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WORLD MARITIME UNIVERSITY

Dalian, China

**Study and Suggestions on the Emergency Systems of
Marine Pollution Accidents**

By

LI HUI

The People's Republic of China

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

MASTER OF SCIENCE

(MARITIME SAFETY AND ENVIRONMENT MANAGEMENT)

2015

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.

(Signature):

(Date):

Supervised by: Professor Zhang Cunyou

Dalian Maritime University

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ABSTRACT

Title of dissertation: **Study and Suggestions on the Emergency Systems of Marine Pollution Accidents**

Degree: **MSc**

With the rapid development of offshore petrochemical industry and transportation, the number and tonnage of the ships, the frequency of in and out ports and also the probability of marine accidents have increase. Moreover, the risk of marine pollution accidents is increasing at the same time.

This thesis makes comparative analysis of the laws and regulations of marine pollution emergency and the emergency systems in China and developed countries in Europe and America. It is proved by practice that the work mechanisms of marine pollution emergency in developed countries are comparatively more efficient and effective. In reference to those countries' work mechanisms, some concrete advice is given to establish work mechanism of marine pollution emergency in China in the thesis.

The thesis introduces the research background and significance, overviews the present status of domestic and foreign laws and regulations and make comparative analysis from two aspects, marine pollution prevention and compensation for the oil pollution damage. Furthermore, the thesis summarizes the emergency systems of marine pollution in the US, Japan, the UK, France, Germany, Sweden and Australia. Then the thesis makes an analysis of China and American emergency systems of marine pollution from five aspects, which are legal support, institution setting, emergency resources, coordination mechanism and compensation mechanism. On

the basis of the five aspects, the thesis gives some suggestions on domestic emergency work of marine pollution accidents.

KEYWORDS: marine pollution, emergency system, IOPC Fund

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List of Abbreviations

CERCLA	Comprehensive Environmental Response Compensation and Liability Act
OPRC	Oil Pollution Preparedness, Response and Cooperation
MSRC	Marine Oil Spill Response Company
MRCC	Maritime Search and Rescue Centre
C.I.R.S.C	China International Rescue And Salvage Conference

Chapter I Introduction

1.1 Research Background and Significance

Nowadays, China is the consumption power of oil and chemical goods. With the development of China petrochemical industry and shipping industry in recent years, the number of oil and chemical ship sailing in China's sea area increases year by year. The navigable waters in China become busier, accompanied by the number of ship damage accidents increasing year by year. In the mean time, the risk of marine oil and chemical pollution accidents also continue to increase.

1.1.1 Oil Reserve Tank May Cause Marine Pollution

To meet the demand of transporting the oil and oil products by sea, multiple oil terminals of 300,000 tons and above have been established in China coasts in recent years, and around the oil terminals oil reserve tanks including the state strategic oil reserve base are constructed. Construction of oil reserve base on the coast may cause accidents, which will lead to a large amount of crude oil leaking into the sea. Thus, serious marine environment pollution and economic losses will be caused.

Figure 1 and Figure 2 show that the number of ship flowing in China coasts increases year by year, and the risk of the matching marine pollution accidents also increases. Therefore, effective prevention and control measures must be taken to reduce the risk of marine pollution accident.(Ma,2010; Zhang & Liu,2006)

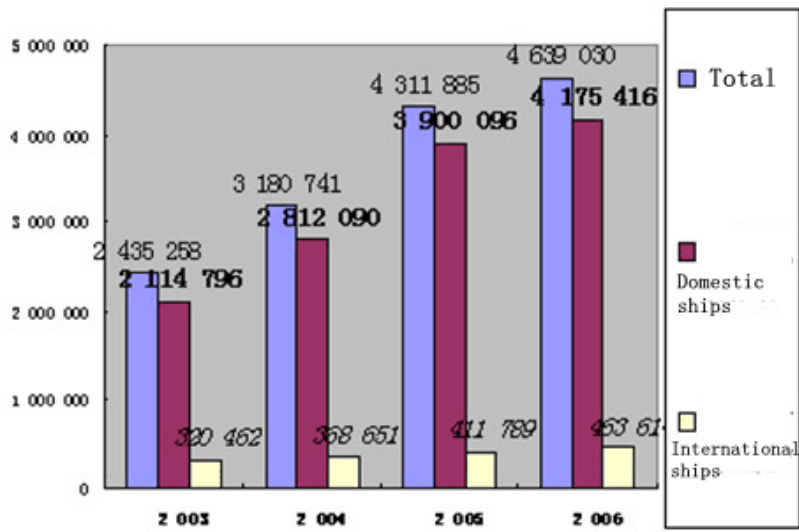


Figure 1 Ship Flow in China Coasts from 2003 to 2006

Source: Guan, W.B.2009

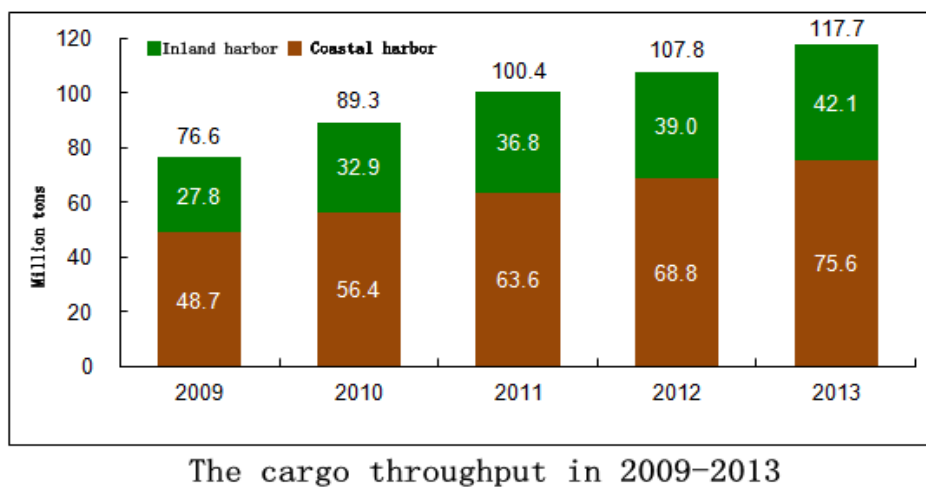


Figure 2 Cargo throughput in China ports from 2009 to 2013

Source: ASKCI Consulting Co., Ltd. 2013

1.1.2 Transportation of Dangerous Chemicals May Cause Marine Pollution

Marine pollution accident includes marine oil spill accident, marine bulk chemical spill accidents, ship waste discharge, ship ballast water discharge and so on. Marine oil spill accident and marine bulk chemical spill accident are commonly unexpected, and are likely to cause heavy loss to the environment and state property because of the great scale, wide scope of influence, and big difficulty of cleaning. Once the two kinds of accidents happen, emergency responses should be implemented and integrated resources taken to deal with the accidents, in order to reduce the possible damage and control the situation as soon as possible (Deng,2010).

Maritime dangerous chemical accident refers to the ships carrying dangerous chemicals, experiencing fire, explosion leakage and so on in the process of sailing, berthing and operations on the water, causing harm to life and property and marine ecological environment. With the development of world economy, the progress of the society and the improvement of people's living standards, the demands of each country for all kinds of chemical products are increasing rapidly, when the marine chemical bulk transportation emerges. In recent years, frequent marine accidents attract the world's attention to maritime safety and marine environment, which include that accident cases of bulk chemical ships. Bulk chemical ship is one of the ship types that have biggest threat to maritime safety and marine environment, which has now drawn high levels of concern from each coastal country and these countries are taking corresponding actions and measures.

