the sea of land-based

pollutants is 31.7 billion tons, in which there are more than 14.63 million tons of pollutants. (Ministry of Environmental Protection of the People's Republic of China, 2007) Second, pollutants drift fast and have strong diffusibility. If one sea area is polluted, pollutants will spread to the surrounding waters with the water flow. Third, the harm of pollutants is high. Because the ocean is the lowest lying, once the pollutants enter into it, no other outlet can be transferred, its harm can directly affect marine life, and also can damage to human health through the food chain. Marine pollution is a process of long time accumulation, the probability is low to be discovered and paid attention to it by people.

2.1.1 Oil pollution

Oil pollution mainly includes operational discharge and accidental discharge.

2.1.1.1 Operational discharge

Operational discharge mainly refers to the discharge of the washing water, the oily bilge water and ballast water of oil tanker. According to the estimation of the International Maritime Organization, the quantity of pollution sources discharged into the marine environment is at least 3.2 million tons each year, and the operational discharge is about 30% of the total.

（1）Bilge water

Because the petroleum products are used as liquid fuel and lubricating medium, the leakage of fuel system and lubrication system can be found, and the oil will leak when repairing the machine, replacing a small amount of oil and cleaning filter. These oils in the bilge water mixed with the water leaked and concentrated from water system make up the oily bilge water. Oil content in the bilge water can be as

high as 0.5%, the oil discharged into the sea with the bilge water can be up to several million tons every year in the world.

（2）Ballast water and washing water

The inner surface of shell plate, bulkhead, roof, bottom bottle and metal structure of transverse and longitudinal side frame of oil tank remain part of the oil or oil products. In addition, the residual which can not be pumped from oil tank oil can usually reach 0.3% - 0.6% of all transported oil. The oil tanker must be full of ballast water in order to ensure the seaworthiness of the ship and avoid the no-load oscillation overturning after the return trip of the ship. The ballast of general coastal tanker requires 20% - 25% of total fuel capacity, offshore tankers can reach to 35% - 40%, it can reach to 40% - 50% in bad weather condition, and 50% - 60% under special circumstances. Residual oil in cargo oil tanks in ballast voyage is mixed with ballast water before entering the oil loading ports,all ballast water of ships must be removed from the tank in order to receive a new shipment of oil, which makes oily ballast water discharged into the sea. In addition, washing water of oil tankers is also a major factor causing marine pollution. The oil ships need to wash off residual oil tanks when the tankers change the different kinds of oil or get maintenance, tankers need to be washed about 6-8 times on average a year.(Qin, 2007)

2.1.1.2 Accidental discharge

（1） Aground, stranding and collision accident can damage oil tank leading to pollution to the ocean or emergency discharge in the rescue process.

（2） Oil operations pollution

This type of pollution is mainly caused by leakage in the bunkering, the loading and unloading oil barge in the engine room operations. Although the quantity of this kind of pollution is not large, the frequency of occurrence is very high. Taking Shanghai port as an example, there were 1013 oil spill accidents, and oil pollution incidents caused by oil operations amounted to 370 times, accounting for 37.5% of the total pollution events.(Qin, 2007)

2.1.2 Bulk cargo of toxic chemicals pollution

Bulk chemicals are flammable, toxic, perishable and serious of pollution and other harmful characteristics, which bring dangerous and difficulties to the storage and transportation, and pose a serious threat to the ecological environment and human health. Accidents usually occur in the following form: Chemical fire, chemical spills, chemical reactions, etc. Bulk chemical tanker accidents always cause serious harm to the environment and the health of residents, and the economic loss is immeasurable.

2.1.3 Sewage pollution

(1) The definition of ship sewage

Ship sewage is defined by the MRPOL73/78 convention as: drainage and other wastes from any form of toilets and urinals; drainage from medical premises (dispensary, sick bay, etc.) via wash basins, wash tubs and scuppers located in such premises; drainage from spaces containing living animals; or other waste waters when mixed with the drainages defined above. Sewage from ships not only contains organic matter and minerals, but also contains a lot of bacteria , parasites, and sometimes contains harmful aquatic organisms and viruses.

(2) The impact of water for environment

Untreated ship sewage which freely discharges into the water will have a series of biochemical functions. Natural purification process of water environment is the process of using bacteria and other microorganisms to decompose organic matter to inorganic compounds and carbon dioxide. Although the natural purification process is very slow, the process is still a balancing process, and it is the decisive factor to maintain the balance of the dissolved oxygen content. If a large amount of sewage is discharged into the water, it will reduce the content of dissolved oxygen, thereby destroying the natural purification process and the ecological balance of water environment, changing the ecological characteristics of water environment and causing the migration or death of fish and other animal. When the contents of nutrients in sewage discharged in the water environment reach 0.01mg/L, it can result in the excessive growth and reproduction, appear eutrophication, the decrease of the content of dissolved oxygen in the water and the emergence of the anaerobic condition causing the marine animals, flora of aerobic groups (such as fish) to be replaced by lower anaerobic groups (such as soft insects). Destruction of the natural purification process of water environment and the presence of suspended solids in sewage will produce a serious impact on coastal fisheries and other marine resources.(Qin & L, 2005)

(3) Effects on human health

There are millions of bacteria in per 1ml of untreated sewage water, most of which are pathogenic bacteria, which can infect many kinds of intestinal infectious diseases. If fecal sewage is not adequately treated to kill pathogenic bacteria, it will pollute the water, spread the disease and produce a serious threat to human health.

2.1.4 Pollution by Garbage from Ships

(1) Definitions

Garbage contains all kinds of victual, domestic and operational waste (excluding fresh fish and parts thereof), which are generated during the normal operation of the ship and are liable to be disposed of continuously or periodically except those substances which are defined or listed in other Annexes to the present Convention.

(2) The relevant provisions

International ships navigate all over the world, so the crew and passengers have close contact with the docked state, which are easy to carry infectious pathogens causing diseases or epidemics. Animal products and plant that come from epidemic area may create the conditions for the toxic, harmful biology and animal pathogens to spread, and cause a serious threat to the port. There is strict management system for international navigation ships about dumping. IMO developed MARP0L73/78 Annex V " Prevention of Pollution by Garbage from Ships " which has clear requirements for international shipping garbage dumping. Rules have been classified for ship garbage, and stipulate the nearest distance range of land dumping into the sea according to the pollution and waste degradation of provisions. With regard to food wastes, it stipulate that the disposal of food wastes into the sea may be permitted when they have been passed through a comminuter or grinder from such fixed or floating platforms located more than 12 nautical miles. Every ship of 400 gross tonnage and above, and every ship which is certified to carry 15 persons or more, shall carry a garbage management plan which the crew shall follow and shall be provided with a Garbage Record Book. All countries and regions joining the International Maritime Organization shall enjoy the rights and obligations of the rules involved, and these countries must comply with the relevant rules for the international navigation ships of dumping garbage, otherwise it will be severely punished.

2. 1.5 Air pollution from ships

Air pollution is caused by ship emissions of greenhouse gases to the atmosphere. A report said that 30% of global annual emissions of nitrogen oxide gases come from ships, and thus it can be said that the exhaust gas pollutes air quality as seriously as exhaust emissions of car pollution, which cause adverse effects to the body health of human. The data from the study concluded by International Maritime Organization show that 1.1 billion tons of carbon dioxide emissions come from the shipping industry in 2007, by 2020, it will reach 1.4 billion tons. International Association of Independent Tanker Owners also published a report related to the shipping industry at present indicating that shipping industry every year consumes 2 billion barrels of oil. As a result, more than 1.2 billion tons of carbon dioxide are released accounting for 6% of the total emissions. The amount of greenhouse gas emissions from shipping industry is twice as much as that from the airline industry. According to the forecasts, by 2020, the global shipping industry will spend about 400 million tons of fuel, and greenhouse gas emissions will increase about 75% on the current basis.(Chinese Quality News. 2010)

2.1.6 Alien biological pollution carried by ballast water

When the ships sail in light condition, ballast water need to be pumped in to maintain stability of the hull. If the ballast water is driven from a certain port with pathogens, which mixes with residual oil or other harmful substances, at last, it is directly discharged into the sea causing pollution for the port waters. Therefore, the ballast water has become the medium among harmful substances in the ocean regions.(Economic Information Daily, 2005) Generally speaking, a load of one hundred thousand tons of cargo ship carries about 560,000 tons of ballast water, all ships carry about 10 billion tons of ballast water annually, and there are more than

7000 kinds of organisms carried by ballast water. thus, the materials in the ship ballast water spread across the globe. Until now, there have been more than 500 kinds of biological species confirmed by ballast water(Fan & Xu, 2008).

2.2 Hazards of pollution from ships

2.2.1 Hazards on marine life and water environment

The pollution from ships would have disastrous effects on marine organisms. Once the pollution occurs, the oil enters the sea, forming a layer of oil film on the surface of the sea. The film will reduce the sunlight penetration into water and create gas insulation between seawater and atmosphere, which can lead to severe hypoxia in water preventing photosynthesis of marine organisms, and cause large number of deaths of fish, shellfish and other biological. Marine plankton are particularly sensitive to oil toxicity, so it will affect other marine life in the form of the food chain after it absorb a large amount of oil. According to the reports, in the past 50 years, oil pollution has resulted in more than 1000 kinds of marine extinctions. Ships excessive emissions of carbon dioxide and other harmful gases would form acid rain in the atmosphere and do harm to marine organisms. Propagation of harmful substances caused by ballast water has been listed as one of the four major hazards to the oceans.

2.2.2 Hazards to human health

The ship pollutants are difficult to decompose after being discharged into the sea, which not only do harm to aquatic life, but also enter the body through the food chain causing damage to human health. In addition, pollutants can also cause deterioration of water quality resulting in the use of the water of damage to human health.

2.2.3 Huge losses to the economy

(1) Oil spill damage to fishery: the adult fish are very sensitive, and they will be dead when they smell the oil. But juveniles live in shallow waters and are vulnerable to oil pollution. Cage culture of fish cannot continue to live because there is nowhere to escape. In addition, it is difficult to clean the cage after being polluted by oil spill, and the replacement cost is also very high.

(2) Effects of oil spill on the shallow shoreline: shallow waters are usually the most concentrated area of marine organisms, such as fish, shellfish, seaweed layer etc. In addition, oil spill will affect the development of related tourism.

(3) The harm of oil spill to the pier, maritime industries: dock and ship berthing area is very sensitive to oil spill. Once the oil spill occurs, we need to clean waters in case they would affect the normal condition of entering and leaving port. In addition, if the shoreline sets water intake for factories, the oil will enter the system and will cause damage to associated equipment, and the plant will suffer huge losses. According to the 2004 “China Fishery Ecological Environment Bulletin”, economic losses of China fishery are up to 36,500 million Yuan annually affected by oil and other various pollution. According to information of the International Union for Conservation of Nature and Natural Resources (IUCN), about 50 kinds of world's most dangerous alien species invade China, resulting in direct economic losses of about 57.4 billion Yuan.

2.3 Theory of marine pollution prevention management

For the better development of ship pollution prevention management, here are two theories that have been fully used in the work.

2.3.1 The theory of government intervention

Government intervention mainly refers to the way in which the administration as a national authority intervenes social and economic life through administrative intervention. Government intervention in the pollution caused by the activities of the ship is a wide range, complex decision-making process. Correct decisions must be based on reliable and sufficient information, and the need to have accurate judgment to the shipping industry status. Correct decisions consist of formulating the corresponding regulatory policy, and taking certain measures and appropriate intervention. The realistic and reasonable relationship between the government direct regulation and economic regulation and other means is the optimal combination.

Government Intervention can be summarized in three strategies, which can either be used alone or in combination.

(1) Direct intervention

Direct intervention is directly in the regulations or standards. It is based on the theory of government intervention, requiring the use of technology to meet the relevant requirements in order to regulate ship emissions standards. The regulations will meet the requirements of the technology market for the ship, thereby stimulating manufacturers of the ship, marine equipment and fuel to actively develop technical compliance.(Anderson, 2002)

(2) Economic intervention

Theoretical basis of economic intervention is that rational actors will take into account the economic incentives. A common feature of all financial instruments made by intervention theory is enough to influence the choice of actors. In order to realize the control of the specified emissions, economic interventions can be single or

expanded, and can also be combined to environmental indicators.(Kageson, 1999)

(3) Shaping the environmental philosophy of information intervention

Shaping environmental concept of the information intervention is related to the intervention certification of production. Through the information intervention, the relevant manufacturers can grasp the impact of expected product, not only considering from the interest, but also considering the social image of enterprises from the aspects of morality, and thus find the best integration between economic benefits and environmental protection.

2.3.2 The theory of safety management

2.3.2.1 The theory of safety management

(1) Conception

Safety management is a series of activities carried out on the safety production management plan, organization, command, coordination and control in order to protect the health and safety of workers in the production process, protect property of state from loss, promote the enterprises to improve management and improve efficiency.

(2) Basic principle

(a) System principle

The system principle is that people make full use of the theory, viewpoints and methods of system in the management work on management activities to achieve the optimization of management, namely, from the angle of system theory to recognize

and deal with the problems in the management.

(b) The principle of humanism

The principle of humanism is that we should fully embody humanism as guiding ideology in the management activities and put the human factor in the first place.

(c) Precautionary principle

Precautionary principle is to prevent and reduce the unsafe behavior, unsafe condition of things and people through effective technical and management measures.

(d) Compulsory principle

Compulsory principle is to control intention and behavior of people, so that other personal behavior and activities are bound by the requirements of safety management in order to achieve an effective safety management.

2.3.2.2 System security management theory

(1) The basic concept

System security: In the system life cycle management, application of system safety management and system safety theory to identify hazards and minimize the risk to optimum degree of safety regulations in the stipulated time, cost and ranges. System security management is to determine the system safety requirements, and ensure the system security projects and activities are consistent with the requirements.

The main points of system security theory

(a) Accident causing theory has changed the focus only on people's unsafe behavior and ignored the traditional concept of a hardware failure leading to the accident, and began to think by improving the reliability of related objects to improve the security of the system in order to avoid accidents.

(b) Risk factors lurk in anything, and nothing in the world is absolutely safe. Usually danger or safety known by people is just a kind of subjective judgment.

(c) Because it is not possible to eliminate all risks and hazards, we can take measures to reduce the risk of existing risk and hazard, and would reduce the overall risk while not just eradicating several specific danger.

(d) With the continuous development of technology, the emergence of new materials and new technologies produce a new dangerous source. As people's cognitive ability is limited, sometimes we can not completely identify risks and hazards.(docin, 2011)

Chapter 3 Brief Introduction of Jingtang Port

3.1 The basic information of Jingtang Port

Jingtang Port is located 80 km southeast of Tangshan Port Development Zone in Tangshan City, Comprehensive ability is located in the eighteenth port. At present, Jingtang Port has built all the first, second harbor basins and part of fourth and fifth harbor basins, and formed overall layout of five harbor basins. It has built 31 berths of 15,000 to 100,000 tons containing miscellaneous, multi-purpose, container, coal, cement, soda ash and other functions of berths, the design capacity is 73.88 million tons / 200,000 TEUS. It built 100,000 ton waterway, can satisfy one-way of 100,000 tons, two-way below 50,000 tons navigation, 3000,000 square meters yard , all kinds of storage, railway, navigation, and auxiliary facilities. Jingtang Port is an important port of key national transportation of materials and plays an important role in the transport of cargo of coal , ore , steel , etc. It is one of the seven port of "coal from the north to the South". The port cargo throughput has reached 105,410,000 tons, grow 38% compared to the same period in the twentieth anniversary of the port operation in 2009. The port has entered the ranks of China's youngest port of one hundred million tons port.(Jingtang port group co.,LTD., 2014)

At present, the port project construction like a raging fire. Liquid chemical terminals in harbor five and No.20-22 in harbor three has been put in operation, 200000 tons waterway, 250,000 tons deep-water port and other key projects are speeding up the operation and construction. In 2015, the port cargo throughput will

reach 1.5 hundred million tons, and container throughput will reach 1000000 TEUs. In 2020, it will reach 2 hundred million tons, and up to 2000000 TEUs.

3.2 Meteorological and hydrological data

3.2.1 Meteorological

(1) Wind

Constant wind direction: SW, and its frequency is 9.16%. Strong wind direction: ENE, the frequency which is greater than or equal to force 6 wind is 0.61%. The second strong wind direction: WNW, the frequency which is greater than or equal to force 6 wind is 0.59%. The influence of Typhoon on the areas is small, from 1949 to 2000, a total of 39 typhoons passed though Yellow Sea and the Bohai Sea, only 8 of which affected the area.

(2) Precipitation

Annual maximum precipitation is 931.7mm, minimum annual precipitation is 328.7mm, and the average precipitation is 616.8mm. The daily maximum precipitation is 234.7mm. The longest annual precipitation duration is 17 hours and 5 minutes. The rainy season is July and August with the total average precipitation of 373 mm accounting for 60% of the total annual precipitation.

(3) Fog

The fog's influence is not very big, the time of heavy fog with visibility of less than 1000 meters is 66 hours per year on average.

(4) Temperature

The annual average temperature is 10.2 degrees Celsius. The highest temperature is

in July, the average temperature is 24 degrees. The lowest is in January with an average of -6.9 degrees.

(5) Ice situation

The ice situation is slighter than the northeast of Liaodong Gulf and the South Bank of Bohai, because the water temperature of the region is relatively warm with warm currents flowing into the bohai sea. The top point of branch flow is located in the north of Luanhe River and change with the current intensity and wind currents, however, the area is heavier than Qinhuangdao which is affected by the same stream, because the beach near the Jingtang is wide and shallow, and the water heat capacity is relatively small. Therefore, sea ice of Jingtang harbour is lighter than YingKou, JinZhou and TianJin port and more serious than Qinhuangdao port.

3.2.2 Hydrology

(1) Tide

It is irregular diurnal tide. The highest tide level is 2.244 m, the lowest tide level is 0.04 m and the average tide level is 1.23 m.

(2) Tidal current

It is reciprocating flow, and flows to the southwest at high tide and to northeast at low tide. The trend of average maximum velocity in the range is between 0.19 m/s to 0.74 m/s, and the maximum possible flow rate in a range is between 0.36 m/s to 1.49 m/s.

(3) Wave

The long wave direction : SE direction, the frequency is 11.57%. The second long wave

direction : SE direction, the frequency is 9.20%. Strong wave direction : ENE direction , the frequency is 1.46% when H is greater than 2.0m. The second strong wave direction : NE direction , the frequency is 0.78% when H is greater than 2.0m.