There were 60 harmful and toxic chemical pollution accidents from 1990 to 2005 in China (including the Yangtze river). The pollutants involved ten kinds, including benzene, styrene and other toxic chemicals.

On March 7th, 1997, the bulk chemical ship “Bluesky No.2”, constructed in 1980 with a deadweight of 130 tons, sailed from Yosu, Japan to Shantou, Guangzhou and sank in the ocean 200km to the east of Hangzhou with 988 tons of dioethylphthalate.

On October 8th, 1997, the ship “Gan Fu Oil 005” of Jiangxi province carrying 149.336 tons of pure benzene sank in Yunyang reserve base of Sichuan province and greatly polluted the drinking water of the Yangtze river.

On the morning of April 17th, 2000, the ship “Da Yong” of South Korea carrying 2,290 tons of styrene collided with the ship “Da Wang” of Hongkong Barak shipping company, which caused large amounts of styrene leaking into the sea. Though emergency rescue measures were adopted, there were still 708 tons of styrene leaking into the sea. According to the experts, the losses caused by this leakage were about 200 to 300 million yuan (Liu, 2009).

On November 2nd, 2010, China Maritime Safety Administration organized a comprehensive and simulative emergency disposition of bulk chemical leakage with largest scale and strongest expertise in China, named 2010, Ningbo port emergency drill of chemical leakage (Weng.2007). However, China has not established a national level emergency response mechanism of bulk chemical leakage so far. The present situation is that emergency response mechanism of chemical leakage is in disorder.

1.1.3 Grave Ship Oil Spill Accidents May Cause Marine Pollution

The main sources of marine oil spill accidents include ship accidents, marine oil exploitation accidents, offshore oil platform and pipeline leakage accidents, leakage accidents caused by land accidents and so on.

With the rapid growth of China's coastal marine traffic flow and shipments of oil and oil products, there are a lot of oil tankers and other types of ships sailing in China's coast every day, which is likely to cause vessel traffic accidents, such as collision, stranding, sinking and so on and increase the risk of pollution accidents.

There were a total of 69 ship oil spill accidents with a leakage over 50 tons in China's coast. The total leakage amount reached 20,240 tons. Some ship oil spill accidents caused serious environmental pollution and economic losses because of the large amount of leakage and concentration of leakage time and closeness to environmentally sensitive area (Zhao,2010). For example:

The ship "Chang Yang" pollution accident in the Huangpu river of Shanghai in August, 2003;

The ship "ARTEAGA" pollution accident in Dalian new port in April, 2005; The ship "Modern Independent" pollution accident in Zhoushan, Zhenjiang province in April, 2006;

The "July 16th" accidents in Dalian in 2010;

The oil spill of CNOOC in Bohai Bay in June, 2011 (Li,2013) .

Table 1 is the class of ship oil spill accidents in China from 1973 to 2006. Figure 3 is the impacted areas by marine pollution from 1973 to 2006 .

Table 1 The Class of Ship Oil Spill Accidents in China from 1973 to 2006

Class of Oil Spill (Tons)	The number of oil spill	Percentage of total number (%)	Oil spillage (Tons)	Average oil spillage (Tons)	Percentage of total spillage(%)
50-100(Not include 100)	9	13	640	71	1.7
100-500 (Not include 500)	43	62	10263	239	27.7
500-1000 (Not include 1000)	10	15	7263	726	19.6
1000 (Above)	7	10	18911	2701	51.0
Total	69	100	37077	537	100

Source: China Association for Science and Technology. 2009

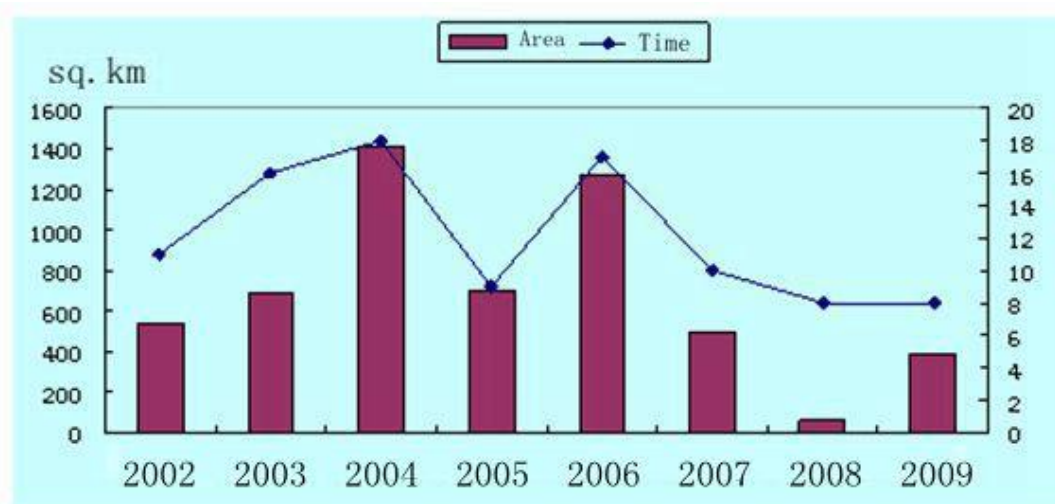


Figure 3 Statistics of Number of Marine Pollution and Impact Area from 1973 to 2006.

Source:Guan ,W.B.2009

1.1.4 Offshore Oil Platform Accident May Cause Marine Pollution

In recent years China offshore oil exploitation industry has developed rapidly, but the related risk of marine oil platform and submarine oil pipeline leakage accident also increases. The exploration and exploitation of offshore oil is mainly carried out in Bohai sea and the South China sea. According to the statistics of State Oceanic Administration, the number of oil pipeline leakage in the Bohai sea is about 0.1 per year and the number of oil spill caused by fire and blowout in Bohai oil platform is 0.2 per year (Qian,2011) .

The oil spill accident of drilling platform “the deepwater horizon” in the Gulf of Mexico, US shows that there are high risk of oil spill in the offshore oil exploration and exploitation. Figure 4 is the statistical figure for the oil platform leakage accidents that happened during the period of the“11th 5-year”.

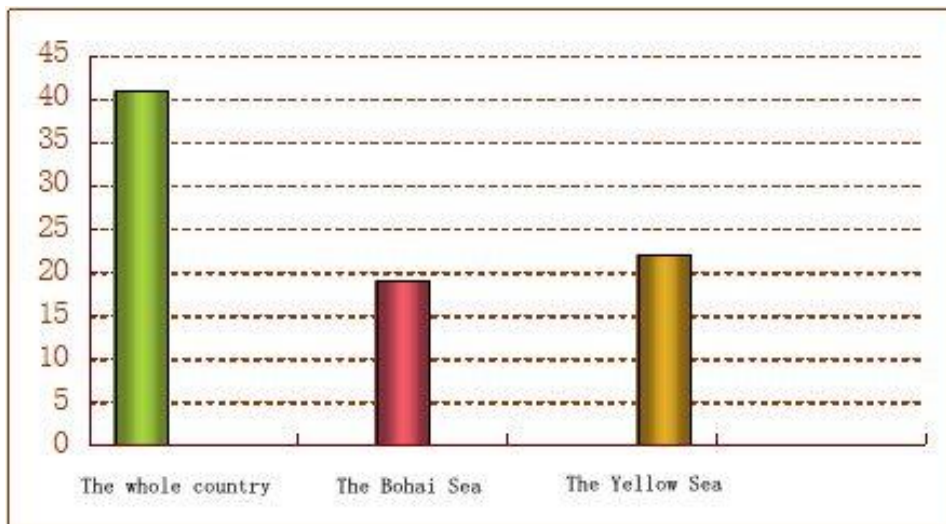


Figure 4 Number of the Oil Platform Leakage Accidents During the Period of the“11th 5-year”

Source: Xinhua Net web.2011

1.2 Main content of the Research

“July 16th” accident which happened in Dalian new port caused a large amount of oil spill and lead to serious pollution of ocean and coasts. Under the support and guidance of Ministry of Transport and other state ministries, the government of Dalian organized a large-scale and fruitful clean-up activity. Liaoning Maritime Bureau, as the command centre, took responsibility for the clean-up organization and coordination. Though the clean-up activity of “July 16th” accident obtained success, some problems were exposed (Guan,2011).