(4) Ocean current

The basic pattern of this sea currents is reciprocating flow giving priority to tidal current and less residual current. The nature of tidal current is not regular semidiurnal type, the main axial is NE-SW, namely for the alongshore. The flow direction is SW at high tide and NE at low tide. The measured velocity range is roughly between 0 - 0.84 m/s. The current of spring tide and neap tide at high tide is stronger than at low tide. Maximum flow rate occurs on the surface, the underlying velocity is generally small, flat on the farther offshore, the greater the flow velocity. The flow velocity and flow direction of nearshore residual current are relatively complex. The residual current velocity is small with the maximum of 0.15 m/s. The concentrated direction of residual current flows to SW.

3.3 Conditions of channel and anchorage

(1)channel

Approach channel is perpendicular to the shoreline, and channel direction entering the harbor is 135 to 315 degrees. The length of channel is 6820 meters, the width is 160 meters at the bottom, the water depth is 12 meters, and the maximum ship is 70000 tons through tide.(Figure 3-1)

(2) Anchorage

The existing anchorage is 3704 meters long and 1852 meters wide. Its depth is 13 to 15 meters, and it covers an area of 8.227 million square meters.

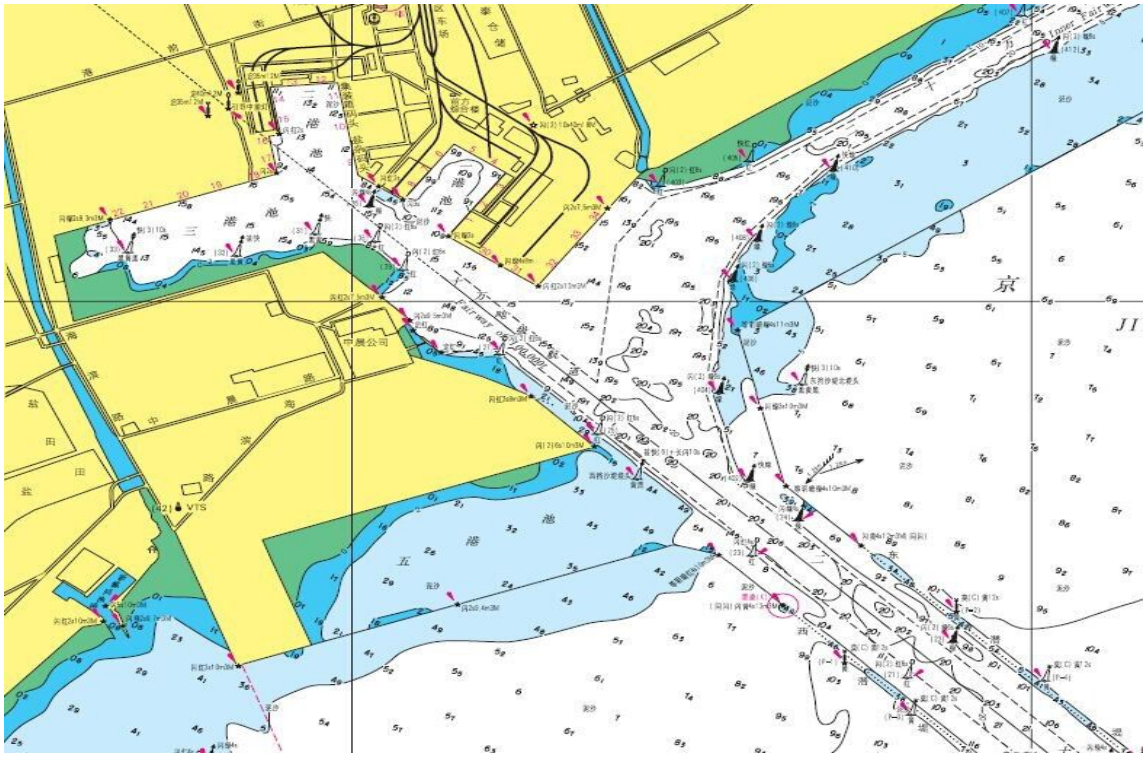

Figure 3-1 Harbour chart of Jingtang Port

Source: Chart 22111, (2013), China MSA.

Table 3-1 The basic situation of Tangshan City Jingtang Port

harbor basin	berth	Mooring capabilit	berth length	actual depth	use
First Harbor	1#	3.5	235	10.9	bulk-cargo
	2#	1.5	180	9.8	bulk-cargo
	3#	1.5	185	9.8	Bulk cargo
	4#	1.5	202	9.8	Bulk cargo
	5#	1.5	202	9.8	Bulk cargo
	6#	1.5	195	9.8	Bulk cargo
	7#	1.5	183	9.8	Bulk cargo
	8#	1.5	183	9.8	Bulk cargo
	work-boat	/	189	4.5	work-boat

	Soda ash	7000	161	8.6	Soda ash
Second Harbor	9#	3.5	210	12.1	Powder salt
	10#	3.5	305	12.1	Bulk cargo
	11#	3.5	252	11.0	container
	12#	2.0	226	11.0	Bulk cargo
	13#	2.0	205	11.0	Bulk cargo
	14#	5.0	74+160	11.0/13.3	Bulk cargo
	15#	5.0	160	13.3	Bulk cargo
Third Harbor	16、17#	0.5	311	9.7	Work boat
	18#-22##	4.0	1125	15.8	Bulk/contain
	30#	5	390	13.5	bulk-cargo
	31#	7.0	20+290	13.5/15	bulk-cargo
Fourth Harbor	32#	10.0	760	16	bulk-cargo
	33#	5.0		16	bulk-cargo
	34#	3.5		16	bulk-cargo
Dangerous goods Harbor	liquid chemical	5000（2）		13	petroleum products
	Zhongchen	3.0		9.9	liquefied gas

Source: Jingtang Port authority, (2013).Historical data of Jingtang Port.

3.4 Types and tonnage of the ship

The ship types of Tangshan Jingtang Port Area mainly include: general cargo ships, bulk carriers, oil tankers, container ships, fishing boat, engineering ship and other transport ships. According to statistics during 2006-2010 years, the number of ships above 500 gross tons is 9935 on average annually， general cargo ships account for 18.37%, bulk carriers account for 65.83%, oil tankers account for 1.2%, container ships account for 3.6% and other vessels account for 11%.(Table 3-1)

As can be seen from above, most ships in the waters of the Tangshan City Jingtang Port are large tonnage bulk and general cargo ships. Because of their large load, long voyage and other characteristics, the ships carry lots of fuel. Once the ship pollution accidents occur，it will cause pollution in large area.

3.5 Sensitive region

3.5.1 Luanhekou wetland ecosystems

Luanhekou region is the modern estuary built in 1991. It is south to Langwokou, north to Tazigou with shoreline length of approximately 21 km, The total area is about 500 square kilometers with land area of about 350 square kilometers, and sea area of about 150 square kilometers. The whole basin is continental monsoon climate, the average rainfall is 665 mm, estuary area of it is 620 mm. Three-quarters of the rainfall is concentrated from July to September annually. Luanhe Basin is in Mongolia temperate zone semi-arid climate zone and north china warm temperate semi humid climate zone. The upper and middle of Luanhe is mainly in mountainous and hilly area, which is characterized by Coniferous broad-leaved mixed forests and broadleaved deciduous forests. Plain vegetations appear in the downstream, which are mainly broadleaved deciduous forests and cultivated vegetations. Some salt vegetation and cultivated vegetation appear in the estuary, but mainly are the coastal salt vegetation. Afforestation can also be seen in the estuary area. The Luanhe River is a small river, the total length of which is 888 kilometers. The length is 250 kilometers in the south of the Great Wall, and the average annual runoff is 4.563 billion cubic meters. The runoff from June to September accounts for about 70 to 80 % of the year, and one flood can account for 60% to 70% of annual flow.

Since this area is sparsely populated or uninhabited in many places, the land is fertile and vegetation condition is good, which is ideal for the migration of birds. Larus saundersi which are endangered birds inhabit and breed in this area, mortar volume Tern and Wo Peng also breed in this habitat. The Luanhe estuary belongs to the original nature of wetland ecosystem and rare birds perched breeding areas and migration channel. The water amount of the Luanhe River is stable, and the upstream vegetation conditions are better and arre less affected by industrial pollution. Therefore, water quality is good, and it is conducive to the protection of biological diversity.

3.5.2 Puti Island Provincial bird sanctuary

Puti island provincial bird sanctuary is located in north latitude 39°36'- 39°08', longitude 118°51 '- 118°49', its administrative divisions belongs to the Laoting County of Hebei province. Protected areas include land and surrounding tidal flat, tidal creek waters of the Puti Islands (island number 62, 63, 64, 65, 66, 67, 68, 69, 70, 71), the total area is 2,400 hectares and the land area is 398 hectares, tidal flat and tidal creek water area is 2,002 hectares. There are totally 157 kinds of vascular vegetation in the protected area belonging to 44 families, 119 genera, including two kinds of 2 genus and 2 species of ferns, 155 kinds of 117 genus and 42 families of angiosperm. The main vegetation types are broadleaved deciduous forest, bushwood, grass and shrub, coastal salt vegetation, coastal psammophilous vegetation, marsh vegetation, cultural vegetation.

There are 335 kinds of birds in protected areas belonging to 56 families and 19 orders , and 136 species of passerine birds (40.6%), 199 species of non Passeriformes (59.4%) and many rare birds.