- (1) At the national level, although China enacted *Emergency Plan for China National Ship Pollution Water Area*, it has not established the real marine pollution emergency plan at the national level. As a result, emergency system of marine pollution at the national level remains to be perfected.
- (2) At the local level, the government of each province and city has made emergency plan of vessel pollution water in their own jurisdiction, but there is a lack of coordination and unity between provinces and cities and the problem of no specific responsibility distribution is prominent (Guan & Han,2010).
- (3) The emergency power is insufficient. Dalian only had 200 meters of fire-resistant oil boom when “7.16” Accident happened. Therefore, the ordinary oil boom was set at the scene. However, due to 3 out of 4 oil boom being destroyed setting in the waters caused by the fire on the surface of ocean, the effects of controlling the oil spill was influenced (Liaoning Maritime Safety Administration,2011).
- (4) In the aspect of compensation for marine pollution accident, there is a lack of legal claim procedures for the victims and assistance mechanism for the victims of marine pollution accident.
- (5) China has not established the compensation fund system for the damage

caused by the marine pollution accident. As a result, the phenomenon of having no access to claim for compensation occurs frequently. At present, the risk of marine pollution accidents continues to increase. To integrate and improve the national and local emergency system of marine pollution accidents is the effective response to deal with the marine pollution accidents (Feng,2010).

The purpose of this research is to analyze the deficiency of the current emergency system of marine pollution accident. On the basis of comparatively perfect effective emergency mechanisms of oil spill in some developed countries which are proved by practice, the research aims to put forward the emergency mechanism for China marine pollution accident.

Chapter II- The Emergency System of Marine Pollution Accidents of Western Powers

From November 19th to 30th of 1990, the International Maritime Organization held the conference of “international cooperation on oil pollution preparedness and response”, during which the International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (or OPRC 1990 for short) was approved (IMO, 1990). OPRC 1990 requires all contracting parties take establishing national emergency system of oil spills and making emergency plans for oil spills as their obligations and duties of performing the convention. All major shipping powers in the world have established their national emergency system of oil spills. The emergency systems of oil spills in the US, Japan, the UK, France, German, Sweden and Australia are outlined as follows (Liu, 2005 ; Li, 2007 ;. Xinhua Net web, 2007).

2.1 U.S Emergency System of Marine Oil Spills

The US has established three levels of national, regional and local emergency response organizations with their own emergency response plans of each level. National emergency response organization is a coordination entity of national plans and policies which gives policy guidance before the accidents and provides assistance during the accidents instead of dealing with the accidents directly. The members come from environmental protection agency, coast guard and other federal departments which are responsible for environmental administration. The whole US is divided into 13 zones, each of which has established a regional emergency response organizations. The regional organizations are under coast guard and environmental protection agency. They are in charge of making local emergency

response plans and policies and coordinating for local organizations instead of taking direct responsibility for accidents. Local emergency response organizations are accidents emergency command entities which command and coordinate at the accident scene with the assistance of the commander sent from the environmental protection agency or coast guard. In the US, most cleaning work of pollution accidents is done in accordance with the advance agreement with the contractors in each defence area. Besides, the commander on the spot can use national assault force. The coast guard establishes two national assault teams equipped with large-scale pollution prevention equipments along the Pacific coast and the Gulf of Mexico. They are in charge of the cleaning work of large-scale oil spills and chemical leakages in marine environment (Zheng & Tian, 2015 ; Wang & Dong ,2010).

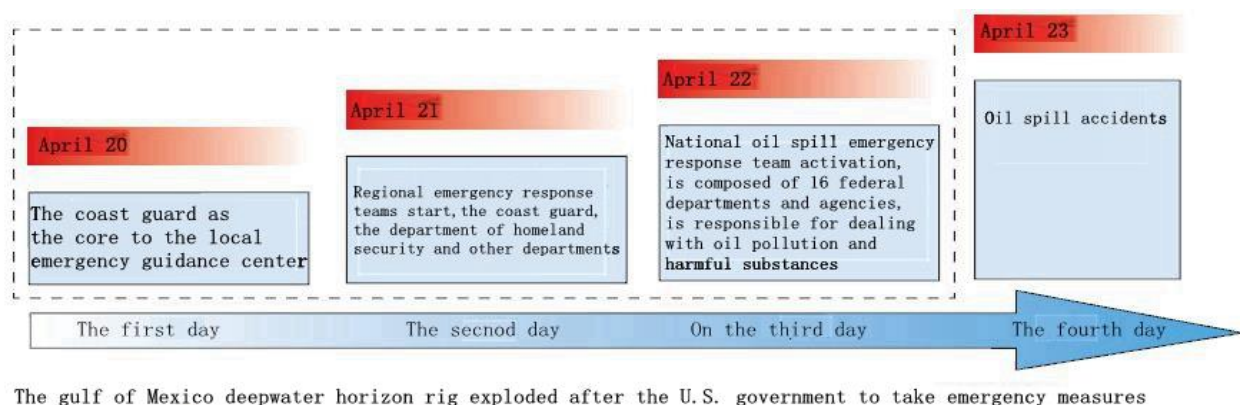


Figure 5 The Gulf of Mexico deepwater horizon rig exploded after the U.S. government to take emergency measures

Source: Li, X.F.2013.

2.2 Japan Emergency System of Marine Oil Spills

Japan emergency force mainly consists of Japan Coast Guard and the marine disaster prevention centre.

Japan coast guard mainly takes charge of monitoring and supervising within the sea area. It has its own equipments of oil spills cleaning and controlling and fire floats aiming at large areas of oil spills and guarantees that these equipments are available whenever necessary. Japan coast guard also establishes the basic data of coastal environment and provides related information for institutions of oil pollution prevention and treatment through the Internet in order to guarantee its effective response to marine oil spills. Japan coast guard predicts the drifting direction of oil spill as well and helps control and clean marine oil spill to dispose of these accidents. In addition, Japan coast guard sends patrol boats and planes to monitor marine pollution and specifically strengthens the monitoring actions of dense navigation areas.

Japan marine disaster prevention centre was established in 1976 in accordance with related laws of the prevention and treatment of marine pollution and natural calamities. It is also a core institution of marine disaster prevention among the people. It takes direct order from Japan coast guard and takes actions of cleaning oil spills when accidents occur. It sets up four subordinate committees which are committee of cleaning oil spills, ship's fire fighting, equipments and training. The centre has vessels and equipments used in marine disaster prevention. Meanwhile, it conducts marine disaster prevention training, promoting the international cooperation concerning marine disaster prevention and doing research and study of marine disaster prevention work (The Chinese Text Library, 2007).