There are 3 orders of mammals. The first is carnivore, a total of 2 family ， 2 kinds (red fox, badger). The second is lagomorphs , only one family, one kind (Lepus capensis). The third is rodent, 2 families, 4 kinds(Rattus norvegicus, Apodemus, hamsters, hamster grain back).

3.5.3 Yuedao Island

Yuedao Island is located in the Bohai Bay in the southwest of Laoting county. The total area of the island is 0.43 square kilometers and 4 kilometers away from the Bodhi Island. It was named because of its shape like moon. It consists of seven islands including Yuetuo, Yaotuo, Xituo and so on. It is a natural bathing beach and ecological tourism resort. Surrounded by the sea, its marine products are abundant.

3.5.4 Xiangyun Island

Xiangyun Island is formed with a 13.5 km long sand dam because the Luanhe River carries large amounts of sediment into the sea, which subsides in the sea entrance to the Daqinghe river. Xiangyun Island includes Jinsha Island and Xindaihe scenic spot. Jinsha Island is located in the southwest of Bohai Bay and is a famous Leisure Holiday Resort.

Beaches and abundant hot springs and island resources of Tangshan Bay International Tourism Island are rich. beach quality of Tangshan Bay International Tourism Island is best in the Bohai Bay and is an excellent natural beach .

3.5.5 Sea fishing and farming areas

The main types of aquaculture near Jingtang Port are shrimps and economic bivalves. Coastal shrimp aquaculture in Laoting County is mainly distributed in Luanhekou. There are 500 acres of ponds from Laoting saltworks to Wangtan section near the port. Laoyujian fishing shop is near the Daqingke river estuary. Migou fishing

shop is near Erpaigan. The two fishing shops are about 6 kilometers away from the port. The amount of fishing of two fishing shops account for more than 1/3 of it in Laoting County, the main catch species are perch, pike, flounder and shrimp.

3.5.6 Thermal power plant water intake

Hebei Datang Wangtan Power Plant is located in the Jingtang Port. The project uses seawater as cooling water Supply System through the open channel water from the main channel Jingtang seawater, seawater circulating pump send seawater to the power plant through ascension. The flow of open channel is 76.60m3/s.

3.5.7 Salt and salt chemical industry

Tangshan City is our country's important salt production base. Nanpu Saltwork located in Jingtang Port is largest Saltwork in Asia. The salinas distribute from the Daqinghe to coastal estuary. There are 16 salt production enterprises in Jingtang Port. The total area of salinas is 49,008 hm^2 (13.6% of the total salt area , 15.5% of salt in northern areas , 17.7% of the Bohai Sea region) , and the total output is 2,559,100 tons of crude salt.

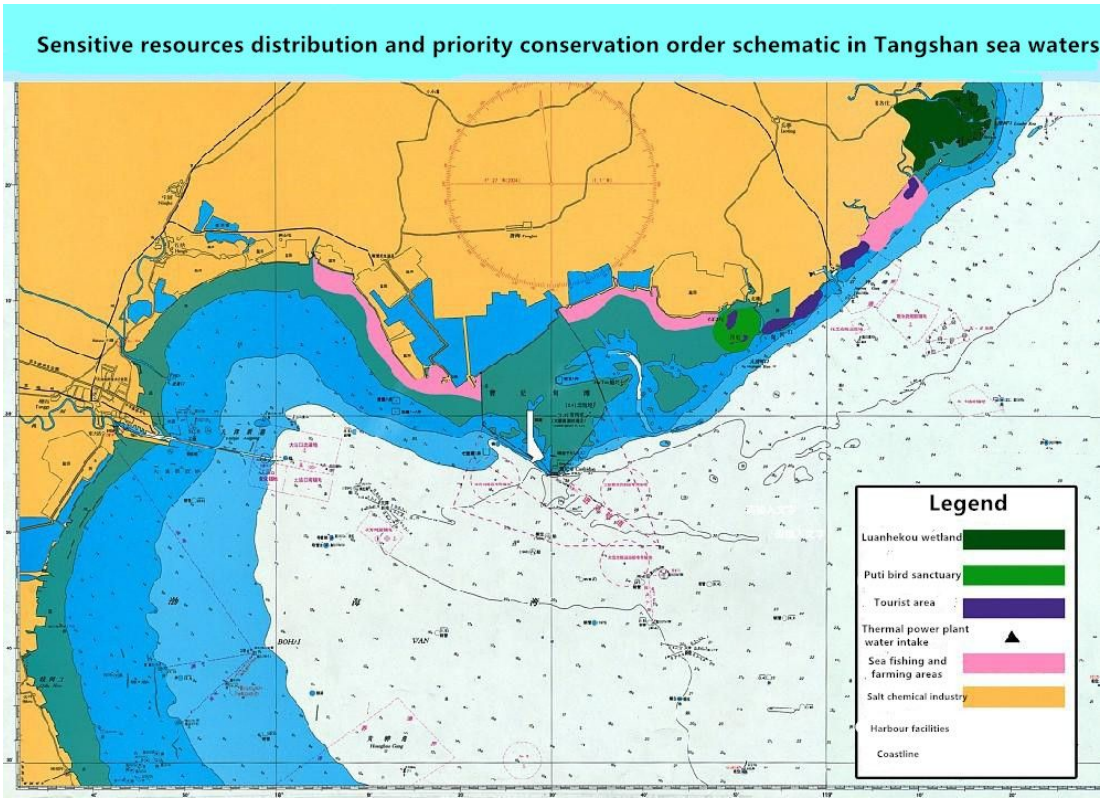

Figure 3-2 Sensitive resources distribution and priority conservation order schematic in Tangshan sea waters

Source: Tangshan City. (2012).Ship Pollution Accident Emergency Plan in Tangshan Jingtang Harbour. Tangshan: Author.

Chapter 4 Ship Pollution Prevention Management Status of Tangshan Port

4.1 The achievements of maritime departments

4.1.1 Ship Pollution Emergency Plan of Jingtang Port in Tangshan city

Tangshan MSA combines local governments and various departments compiles "Ship Pollution Emergency Plan of Jingtang Port in Tangshan city" and establishes the oil spill emergency response organizations of Tangshan city.(As Figure 4-1)

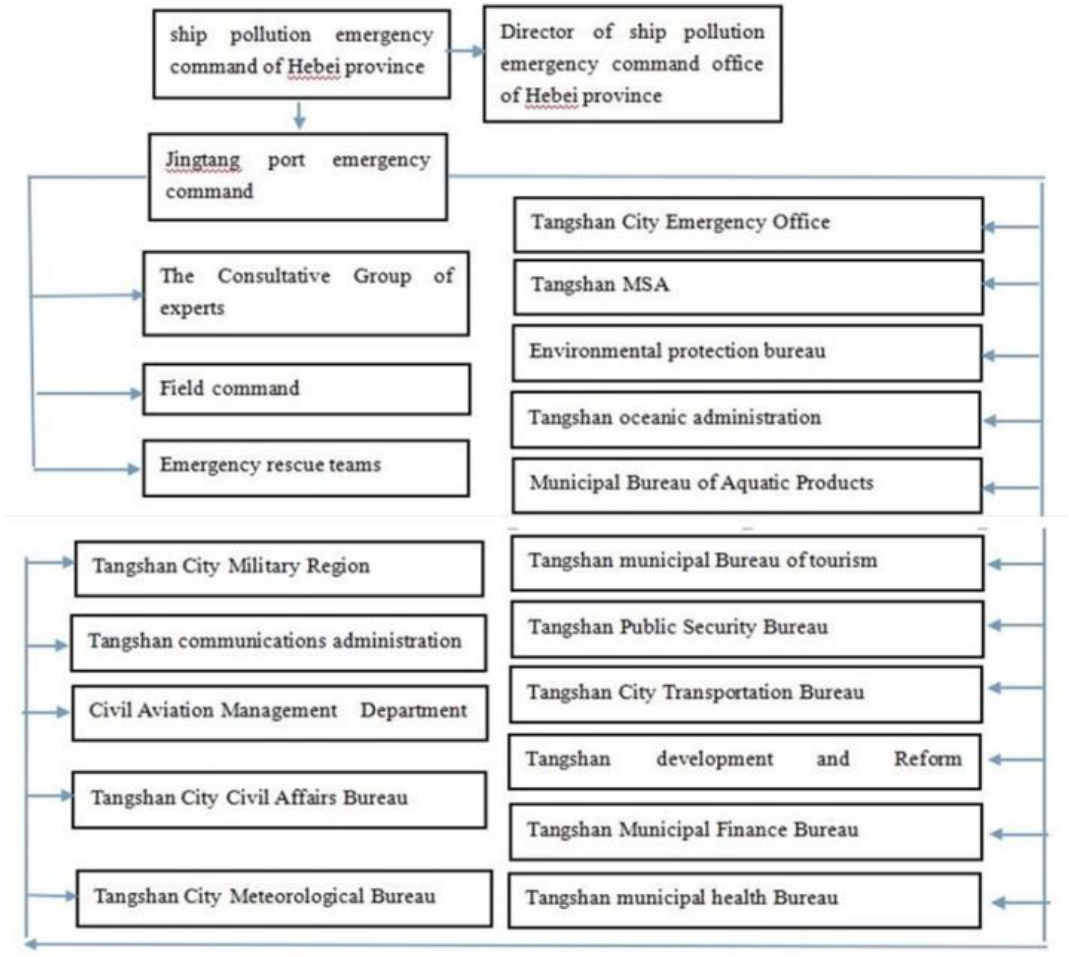

Figure 4-1 Tangshan city Jingtang Port ship pollution emergency commanding organization framework

Source: Tangshan City. (2012).*Ship Pollution Accident Emergency Plan in Tangshan Jingtang Harbour*. Tangshan: Author.