2.3 U.K. Emergency System of Marine Oil Spills

The emergency system of marine oil spills in the UK is mainly run by the marine pollution control centre. It is under the coast guard of transportation department and performs the convention of international maritime organization on oil spills response. The centre has the aviation remote sensing surveillance force, the computer system of evaluating the amount and drifting direction of oil spills, the capability of spraying oil dispersant in the air or on board and the equipments of recycling or transferring oil spills at sea or on shore. The British marine pollution control centre mainly takes charge of marine response in large oil spill accidents and the coordination of shoreline cleaning work. It gives technical guidance to the related departments of local governments in the aspect of coordinating the shoreline oil pollution cleaning work.

The marine pollution control centre and local governments conduct the emergency response work with the support from the coast guard of the transportation department which establishes 21 rescue coordination centres in the whole country, marine safety agency, fishery department, environment department, department of defence, weather bureau and the support system consisting of the nature protection organization, oil companies and the British oil spill control association. Once the marine oil spill accidents occur, minor accidents can be disposed by the rescue coordination centre of coast guard while major accidents can be disposed by related departments which are coordinated by marine pollution control centre and local governments.

The related departments of support system provide support in accordance with their obligations. It is different from other countries in that the department of defence

provides the assistance of knowledge, equipments and personnel to the marine pollution control centre for value. The oil companies sign the volunteer agreement with marine pollution control centre so that the centre can get the support from these companies when large oil spill accidents occur. In addition, the British oil spill control association is an important support organization of emergency response of oil spills in the UK. It is a commercial association which represents the interest of each company and provides equipments and service for British and overseas industry and shipping pollution. The red alert system owned by the association can 24-hour provide emergency response equipments and appliances for each membership corporation quickly (The Chinese Text Library, 2007 ; Bai, 2010).

2.4 France Emergency System of Marine Oil Spills

The emergency system of France consists of the system offshore and the system on land and coast and two levels of emergency organizations are established separately. In the central authorities, it sets up the inter-ministerial maritime committee under the administration of the state secretary of maritime affairs and the civil safety committee under the administration of interior minister which respectively takes charge of examining and approving the emergency response plans of pollution offshore and pollution on land, pollution control work and national emergency response drilling. On the local level, the coast defence command is responsible for planning and guiding marine pollution control work, coordinating with local authorities and marine enterprises to develop emergency response plans and organizing personnel to train and drill. The work of cleaning pollution in France mainly relies on the manpower and material resources among enterprises and the people. They usually adopt the way of temporary renting and requisition. Besides, each navigation zone of the country has a high-power tugboat and a crew team.

Several action groups are established in civil security and military organizations to take charge of disposing marine accidents (Kou,2011 ;Sun,2009).

2.5 German Emergency System of Marine Oil Spills

The mission of removing oil in German is jointly undertaken by federal government and coastal states including Bremen, Hamburg, Niedersachsen and Schleswig-Holstein. The organization structure they adopt is divided into the following parts: First, the marine/offshore oil pollution committee consists of experts; second, the oil removal team which takes charge of removing oil; third, the oil pollution accidents alarm institution which is established in national alarm centre and works 24 hours to report oil pollution accidents to each international and domestic communication station; fourth, the federal special team and the federal offshore special team in Cuxhaven whose task is to examine and approve the plans which are put forward by the marine/offshore oil pollution committee and support the oil removal team when accidents occur; fifth, consultant institution which provides knowledge on oil pollution accidents for administrative departments and the oil removal team and puts forward research projects and advice (Zhao,2005).

2.6 Sweden Emergency System of Marine Oil Spills

In order to reinforce the protection and administration of marine environment, Sweden established marine environmental protection and administration agencies in accordance with related laws and regulations. In the aspect of prevention and treatment of marine oil pollution, the agencies are administrated by Sweden's national technology development bureau with the coordination of other departments

including national environmental protection agency. The executive department of removing oil is Sweden Coast Guard. There are several specific agencies concerned participating in the environmental protection and administration: First, national environmental protection agency. It is under the Ministry of Agriculture and takes charge of the environmental protection of water and air. It is an environmental monitoring institution of central authorities. It is responsible for coordinating the monitoring activities of each county's administrative bureau and gives assistance when it is necessary. Second, environmental protection visa agency. It takes charge of issuing permits of industrial and mining enterprises which may pollute environment and permits of disposing the waste. Third, Sweden's national technology development agency. It is an independent national institution. It is in charge of providing funds for related departments, institutes and universities, by which it administrates and stimulates the development of science and technology. Last, Sweden coast guard. It is under the customs and holds responsibilities for monitoring territorial waters, prohibited military zones, continental shelf activities and marine dumping during navigation and water carriage and law enforcement work. It also undertakes the work of hydrographical survey and sampling. It is the duty of the coast guard to monitor Sweden marine oil pollution and dispose of accidents. The whole country is divided into 4 coast guard zones and 15 coast guard administrative zones. 2 to 4 coast guard stations are established under each coast guard administrative zone. The coast guard stations work day and night. Watch-keepers and vessels are 24-hour acquired the clock on duty in each coast guard zone while staff and vessels which are off duty are also on the alert (Li,2013).

2.7 Australia Emergency System of Marine Oil Spills

The oil pollution administrative departments consist of the federal government, the state government and the petroleum resources industry. Each department concerned has clear division of their responsibilities. The harbour and dock management department is responsible for the sea area within harbours and docks; the state government is in charge of seacoasts and beaches; the public resource department of the federal government takes charge of offshore sea area; the public resource departments of the federal government and the state government jointly administrate deepwater area. There are oil pollution committees consisting of local officials, environmental protection agencies, police, service departments of oil spills and departments of petroleum industry established in each government. The whole Australia has established nine oil spill equipment depots in strategic areas, each of which includes 100 tons of hydrocarbon solvent oil removal agents, 8 sprinkling equipments, recycling equipments, oil fences and necessary communication equipments (Chaffey ,2013).

Chapter III Comparative Analysis of China and US Emergency Systems of Marine Pollution Accidents

The US approved the Oil Pollution Act of 1990 and established the soundest emergency response system of oil spill prompted by the Exxon Valdez oil spill (Feng & Liu, 2010). In the following, the author analyzes China and US emergency response systems of oil spill, which has some reference significance for domestic construction of emergency response system of oil spill (Wang, 2011).

3.1 Legal Support

3.1.1 U.S

The US construction of national emergency response system of oil spill has a lot to do with the support of mature, perfect and international legal system, especially the Oil Pollution Act of 1990 issued on August 11th, 1990. The content of the Oil Pollution Act of 1990 covers the prevention and removal of oil spill, compensation and responsibility of oil pollution, international cooperation, technology research and development of oil spill, fund amendment of oil spill and so on, which aims to build a legal system of oil pollution widely used in ships, offshore oil platforms and offshore installation. In addition, each state and region of the US sets up some local laws and regulations according to the specific circumstances and investigates the responsibility of some behaviour not applying to the Oil Pollution Act of 1990. Other regulations about pollution emergency include: the CERCLA Act, the Emergency Plan Formulation and Residents' Right to Know Act (1986), the Federal Water Pollution Control Act, the Clean water Act, Transport of Dangerous Goods Regulations (1974), Resource Conservation and recovery Act (1976), Water

Purification Act, etc. The laws and regulations mentioned above provide a strong support for US emergency response work of marine pollution accidents.

3.1.2 China

In 1998, China joined the 1990 International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC Convention). The relevant requirements of formulating all kinds of emergency plan of marine oil spill in the Marine Environmental Protection Law which came into force in 2000, are also the main legal basis of establishing China emergency system of ship pollution. It makes China have no specialized legal basis for preventing and curing the petrochemical pollution because of a lack of relevant laws (Fang & Yang,2007).

3.2 Institution Setting

3.2.1 US

As the framework of emergency response mechanism for pollution, US emergency plan for pollution is made up by national emergency plan, regional emergency plan and local emergency plan, which formed the response and preparation mechanism of three levels. The mechanism is applicable to all oil spill accidents, including national serious oil spill accidents. The national large and complete response system is the one that supports the reaction mechanism.

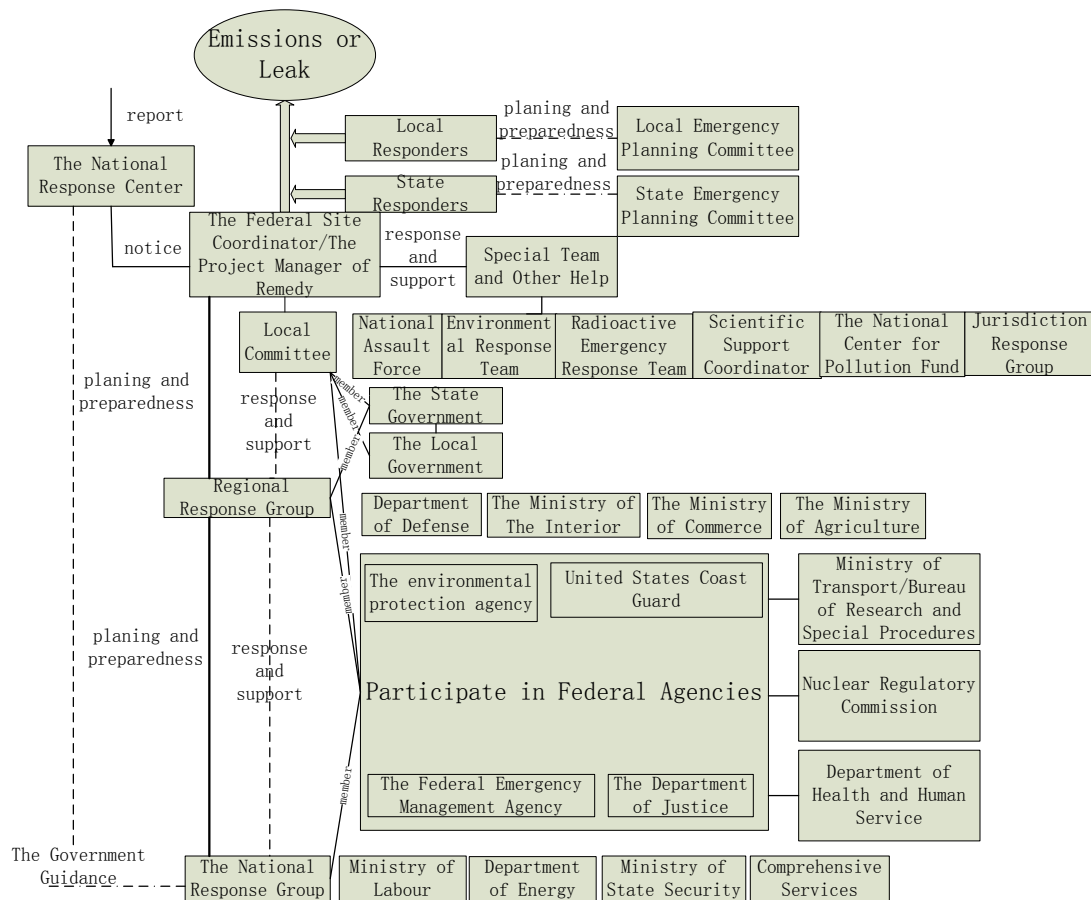


Figure 6 The U.S pollution emergency chart

Source: Li, X.F.,2013.

The National Response Group is the planning, policy and coordination group of first level in the emergency management structure. It does not carry on specific events directly, but provides guidance and assistance when necessary. The national response group consists of 16 federal government standing bodies, each of which takes different responsibility for the emergency response of pollution accidents. The director of the National Response Group is held by the Environment Agency and the vice director is held by the Coast Guard. The National Response Centre is located in the US Coast Guard Headquarters, which is the communication centre of national response group. After receiving the report the National Response Centre immediately

notifies the pre-assigned site coordinator in advance and reports to the departments of it. In addition, the National Response Centre should evaluate the received information and immediately report the potential disasters or clean cases to the emergency management agency.

The Regional Response Group is US planning, policy and coordination group of second level in the emergency management structure, Like the National Response Group, it does not carry on events directly. There are 13 Regional Response Groups in total in the US, the members of which are the same as the ones of the National Response Group. But it also includes representatives of the state and local government. The co-director of the Regional Response Group is determined by the water area where the pollution accidents happen.

The third-level management structure is the local emergency plan, which is an “immediate response” file and can be revised once a year. The file includes environmental sensitive area and resources in risk areas, response equipment guidelines, response procedures and local communication network (Wang, 2013).

3.2.2 China

The work of establishing emergency system for ship pollution and dealing with the emergency of ship pollution accidents is mainly carried out by the Maritime Bureau of Ministry of Transportation and government of each coastal provinces and cities. In accordance with establishing and emendating framework guidelines of emergency plan for the precipitating event by the departments and units under the state council, the maritime bureau drafted the national emergency plan for ship pollution and supports the departments directly under it to formulate the emergency plan for oil spill in jurisdictions with the local government at various levels (Leng, 2005).

At present, the emergency plans of the major coastal provinces and cities have been promulgated by local governments. According to the requirements in the 1990 OPRC Convention and the Marine Environmental Protection Law, Maritime Bureau carried out the construction of emergency plan system at all levels across the country. Based on the framework of emergency plan at 5 levels- the national level, sea level, provincial level, municipal level and port terminals level, the national emergency pre-plans for sea area were enacted in 2000 (State Council,2006) . In 2006, the emergency plan for ship pollution of Shanghai, Zhejiang, Tianjin, Hebei and Shandong was worked out and promulgated by local governments. Meanwhile, 31 emergency plans at prefecture level were also promulgated by local governments. In the aspect of establishing management agencies for oil spill emergency, coastal ports all over the country have set up specialized commanding agencies for oil spill emergency. Some coastal provinces and cities set up the emergency response centre for oil spill (Ye,2008) .

At present, the development of building the emergency system of the provinces, cities and regions all over the country is unbalanced. In some areas, emergency plans have not been set up yet. In some provinces and cities, though emergency pre-plans have been promulgated by local government, the operation and performance of the emergency system is on various levels. Once there is a pollution accident, the maritime administrative department in the jurisdiction of the accident shall organize emergency operations. When the accident happens at the boundary water or the accident level surpasses the regional emergency ability, generally the Maritime Bureau of Ministry of Transportation takes the responsibility for coordinating the cooperation of emergency operation between the regions (Yang &Yang,2009) .