All the above departments should clear responsibilities of various departments, cooperating together to complete the oil spill clean-up treatment and develop contingency plans and grading response procedure.(Figure 4-2)

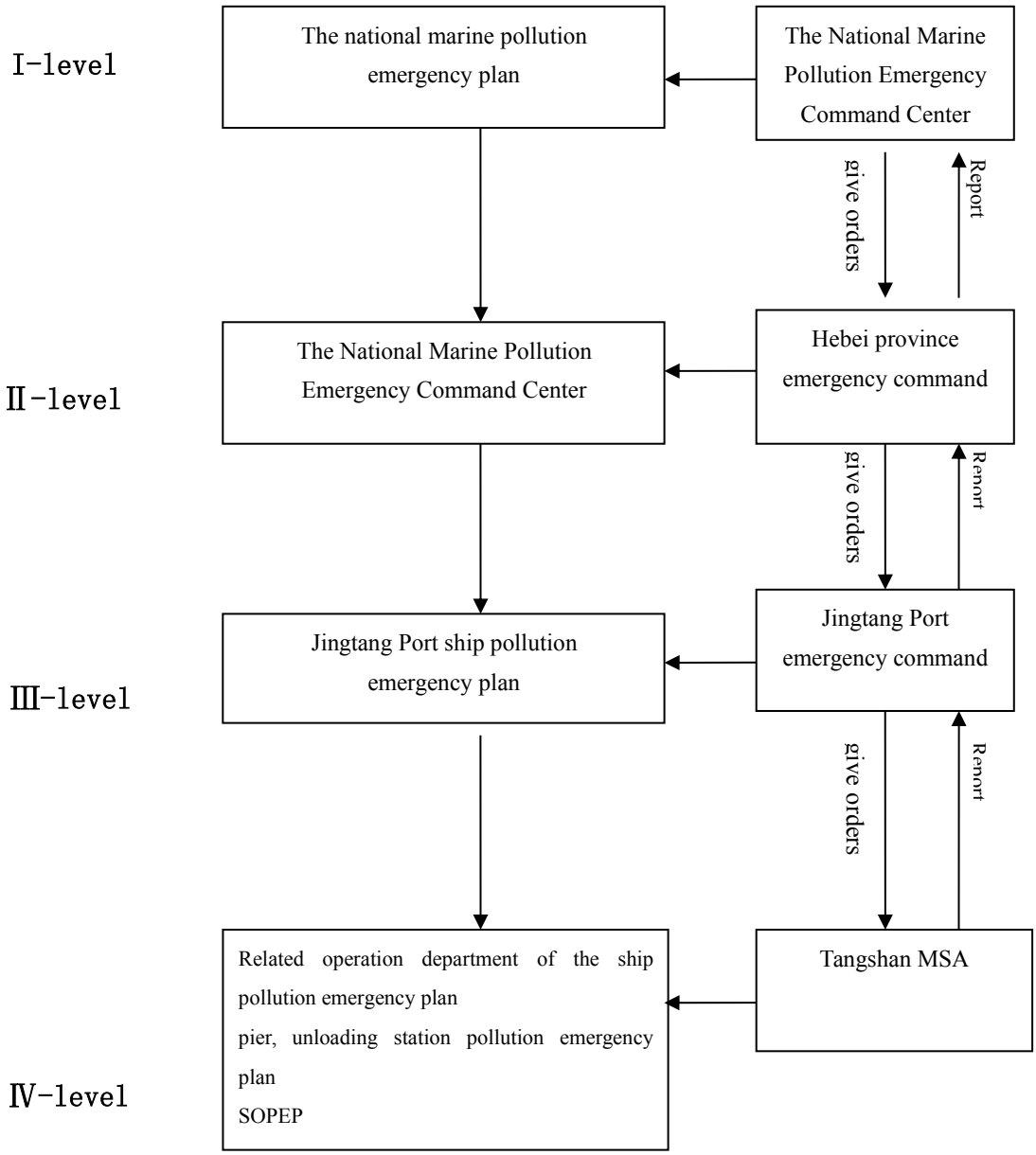

Figure 4-2 Emergency response flow chart

Source: Tangshan City. (2012).*Ship Pollution Accident Emergency Plan in Tangshan Jingtang Harbour*. Tangshan: Author.

4.1.2 Establishing oil spill emergency response procedures

The oil spill emergency response is an important part of the oil spill emergency plan, which runs through the whole process after the oil spill occurs. Oil spill emergency

response is commanded by Command center according to the following procedure and content.(Figure 4-3)

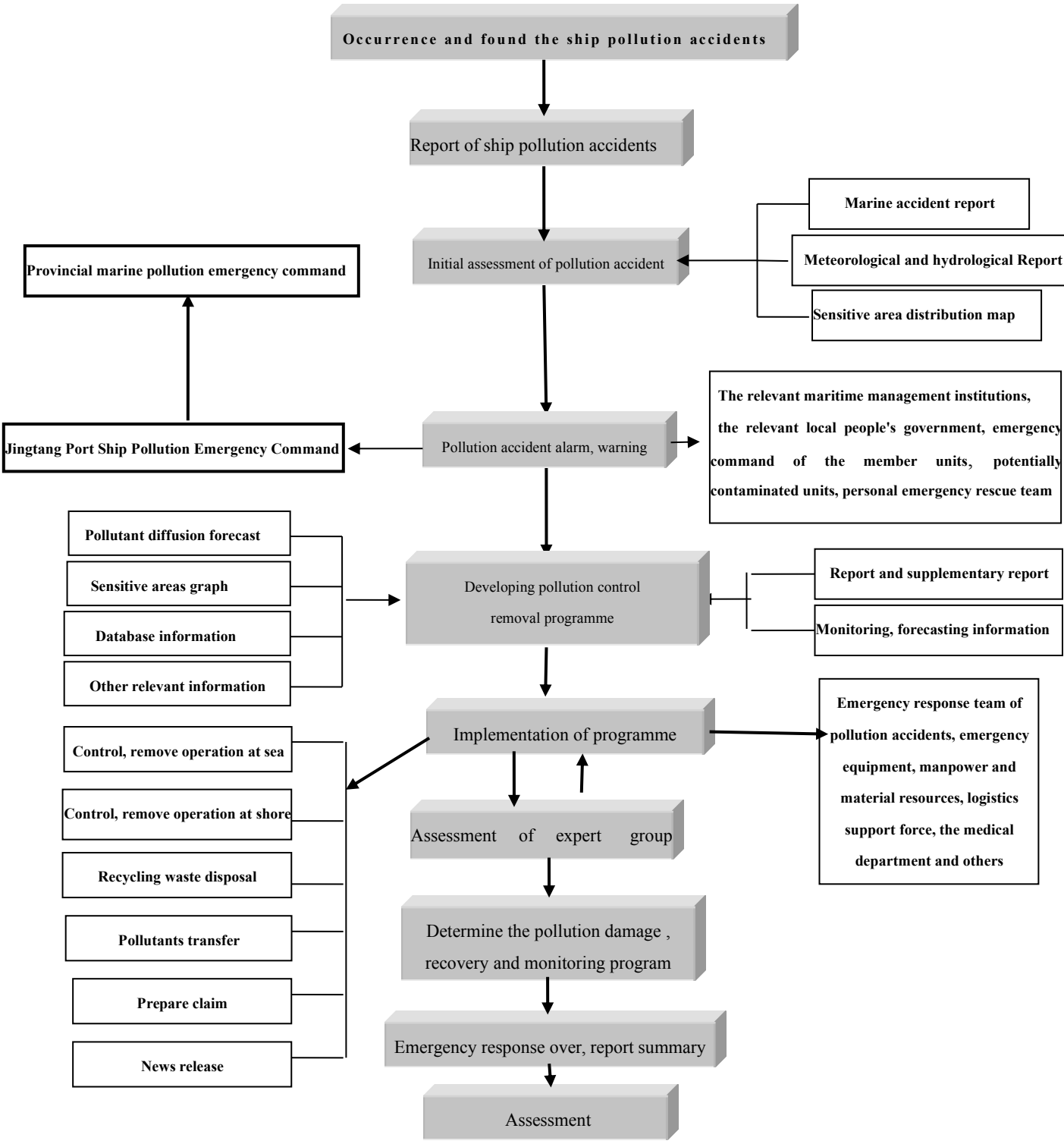

Figure 4-3 Emergency response operations flow chart

Source: Tangshan City. (2012).*Ship Pollution Accident Emergency Plan in Tangshan Jingtang Harbour*. Tangshan: Author.

4.1.3 Establishing ship cleaning companies

There are two companies recorded in Tangshan MSA, HaiZheng Ship Pollutants Emergency Treatment CO.,ltd and Tangshan Harbour Hailian Marine Emergency Co.,LTD. They are assessed as the first level of ship pollution cleaning unit in accordance with the "Ship pollution cleanup agreement management system implementation details" and other relevant provisions and have the open water operation ability, advanced equipments and all kinds of cleaning equipments. There are four oil spill emergency ships, twenty auxiliary ships, eight senior commanders in the two companies.

Tangshan MSA has given comprehensive services to the two companies from the interpretation of laws and regulations of stable to equipments with standard, from the establishment of safety management system to the writing of the contingency plans and from equipment to field exercises. Finally, cleaning companies pass through review of expert group and realize the target to set up the first level of ship cleaning companies.

4.1.4 Improving the Jingtang Port existing oil spill response equipments, materials.

The existing equipments are as follows:

Table 4-1 Oil spill response equipments list of Jingtang Port

Ordinal	Items	Models and names	Quantities	Function	Position
1	Inflatable open water oil booms	Inflatable booms WQJ1500	1200m	Freeboard 500mm Draft 780mm	Ji Huang Gang Yu Gong 106
2	Solid float type open water oil booms	Plate shaped float type oil booms HPFP1500	2800m	Freeboard 500mm Draft 960mm	Warehouse
3	Non- open waters booms	Solid float-type booms HPFC900	3000m	Freeboard 240mm Draft 490mm	Warehouse
4	Coastal protective booms	Coastal protective booms WQV600	2000m	Freeboard 150mm Draft 380mm	Warehouse
5	Beach oil booms	Beach oil booms WQV600T	2000m	Freeboard 200mm Draft 250mm	Warehouse
6	Fireproof booms	Fireproof booms WGJ900H	400m	Freeboard 300mm Draft 600mm	Warehouse
7	The oil collecting machine	Dynamic bevel oil collecting machine DXS160	2 suits	Bilateral oil collecting rate 160m³/h/suit	Qing Wu Ying Ji 01
		Rotary oil collecting machine ZSJ50	2 suits	Collecting rate 50m³/h	Warehouse
8	Sprinklers	Marine Sprinklers HPS140	4 suits	Spraying rate: 140L/min	Qing Wu Ying Ji 01
		Portable Sprinklers HPS40	8 suits	Spraying rate：40L/min	Warehouse
9	Cleaning device	Hot water Cleaning machine	8 suits	Maximum pressure：200kg/cm² 8mpa	Warehouse

		CAYR150			
		Cold water Cleaning machine CAYL150	4 suits	Maximum pressure：250kg/cm 8mpa	Warehouse
10	Absorbing material	Absorption felt PP-2	24 tons	Oil absorption capacity: 15 times of its own weight	Warehouse
		Oil drag bar XTL-220Y	4000m	The minimum oil absorbing capacity per meter: 15 times of its own weight	Warehouse
11	Oil spill dispersant	Conventional oil dispersant GM-2	16 tons	/	Warehouse
12	Unloading device	Hydraulic oil pump DOP250	4 suits	Unloading capacity：150m^3/h	Warehouse
13	Chemical adsorbent	Socorro chemical absorbent	10 tons	/	Warehouse

Source: Jingtang port authority, (2013).Historical data of Jingtang port.

4.1.5 Vigorously carrying out special inspections of pollution prevention and increasing the supervision of the ship pollution prevention in Jingtang Port .

Tangshan MSA makes full use of VTS, AIS, CCTV, VHF, patrol boat and other technologies to strengthen supervision to jurisdiction.

(1) Strengthening the inquiry frequency to the entry and departure ships, passing ships and anchor ships, increasing cruise intensity of patrol ships to harbor, waterway and anchorage, comprehensive collecting abnormal situation in multi-channel, wide coverage.

(2) Increasing the inspection, investigation efforts to the sea area and coastline.

(3) Strengthening pollution prevention inspection of dangerous goods.

(4) Strengthening the inspection to pollution prevention of construction work.

(5) Strengthening supervision sampling work lifting operations of oil platform.

(6) Increasing approval and inspection to the Involving pollutants operation.

(7) Strengthening inspection to the marks, documents, certificates and equipments of pollution prevention, implementing the crew operational check, strengthening inspection to the oily water equipment usage condition, emissions standard condition, residual oil disposal condition, taking strong measures against the use of pollution prevention equipment on board which does not meet the requirement and illegal discharge of pollutants behavior. Strengthening the supervision of dangerous goods and dangerous ships.

4.1.6 Increasing publicity of the new rules of about pollution prevention, Organizing the implementation Conference about pollution prevention regulations.

The measures for the implementation of civil liability insurance of oil pollution damage from ships, *the measures for the implementation of civil liability insurance of oil pollution damage from ships*, *pollution of the marine environment emergency preparedness and emergency response management regulations* and other provisions of pollution prevention have been introduced, in order to promote the relevant companies to understand the content of the regulation, Tangshan MSA attaches great importance to regulation of the propaganda work, and organizes more than 50 companies and more than 80 people including shipping companies, ship relevant work companies and agencies to hold a meeting to propagate the laws in March.

4.1.7 Holding the oil spill emergency drill.

In order to improve pollution accident investigation and emergency response level of Tangshan MSA, in accordance with the requirements of "Tangshan City Jingtang Port pollution accident emergency plan", based on the display of achievements of oil spill emergency response team, Tangshan City Jingtang Port pollution accident emergency drill was held successfully in Shougang dock in 2013. Through this drill,

the effectiveness and operability of "Tangshan City Jingtang Port pollution emergency plan" have been fully embodied, emergency preparedness and emergency disposal actual level of ship pollution cleaning operation companies obtain the comprehensive inspection, which have laid a good foundation to protect water environment security of Jingtang Port area.

4.1.8 Actively carrying out the mass line of educational practice

Tangshan MSA has visited the relevant companies and obtained specific problems and difficulties from dock owners, and actively explored the establishment of the Jingtang Port Ship Pollution Emergency defense organization which met the requirements of laws and regulations and the actual area. In December 2013, a press conference of establishment of Tangshan Jingtang Port Ship Pollution Emergency defense organization had been held in Tangshan City Conference Center, which indicated the emergency response capacity of Jingtang Port have been formed.

4.2 The existing problems and causes of ship pollution prevention management

4.2.1 Pollution emergency ability is weak.

In February 2011, during the period of unloading of "HISTRIA DIAMOND" in Jingtang Port, oil in fuel oil tank flew out into the sea because the discharge pipe in ship cargo bilge rust wear rusts which lead to about 33.38 tons of fuel oil (380cst) leakage into the sea and causing RMB 4.5489 million direct economic losses. From the cleaning process of "HISTRIA DIAMOND" pollution accident, we find that fuel oil discharged into the sea and clotted due to the bad weather and low temperature. The oil receiving machines and unloading pumps have little effect for the thick oil, which made cleaning progress slow.

4.2.2 Social sensitivity is not strong for the pollution accident.

In October2011, “AnLan 1” discharged about 20 kg of fuel oil into the sea because the fuel oil spill from daily service tank vent holes causing marine pollution to sea

area. As can be seen from the accident, the accident occurred in October 8th, and it was not until the afternoon of October 9 that dock management, workers and ships around the accident ship found the oil at surface of the sea. However no one reported the accident to MSA until the afternoon of October 9th, which reflected the weak sense of social responsibility for the marine environmental protection of marine pollution.

4.2.3 Ship pollution prevention management of construction operations is weak. With the rapid development of construction of the port, a lot of construction ships continue to throw into the construction. Affected by features of the construction, these ships generate lots of garbage and sewage, and pollution prevention awareness of crews is not strong, which brings greater risks to the marine environment.

In 2011 "Xi Yang No. 7" pollution accident occurred. The hydraulic hose cracked in the maintenance process resulting in hydraulic oil discharging into the sea because the ship was old. If the accident occurs during the operation， oil pressure will be high, the hydraulic oil discharged into the sea will be more. At the same time, the Sandao construction water is in the closed water, slightly larger vessels can not enter the waters. To make matter worse, the smaller ships in bad weather conditions can not enter into the waters either. Therefore, once the ship pollution accidents occur in this region, the investigation especially cleaning work is facing great challenges.

4.2.4 Oil spill response equipment database management system is not perfect. Jingtang Port oil spill response equipment database was established in 2008,and stored pollution prevention equipment emergency equipment of Tangshan port group,State Development Investment Corp and Tangshan MSA. However, the current management mode of equipment database is simply checked or repaired by service person annually. Port and dock have no professional equipment and personnel to maintain the equipments. With the arrival of the three-year service period and aging equipments, maintenance of equipment will become the focus of

the later period management of equipment database.

4.2.5 Unknown pollution prevention means are very few.

Modern pollution prevention monitoring methods and equipments are backward, and have not been obtained the very good application in the Jingtang Port area. As oil spill accidents or pollutant emissions are generated in the process of navigation, the relevant departments can only rely on experience to solve problem due to lack of necessary monitoring, detection and forensics equipments. This will result in a huge amount of work and will increase the difficulty in collecting evidence. So it is difficult to give constraints and punishments to ship and crew's behavior, which lead to the low cost for their illegal behaviors, and to some extent, contributes to the illegal activities.

In 2013, the number of unknown oil pollution reports were 3 times， the number of the unidentified floating oil fax received from the State Oceanic Administration were 16 times, and there was no unidentified oil discovered by Tangshan MSA for the first time. The unknown oil is usually located in the scenic spot, the location of unidentified floating oil found by satellite is usually anchorage. If Tangshan MSA cannot find it in time, we will be in the dock.