3.3 Emergency Resources

3.3.1 US

US emergency response team for pollution is organized by the contractor of oil spill removal, special team and other assistance.

The contractor of oil spill removal is professional clean-up enterprises for profits on the basis of the marketization, which can be divided into national, state and port level. The members of the oil spill removal enterprise consist of oil companies, the owner and oil receiver, etc. US national Marine Oil Spill Response Company (MSRC) is equipped with nearly 80 member units. These member units pay annual fees to MSRC according to the oil capacity in the last year in their jurisdictions. These fees are used for MSRC work, cost of equipment investment as well as cost of research and development. MSRC has owned equipments worth nearly 400 million dollars and has set up emergency response centres in 5 regions across the country. Each region has 3 to 6 equipment setting points and is equipped with containment boom of 30,000 feet, all kinds of efficient transport equipment, all kinds of oil removal equipment, advanced communication facilities and logistics information system (U.S. coast guard ,2001).

The contractor of oil spill removal provides a line of defence and takes responsibility of the initial reaction job with local fireman, police and other personnel handling emergency event. When the reaction is needed, each national department including the federal government is ready to give support and help. These special teams include:

3.3.1.1 The National Storm Troops

US National Storm Troops of Coast Guard is managed by the National Response Group, which usually starts to work when the serious oil spill accidents happen or

other response group requires collaboration. The National Storm Troops has the ability to adapt to serious oil spill accidents, remove the oil spill and react immediately, especially adapt to the spill occurred in the marine environment.

3.3.1.2 Environmental Response Team

Environmental Response Team is established according to its responsibilities in accident emergency response by Environmental Protection Agency. It can offer a proposal to the site coordinator in the aspects of risk assessment, security of the site, sampling analysis, removal technology, the use of dispersants, the requirements of the clean degree, disposal of pollutants and so on.

3.3.1.3 Scientific Support Coordinator

Most of the Scientific Support Coordinators are the scientific and technical personnel of US National Oceanic and Atmospheric Administration. They provide the movement and track information of oil spill, the environment information required for decision of oil spill response, the evaluation of pollution damage, the risk assessment of natural resources, data management and other science support.

There are also many other assistance forces, which include International Pollution Fund Centre and jurisdiction response group, etc. For example, the jurisdiction response group founded by US Coast Guard in each jurisdiction is constituted by all guard staff and consulting team of response in the jurisdiction. The group is responsible for technology and equipment support to the site coordinator, ensuring all the equipment maintenance of coast guard and providing technical assistance to local emergency plan.

The site coordinator is the pre-assigned federal government official, who is responsible for organizing the response group (the standard response structure as shown in Figure 7), thereby ensuring prompt and efficient response to the oil or

hazardous emissions accidents. The site coordinator can summon assault force, environmental response group, scientific support coordinator and public information support group to assist emergency response actions at any time.

When the accident rise to the national level, it needs the exceptional coordination of federal government , state government, regional government and private resources. In the regulations of the national response system, only the commander Coast Guard or the director of the National Environmental Protection Bureau have the right to announce the state-level leakage accidents. Unified command and management support mechanism is adopted in dealing with the kind of accidents, ensuring that all possible actions are taken to deal with the pollution accidents and putting the full power of standard equipment on the response work.

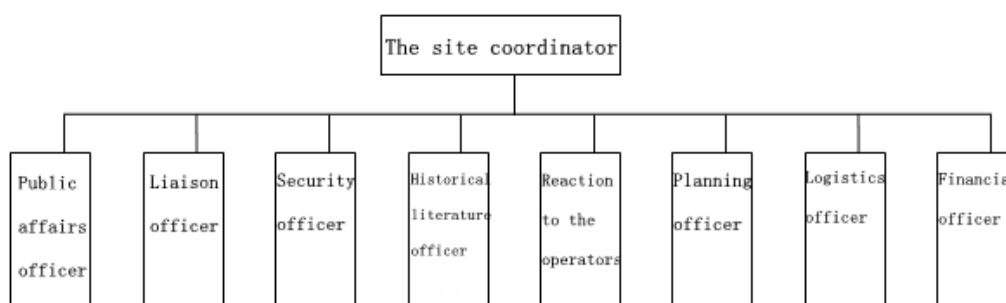


Figure 7 Response organization chart

Source: Wang, C.2013

3.3.2 China

The construction of ship pollution emergency power is divided into two parts: one is the national investment in setting up large contingency equipment base and emergency technical communication demonstration centre in some key water areas; the other is establishing a professional clean-up team with regional characteristics.

China has successively completed the construction of two contingency equipment bases and emergency technical communication demonstration centres in Yan tai, Qinhuangdao. The two centres are equipped with satellite monitoring system, monitoring system and control system of oil spill removal. The two centres have provided strong technical supports for emergency work of ship oil spill (Ministry of Transportation , 2007).

However, there have been no such contingency equipment bases in other areas. The emergency powers of those regions mainly come from port and shipping enterprises, petrochemical industry, sewage disposal unit, oil operation department, wharf and other social forces. There is a big shortcoming no matter from the personnel quality or the equipment. These regions cannot meet the requirement of quickness and efficiency.

After the comparative analysis of related institutions setting and resources allocation between US and China, the author can get the following conclusions:

There are problems of unclear responsibilities in marine pollution emergency work in China. Maritime Bureau is mainly responsible for the emergency work of marine oil spill while Oceanic Administration is in charge of emergency work of oil spill in offshore oil platforms. However, there is no clear responsibility division in accident cases such as Dalian 7.16 accident (Ren, 1993). US divided the country into 13 districts and the division of jurisdiction and responsibility is very clear.

There is no integration mechanism of national and regional emergency resources in China (Yang & Yang, 2009).

China has not established a sound system of monitoring, emergency alarm, emergency response, compensation and the accident assessment.

3.4 Coordination Mechanism

3.4.1 US

US established a national command centre of oil spill emergency response, which is organized by Federal Environmental Protection Agency, Interior Ministry, Ministry of Transportation, Ministry of Agriculture, Ministry of Commerce, Ministry of Defence , Ministry of Justice, Ministry of Health, Nuclear Regulatory Commission, Administrative Department, Department of energy and other government departments. Its main responsibilities are to formulate the plan for prevention and control work of national oil spill, coordinate with the state governments to cooperate with each other in regional emergency work. The national command centre of oil spill emergency response is located in the Coast Guard Headquarters, which is the communication centre of national response group.

Related state governments and some areas also set up emergency response system. The system's main responsibility is to focus on the planning of the prevention and control work of oil spill and coordinate the emergency coordination and support work of relevant departments in administrative region. The duty of the regional emergency response system is specific. One is the essence work of the prevention and control. The second is the quick and efficient removal work in dealing with the oil spill emergency.

The Coast Guard has the highest right of organization, coordination and decision. US OPA90 stipulates that a permanent institution should be set up under the emergency commanding system- an office of preventing and controlling the oil spill. Its members are from each relevant government department and the permanent institution should act according to the national emergency plan and related legal authorized rights. At the same time, the federal government assigns a Coast Guard

official to be responsible for the final decision of the scene. The official can coordinate all related departments and has right to command all ships and even naval vessels in the port. In regional emergency response system, the final decision of the official ensures the joint emergency command act in a quick, coordinated and orderly way (Yu & Gao,2013).