4.2.6 Ships neglect self management and the maintenance condition is poor.

Many of the ships in and out of Jingtang Port belong to the domestic coastal route ships, most of which are old. The operators of shipping companies, especially some private shipping companies, do not want to renew the equipments or spend more money on maintenance, consequently, engine pipeline corrosion is serious and oil leakage occurs frequently.

4.2.7 Cultural quality of Part of the crew is not high, pollution prevention awareness is low.

The ships now sailing in the domestic coastal routes mostly belong to private

shipping companies, whose crews are mostly fishermen with rich sailing experiences, but no legal knowledge and training. So they only know the ship, but ignore the pollution prevention work resulting in pollution accidents. Thus emissions happen after the ship enters the port, such as discharging ballast water, living garbage and sewage not according to the rules. The crews do not pay attention to the relevant pollution prevention program, the responsibility is not strong resulting in pollution accidents.

4.2.8 Air pollution has not been taken seriously.

For a long time, people only pay attention to the pollution on the land and sea, but do not focus on the air pollution, such as emissions of Freon which causes the hole of ozonosphere. In fact, toxic and harmful gas emissions from ships are many, such as the SOx, NOx, which will result in the pollution of the atmosphere, and thus have a negative effect to human health. The ship air pollution control measures are still relatively scarce, and the atmosphere pollution situation is serious.

4.2.9 Shipping company safety management is not strict, the pollution prevention management awareness is weak.

With the rapid development of Jingtang Port economy, it has attracted a large number of foreign shipowners to Jingtang Port to establish shipping companies and agent companies, which has led to rapid growth of transport capacity in recent years. Such companies in common is small and lack of professional management personnel, and ship daily security operations and pollution prevention management are not very seriously, which lead to a large number of low standard ships. It concentrates on the poor condition of ship, ship equipment maintenance is not in place, manning of ships does not conform to the standard and the quality of the crew is low.

Chapter 5 Suggestions to Ship Pollution Prevention Management of Jingtang Port Area

5.1 Performing maritime regulatory functions, improving the level of pollution prevention

5.1.1 Marine department should take their responsibility of pollution prevention.

Marine department should refine ship pollution accidents investigation mechanism. Clear the authority of each department of marine pollution incident investigations and emergency treatments, divide initial investigation and comprehensive investigation duties and launch training of pollution accidents investigator. we should establish pollution accident investigation mechanism of coordination of various departments and law enforcement officer with various personnel skills by making the detailed rules，system modifications and other ways.

5.1.2 we should improve the social sensitivity of marine pollution incidents.

Through the implementation of ship pollution accidents report incentive measures, the relevant departments should strictly implement the marine pollution emergency plan of Jingtang Port and increase attention on the protection of the marine environment of the responsibility of the whole society, so that marine pollution incident report ideas win support among the people.

5.1.3 Tangshan MSA should strengthen management of construction operation ships.

The maritime department, Tangshan International Tourism Island Management Committee, the construction units, sub units should establish linkage mechanism and

strengthen the construction management of the ships from the headstream and fundamental and internal and external training of pollution prevention. Tangshan MSA should strictly implement the bilge water receiving system. FSC should check monthly on oil wastewater receiving companies and other means to strengthen supervision. In order to prevent the pollution incidents due to ground of oil supply ships, Tangshan MSA make the fuel supply rules.

5.1.4 We should further enhance the Jingtang Port pollution emergency response capacity.

At present, commanders of oil receiving companies, operators have been assigned, and pollution prevention equipment has been equipped in place. Tangshan MSA has developed management approaches to increase support and strengthened management to the pollutant receiving companies. Pollution prevention companies should establish a regular theory and practice of personnel training system, equipment maintenance and updated system, emergency response system and accident assessment system and report to the marine department for the record. The marine department should inspect and supervise the personnel command operation level, equipment operation and practicability of plans, and effectively improve the levels and development of oil receiving companies. By perfecting pollution prevention management system of pier owners and oil spill response equipment database, the relevant departments improve the operation ability of related person and emergency response ability harbor defense organization, which ensure that emergency response ability between oil receiving companies and docks coordination and balanced development, so as to continue to enhance marine pollution emergency preparedness capability of the Jingtang Port.

5.1.5 We should strengthen the guidance to the basic level to promote coordinating involvement development of Tangshan MSA.

With the increasing number of ship pollution accidents and illegal acts, the accident investigation and handling are facing great pressure. As a consequence, the

coordination of various departments and development of all staff is indisputable trend of development of Tangshan MSA. We should strengthen the training of the pollution accident investigation officers and reserve officers, increase the typical accidents, the frequency of exchange meetings and new effective laws according to " pollution accident investigation officer management approach of Tangshan MSA", and cultivate a ship pollution accidents investigation team with business skills.

5.2 The relevant departments should check strictly the ship access, improve the threshold of ship inspection and certification.

The most effective way of Pollution prevention is to destroy the headstream of pollution. Shipping companies should be equipped with oil water separators, oil residue recycling equipments and other pollution prevention equipments based on the MARP0L73/78 Convention and relevant domestic laws and regulations. Ship Survey Administration should strengthen the inspection of pollution prevention equipment on the ship's certification, and strictly check the ship access in the annual inspection or periodic inspection and other related inspection, resolutely eliminate ships with deficiencies entering into the shipping market to production and ensure that all the production ships meet equipment standards. (Liu, 2010)

5.3 maritime departments should increase the intensity of crew training and enhance the level of pollution prevention management of crews.

At present, the maritime departments take advantage of some special inspection activities to strengthen the professional knowledge and practical inspection of crews. But this inspection fails to form a system used in daily work causing the crew to prepare before the examination in advance. So the maritime departments should formulate a feasible training and inspection mechanism to improve the management level of the pollution prevention. For example, we should hold theory course regularly, the safe operation of ships and the pollution prevention management of basic knowledge and the latest developments are introduced to the crews combining with a typical case, which allow them to clear their programs and responsibilities in

the management of pollution prevention operation. Shipping companies and maritime departments should test regularly professional knowledge and practical ability of the crews of the pollution prevention management and punish unqualified crews and reward outstanding crews to create good atmosphere to improve the skills of pollution prevention management continuously.(Shen, 2010)

5.4 Maritime departments should use new technologies to monitor pollution and equip with professional pollution detection equipments.

5.4.1 we should establish and improve the Marine Oil Spill Identification System.

(1) The oil spill identification is a powerful weapon to strictly enforce the law and has a strong deterrent force. The oil spill identification is an important means for oil pollution accident investigation, and the conclusions are legal evidences for maritime administrative law enforcement. In addition, the oil spill identification is high-tech means, which plays a positive deterrent to enhance crew awareness of pollution prevention and helps avoid taking chances.

(2) These organisms evolve and form under different geological conditions and a long period of physical and chemical effects. Therefore, the oil produced in different environment or conditions has different chemical characteristics, its spectrum, chromatogram will be different. In addition, the oil spectrum and chromatogram become complex due to manufacturing, transportation, storage, use and other aspects. Oil spectrum and chromatogram are like human fingerprints which are unique, therefore, the spectrum and chromatogram of oil are called "oil fingerprinting".(China Water Transport, 2006)

In point of oil, because the ship's own situation is different, even if the two vessels bunkering the same oil, the "oil fingerprinting" will not be the same. Take the bilge water as an example, because the bilge water is a mixture of a lot of oil and sewage

from the machinery spaces, it will not appear exactly the same two bilge oily water. Therefore, the oil spill identification mechanism can use fluorescence spectrometer, liquid chromatography instrument to detected oil samples from suspect ship, and then compare it with the "oil fingerprinting" from the polluted waters, which can determine the source of oil spill.

(3) Oil spill identification techniques provide scientific investigation and strong supporting evidence of oil spills from ships. The oil spill accidents happened in the past, in order to find the ship, accident investigation authorities often used direct inquiry and explored the oil spill accident scene and checked the pipe system and analysed the effect of the wind and flow to the oil flow, then used this method to find the suspect ship. But the evidences obtained by the above method are not scientific, especially concerning the operation of the ship oil spill accident, the responsible party can destroy the evidence easily making it difficult to obtain evidences. Therefore, the rational use of oil spill identification method can effectively make up for the defects and shortcomings of other means of investigation to ensure the scientificity and provide strong evidence to support the further processing and claims for the accident.

(4) The methods to solve the problem of oil spill identification system are as follows.

(a) We should establish and improve the marine oil spill identification system. It is understood, the oil spill identification is an important mean when foreign maritime institutions investigate pollution accidents. And the current situation of our country is that the institution is less, the mechanism is not perfect, the maritime law enforcement officers are lack of relevant identification concept and professional technology level.

At present, some developed ports begin to use the oil spill identification as an

accident investigation methods, but most of the other maritime departments do not use resulting in lack of enough justice and legal support for the evidences, thereby affecting the investigation and handling of accidents, which made many cases unsolved. Therefore, China's maritime system must establish the oil spill identification mechanism, so that the oil spill identification technology can become one of the important technical means of pollution accident investigation, in this way the level of law enforcement and scientific and technological content of China MSA can be improved.

(b) We must solve the problem of lack of oil spill identification procedures and specification. The oil spill identification is a kind of means combined with law and science with science being the foundation and the law being the guarantee in administrative law enforcement. But there are no related national standards and the maritime system has no corresponding industry standards. Therefore, it is necessary to establish and improve the maritime administrative law enforcement system of oil spill identification and monitoring of industry standards and specifications.

(c) We must solve the legal status of oil spill identification mechanism which is not clear. According to article 5 and article 14 of "Marine environmental protection law of the People's Republic of China", maritime departments shall have the right to use the effective and monitoring methods including the oil spill identification technology. These regulations provide a powerful legal support for the use of the identification technology for maritime departments in the administrative law enforcement, but it only made provisions in principle and has not been further instructions for the establishment of the maritime institutions, legal status, and how to apply to the maritime administrative law enforcement. Therefore, conclusions determined in the oil spill identification can be used as a legal basis in the maritime system and can be used by the court.(Lv & Zheng, 2006)

5.4.2 We must use the new technology in ship oil spill tracking. At present, the real-time tracking and monitoring methods in China for oil spill at sea mainly include aerial remote sensing, satellite remote sensing, radar detection, patrol craft search, computer simulation, but the satellite remote sensing response lag, the cost of aircraft and radar detection is high, the efficiency and speed of patrol is low, and these methods will be more or less affected by weather conditions. The results of computer simulation are susceptible to personnel, technology, which may lead to great deviation. Here suggest methods of Mini buoys to track the oil spill in the sea, have all-weather and whole monitoring ability, and it is a kind of the real-time monitor and low-cost technology method. Marine oil spill tracking buoy is a drifting buoy on water surface and take satellite positioning communication as the main method, which has good tracking ability for the different weather and sea condition. It can quickly and accurately track the oil spill drift direction and position so as to take measures to reduce the accident damage. It can timely and accurately release pollution warning to the environment sensitive area and avoid or reduce the pollution. It can rapidly formulate the oil spill emergency response action and make clear solution, and command effectively to prevent the spread of oil spill. It can effectively improve the cleaning efficiency and reduce pollution and cleaning costs and has the remarkable social and economic benefits.(Liu & Yang & Li & Xie, 2009)

5.4.3 We must equip professional testing tools for the pollution prevention law enforcement person. Now law enforcement officers of Tangshan MSA are not equipped with any testing equipments in the treatment of pollution accident and only rely on the experience to carry out the investigation of the case, which will give the crew an opportunity. They can completely deny the negligence leading to difficulty in collecting evidences in law enforcement investigation. Therefore, we suggest that law enforcement personnel should be equipped with advanced integrity equipments for on-site enforcement activities, such as biochemical oxygen demand meter, so that illegal behaviors of crews can be curbed and the effectiveness of pollution accident investigation work can be enhanced.

5.5 We must use the theory of government intervention to control the air pollution. Air pollution control includes the reduction of pollutants and governance and purification of pollutants which have been generated. According to the situation of our country, we need to make comprehensive use of legal, economic, technical and management means to prevent and control air pollution on the basis of investigation in order to actually reduce emissions from ships.

5.5.1 Legal countermeasures

Generally speaking, the legal measures belong to the category of direct intervention. At present, MARPOL 73/78 annex VI made by IMO aims to build a global emission standards. From the performance point of view, our country should immediately make mandatory emissions through domestic legislation, formulate relevant policies for its implementation, so as to effectively achieve the emission reduction objective.

5. 5. 2 Technical countermeasures

Technical countermeasures can be realized through direct interventions, economic intervention, and information intervention. There are two main methods to reduce SOx emissions, the choice of low sulfur fuel and sea water washing. Sea water washing is a method to reduce SOx emissions. Exhaust gas passes though the sea water and will be removed the particles after washing and filtering. According to annex VI of convention of MARPOL, this kind of cleaning system must obtain the approval, and the wastes generated by using this equipment may not be discharged into the closed port, unless there is evidence to prove it has no adverse effects and in conformity with the relevant provisions of the port state authority.

Methods for reducing NOx emissions include wet air motor, emulsified fuel, selective catalytic reduction and the use of shore power. Using shore power is to make the ship without an auxiliary engine work thereby reducing emissions which requires a power supply system of ship and port.

5.5.3 Economy countermeasures

We should accelerate the construction of port reception facilities and the construction of pollution prevention framework, such as a ship fuel tax, the development of emissions trading system, establishing fund of greenhouse gas emissions, which are used to reduce emissions by Marine waters in our country. (Angela & Sally, 2003)

5.5.4 Stakeholder management countermeasures

The maritime administrative departments should strengthen the work of the relevant research on the port, the government should pay more attention to infrastructure of discharge recovery device, shipping companies should consider the best operation scheme, ship or port related equipment manufacturers should increase the investment in new product research and development of environmental protection. Government intervention is not everything, and there exists the possibility of government failure including the invalid government intervention and excessive intervention. Therefore, our country should properly manage on scope, methods, efforts of of ship pollution prevention, laws and regulations should be fair, the selection of pollution prevention policy tools, infrastructure construction and public investments must be sufficiently researched and assessed. In so doing, invalid intervention can be prevented. In addition, we must prevent the scope of the intervention exceeding the reasonable demand of market failure and the normal operation of the market or intervention is in the wrong direction or improper form.(docin, 2010)

5.6 We must use the theory of safety management to strengthen safety and pollution prevention management of shipping companies.

The national safety management rules are the application of safety management theory and the system safety management theory. It uses the ISM rule, and fully integrates system, humanism, prevention, enforcement theory of safety management

theory. It include all the content of the ship safety management and pollution prevention. Its purpose is to require the company to establish, implement, maintain and continuously improve the company's safety management level and ability. The rule reflects characteristics of manageability, systemic, centrality.

Safety management system is the most advanced safety management model proved at home and abroad. Maritime authorities usually pay attention to strengthen the auditing and monitoring of the company system operation, which will enable the company to seriously implement the relevant work of ship safety and pollution management. Safety management and pollution prevention awareness within the system have been gradually strengthened. Companies carry out regular ship to shore training to improve the ability of emergency response embarking on a virtuous cycle track. The technical condition and the level of safety management have made great progress, which promotes to the company's safety and pollution prevention management.

5.7 We must Improve the ship oil spill emergency function of Jingtang Port

(1) Establishing and implementing the relevant laws and regulations

Tangshan MSA has developed Jingtang Port ship pollution emergency plan which plays an important role for the management of ship emergency pollution and protection of the ecological environment in Tangshan sea area and natural resources. The relevant departments should strictly implement the plan, which may help reduce the influence of oil spill in Marine environment to a minimum.

(2) Improving oil spill emergency guarantee system of Jingtang Port

The strength of emergency support functions largely depends on the hardware capabilities of emergency conditions. We should encourage and attract scientific research institutes, universities and companies to design emergency equipments, and produce more and better oil spill emergency equipments according to the

characteristics of Jingtang Port. Relevant departments should equip necessary emergency equipments in the port and its relevant docks or companies. Once the oil spill accident occurs, we can use them at any time. Specifically responsible for port oil spill emergency protection, companies must organize regular training and exercises, and continuously improve the emergency ability, and the government should give more support and policy. we must ensure procedures normative, government decrees, operation smoothly.

(3) Establishing the necessary financing mechanism.

Practice has proved that the waters clean-up action needs some financial support. Therefore, the establishment of funding mechanism is very urgent. We should build diversified financing channels before the country establishes the oil pollution compensation mechanism through local legislation. In the government's financial arrangements of Tangshan City, it should have a certain proportion as a special fund. In accordance with the principle of "polluter pays payment", we should charge pollution fees from companies or individuals.

Chapter 6 Conclusion

Jingtang Port is in a period of rapid development of port economy, but there also exist various evils in the management of ship pollution prevention, such as poor condition of ships, weak awareness of pollution prevention of crews. The emergency response person and management of shipping company are not in place and so on. Around these problems, this paper analyses the reasons though in-depth research and analysis using government intervention theory and safety management theory. There are three deep-seated reasons. First, The government and the people do not pay enough attention to pollution prevention work, are not willing to put in too much resulting in many defects on pollution prevention management person, equipment , and resources. Second, the popularization of pollution prevention technology is slow, the rang of it is narrow. These technologies are only for some scientific research units to use. A lot of pollution prevention management law enforcement departments are not widely used, and the law enforcement level is not high. Third, social participation is not enough and there is a lack of coordination between the management departments.

In order to better protect the marine environment and prevent the pollution from ships, the following recommendations are suggested to related departments.

(1) The government should take the lead to increase publicity and input to the pollution prevention and control work, enhance the people's awareness of the protection of the marine environment, inspire people to work for the protection of marine environment participation enthusiasm, and fight for support from whole society. At the same time, we should actively guide the various departments,

enterprises, private owners to pay more attention to pollution prevention work, increase investment, make concerted efforts to complete the largest public works.

(2) We should actively cooperate with the relevant scientific research units and departments, as soon as possible to introduce the pollution prevention of advanced technologies and equipments, increase pollution prevention enforcement means and technologies of the relevant departments, so as to promote pollution prevention management level.

(3) Various departments should strengthen communication and coordination with each other, and make concerted efforts to catch condominium together of pollution prevention management situation. The responsibility of pollution prevention management is not a single group or department, but belong to the whole society. Relevant government departments, community agencies, shipping enterprises, research institutions and academic organizations should work together to actively explore and play the overall effect to promote the continuous development of pollution prevention management.

In conclusion, the suggestions proposed by the paper are simple and crude because the theoretical level and ability of author is limited. The aims are to encourage more people to join pollution prevention research management of Jingtang Port area to improve the management level of pollution prevention, so as to build Jingtang Port as a well-known "green port ".

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