3.4.2 China

3.4.2.1 Coordination Mechanism of Ship Pollution Emergency Work

Based on China's Emergency Plan for Ship Polluted Waters, China has established the ship pollution emergency response system from national level to regional level and set up the corresponding commanding agency of oil spill emergency response organization.

The regional oil spill emergency headquarters are located in the corresponding Maritime Bureaus, which are in charge of the unified organization and coordination of marine oil spill emergency in jurisdiction waters. The chief commander is held by the leader of the provincial government or the leader of Maritime Search and Rescue Centre (MRCC) while the vice commander is held by the leader of Maritime Bureau. The administrative body of the headquarter can work together with the one of MRCC (Lv & Qu,2010).

3.4.2.2 Coordination Mechanism of Oil Spill Emergency Work on Offshore Oil Platform

According to the Procedure of Oil Spill Emergency Response Caused by Offshore Oil Exploration and Exploitation constituted by Oceanic Administration, oil spill emergency headquarters at three levels are set up in the sea areas across the country.

oil spill emergency headquarters set up emergency response offices and expert group, emergency response office as the permanent administration.

Once oil spill accidents happens in offshore oil platform, the coordination and organization work of oil spill emergency response are mainly taken by the emergency headquarters and emergency response office. The specific responsibilities of the two are as follows:

- (1) The emergency headquarters launches the procedures of emergency response, commands and supervises the oil spill emergency response work and coordinates related departments.
- (2) The emergency response office carefully formulates and revises the Procedure of Oil Spill Emergency Response Caused by Offshore Oil Exploration and Exploitation, takes responsibility for the daily work of headquarters, organizes and coordinates the oil spill emergency response work, supervises the oil spill emergency action of enterprises and so on.

Both US and China have set up oil spill emergency response headquarters at national, sea and regional levels. There are several differences in the following after comparison between the two mechanisms:

- (1) US set up command centre of oil spill emergency response, which is responsible for formulating the prevention and control work of marine oil spill, commanding and coordinating state governments, stipulating the cooperation and support work of regional emergency response. Comparatively, China has two institutions, marine ship oil spill emergency headquarters and command centre of oil spill in offshore oil platform. However, the coordination mechanism and cooperation mechanism of the two institutions have not been established.
- (2) In US emergency response system, Coast Guard official, State government official and ship-owner formed a command group of three. The Coast Guard

officials' voting right takes 51% in the end, which ensures the quick, coordinated and orderly action of unified emergency commanding. However, there are no clear provisions about the permission of the chief commander in China.

- (3) US command centre of oil spill emergency response is located in the Coast guard headquarters, which is the communication centre of national response group. After receiving the report, it immediately notifies the pre-assigned site coordinator and reports to the member units of national response group. Comparatively, China does not set up the site coordinator and or establishes an effective and unified communication platform.

3.5 Capital Source of Emergency Response

3.5.1 U.S

According to US Oil Pollution Act, 1990 and its supplement, Oil Spill Liability Trust Fund is composed of two parts: emergency fund and basic fund. The emergency fund is mainly used in three aspect: (1) federal removal expenses; (2) states ask for trust funds to immediately start clean-up operation; (3) the trustee starts to estimate the damage of natural resources. Emergency funds, unlike most federal spending, has no requisition for annual money. The remaining money can be reckoned in the next fiscal year. The emergency funds are used to directly support the site clean-up activities of Coast Guard and the Environmental Protection Agency (Xie, 2013).

3.5.2 China

At present, China has not established a fund system yet. Facing the previous oil spill accidents, related departments and enterprises pay the fees first and then get the

money back from the accident damage compensation. Therefore, the author suggests that China should draw lessons from US when establishing fund system in the future, dividing the fund into emergency fund and basic fund. The emergency fund can provide fund guarantee for emergency response in the first place (Han ,2008) .

Chapter IV-Suggestions on Domestic Emergency System of Marine Pollution Accidents

4.1 Suggestion on Perfecting Domestic Legislation for Preventing and Controlling Marine Pollution Legislation

4.1.1 Perfect Legislation for Marine Vessel Pollution

On September 9th, 2009, the State Council issued the 561st decree to implement the Regulations of the People's Republic of China on the Prevention of Vessel-Induced Sea Pollution of new version and officially put it into effect on March 1st ,2010.

Regulations of the People's Republic of China on the Prevention of Vessel-Induced Sea Pollution of new version basically improve the current laws and regulations on the prevention of vessel-induced sea pollution. In order to guarantee the feasible and effective implementation of Regulations in the new version of the People's Republic of China on the Prevention of Vessel-Induced Sea Pollution, we should speed up establishing relevant supporting regulations and standards including a. measures for the compulsory insurance administration of vessels, b. measures for the administration of the oil pollution fund of vessels, c. measures for the emergency management of marine pollution accidents, d. the standard of emergency equipment for vessel pollution prevention and treatment of vessels, ports, docks, unloading stations and relevant operating unit, e. measures for the prevention and control of pollution from relevant vessel operations and regulations for investigation and treatment of marine pollution accidents.

4.1.2 Formulating Pollution Legislation about Offshore Oil Platform and Offshore Equipment

The legislation about offshore drilling platform in China is in a state of unbalanced development. Therefore, it is very necessary to establish or perfect the oil pollution damage compensation system of offshore drilling platform.

4.1.2.1 The Offshore Drilling Platform Should Be Brought into the Scope of Ship to Apply the Related Legal System of the Ship.

Maritime Law of China stipulates in Article 3: “ship” as referred in this law means seagoing vessel and other mobile offshore facilities, except the ship used for military or governmental affairs and small boats whose weight is below 20 tons. This definition puts some “mobile drilling platform” of the offshore drilling platform into the scope of the ship, but other types of drilling platform are still not in the scope. China, unlike US, can not put the offshore drilling platform into the scope of ship through the judge’s interpretation of legislation purpose. However, it can be seen from the US legislation process and the development of international convention that putting the offshore drilling platform into the scope of ship is a kind of solution (Chen, 2002) .

4.1.2.2 Making Special Law for Offshore Drilling Platform

Making special law for offshore drilling platform has become an international trend. After the development of nearly a century, the uniqueness of the drilling platform has got more and more attention of people. The related safety production, leasing, insurance and oil pollution compensation and other operations are developing towards the direction of specialization. The International Maritime Organization is also devoted itself to making proper international convention for drilling platform. US also formed damage compensation system which is applicable for the oil pollution caused by offshore drilling platform.

Therefore, special law can be made for offshore drilling platform if it is not included in the scope of ship. The particularity between the drilling platform and ship should be highlighted to solve the condition that there is no law to deal with the oil pollution damage caused by offshore drilling platform (Zhang, 2011).

4.2 Suggestions on Institution Setting of Marine Pollution Emergency

According to the stipulations of the Marine Environmental Protection Law implemented now and the Management Regulation of Prevention and Control of Marine Pollution to the Marine Environment implemented from March 1st, 2010, the jurisdictions of the marine environmental pollution are respectively authorized to marine, fisheries and other departments. It can be seen from the problems exposed by the current practice that the division of labour is not only against emergency treatment of marine pollution in time, but can also cause multiple departments' jurisdiction overlap and cause conflict phenomenon (Weng,2007).

The emergency response work of marine oil pollution accident in China nearly relies on the Oil Spill Emergency Response Centre of coastal ports under Maritime Bureau of Ministry of Transportation. There are existing obstacles when the emergency response centre deals with the accidents, coordinates various government departments to jointly cope with the accident because it is only a subordinate body of each maritime bureau and there is a lack of specific regulations (Run & Chen & Li ,2009).

China can learn from the advantages of US model and then establish marine oil spill emergency response system with Chinese characteristic and suitable for actual

condition of China. Another suggestion is to establish marine oil spill emergency response centre as the permanent department of oil spill emergency response and adopt the approach of central vertical management. When the accidents happen, the emergency response centre of each ports should report step by step by the provincial, sea level oil spill emergency response centre (Xu, 2005).

4.3 Suggestions on Managing Emergency Resources

4.3.1 Unity of salvage and oil cleaning

Use the pollution prevention emergency equipment of oil spill emergency centre which is invested and established by national government and the emergency device library. Organize and establish professional team of emergency administration of pollution prevention and oil cleaning of salvage departments. In the oil spill emergency actions, marine sectors play a role of organizing and command, while salvage departments play a role of main force in specific cleaning actions and social professional cleaning companies as auxiliary force.

4.3.2 Separation of establishment and management and keeping and using

Marine sectors, as the competent department of the prevention and treatment of vessel pollution in our country, take charge of the unified planning, establishment and putting under centralized management by specialized departments of the pollution prevention equipment of national oil spill emergency centre which is invested and established by national government and the emergency device library of pollution prevention. Marine sectors also take charge of the maintenance, and the use of pollution prevention equipment by entrusting social professional cleaning

companies which meet the relevant requirements and conditions by signing contracts. In the oil spill emergency actions, marine sectors play a role of organizing and command as well as giving professional technical guidance, while social professional cleaning companies play a role of specific cleaning force (Ji & Li ,2013).

To summarize the above analysis, in consideration of the fact that it is a duty of national government to establish the emergency response system of vessel pollution, it is a necessity as well as a must to establish certain amount of national oil spill emergency centres which have the capability of emergency response and can cover a large sea area.

4.4 Suggestions on Coordination Mechanism of Each Department

Many developed countries have established specific regulatory institutions or coordination institutions. For example, the National Oceanographic and Atmospheric Administration is the major institution of marine affairs administration in the US. Its duty covers almost every aspect of marine affairs. On such basis, following suggestions on coordination mechanism of emergency response work of marine pollution accidents are put forward.

First, improve the authority of current laws and state regulations. For example, establish specific chapters of emergency response in the constitution, which keeps clear and definite responsibilities of the government in the way of the fundamental law of the state. Propose to the State Council to establish relevant administration regulations of emergency administration of marine pollution accidents and well defined coordination institutions of emergency response. Relevant ministries and

commissions under the State Council jointly develop regulations of coordination institutions, coordination scopes and responsibilities (Feng ,2010).

Second, improve the relevant regulations of emergency response plan. All emergency response plans which are made specific for sudden accidents of cross-department and cross-region must have well defined chapters to stipulate coordination institutions and responsibilities.

Third, local government departments should associate with enterprises to establish coordination group of emergency response reaction to take charge of the actual coordination work in marine pollution accidents (Song & Wang &Wang, 2010).

Fourth, establish the emergency response reaction joint conference of oil spill of sea area. Relevant departments of each province and city which can participate in the prevention and treatment of oil spill and cleaning work should send representatives to attend the conference. Representatives they send should be able to represent the rights of their departments or institutions.

The joint conference should be held at least once a year to solve the problems of the implementation of this plan by negotiation. When facing severe coordination problem or difficulty, submit to emergency centre, government departments and MSA for decisions.

The major role of the joint conference is listed as follows:

First, discuss and confirm the emergency response coordination and contact information of referred departments.

Second, discuss and confirm the staff training, technical exchange, and drill plans within the plan.

Third, summarize the operation, implementation and execution of the emergency response system and put forward the amendment advice.

Representatives reach a consensus on the joint conference and sign the relevant cooperation contracts. Confirm the leading position of emergency response action centre and each department participates actively and subordinates to the distribution of the centre. If the department does not subordinate to the centre, certain punitive measurement will be adopted. According to the purposes of the conference, each department should actively organize and establish cleaning force, personnel training and unified contact information.

4.5 Suggestions on Capital Sources of Emergency Responses

We can establish the compensation fund for vessel oil pollution damage by learning from the US. The fund should guarantee the capital of emergency response in priority, such as the cost for oil cleaning and emergency rescue (Yang,2006).

Keep to the principle of ship-owners and cargo owners together sharing the risk of the responsibility of oil pollution damage compensation which is stipulated in the 66th regulation of Marine Environment Protection Law. Learn from the Fund Convention of 1992 and the above mentioned America experience and combine with China's national conditions. We can adopt following measures of the resources of fund for compensation for oil pollution damage in our country.

First, the Ministry of Finance levies unified contribution of fund for compensation for vessel oil pollution damage. Such contribution can be levied in the name of fund or tax on cargo receivers of marine shipping oil and its products within the compass of competency of our country. The collection standard which is the contribution of fund for oil cargoes per ton should stipulate a reasonable total amount on the basis of statistics of vessel oil pollution damage within the sea areas and water area of ports under national jurisdiction and confirm a reasonable rate of taxation according to the total amount of oil cargoes which need contribution.

Second, the fund gets the recoveries according to the subrogation.

After the fund compensates for the oil pollution damage, claim compensation from the responsible for oil pollution damage according to the subrogation. Therefore, the contribution gained should be one of the resources of the fund capital.

Third, get the interest revenue of fund capital.

Fourth, collect the administrative penalty for discharge of vessels in violation of regulations or oil cargoes leakage or fuel oil.

When there is discharge of vessels in violation of regulations or oil cargoes leakage or fuel oil, MSA imposes penalties to the responsible according to law and the responsible pay the penalties. It can be one of the resources of the fund capital.

In addition, at the beginning of the establishment of the fund for compensation for oil pollution damage, we can learn from the practice of borrowing from federal finance

when the Oil Spill Liability Trust Fund was first established in the US. The national finance put in necessary capital in advance to speed up the progress of establishing the fund. As the amount of the fund accumulates to certain level, the capital can be repaid from the fund.

Chapter V- Summary and Conclusions

Recent years, marine pollution accidents at sea happen frequently in our country. Some typical examples include the April 17th chemicals leakage accident in 2001, the June 16th accident in 2010 in Dalian, and the oil spill accident of China National Offshore Oil Corporation which happened over the Bohai Gulf in 2011. These accidents led to severe marine environment pollution and caused huge pecuniary loss. These accidents posed threats to people's lives and property as well. With the rapid development of marine petro-chemistry industry and shipping industry, the number and the tonnage of vessels have become larger and larger. With the increasing times of vessels arriving at and leaving ports, the rate of marine accidents increases. Meanwhile, the risk of marine pollution accidents keeps increasing. It can be seen that we are facing a very grim situation of the emergency response work of marine pollution accidents.

Based the on above background, the laws and regulations and emergency response systems related to the emergency response work of marine pollution accidents in western developed countries and our country are compared in this paper. On the basis of using the experience of emergency response work mechanisms of marine pollution accidents in developed countries which are proven by practice to be fairly complete and efficient, specific suggestions on the establishment of emergency response work mechanism of marine pollution accidents in our country are put forward.

The main contents of the analysis of current situation are as follows:

(1) The paper introduces the background and significance of this study.

(2) The paper summarizes the current situation of the laws and regulations at home and abroad and analyzes the prevention and treatment of marine pollution and the compensation for oil pollution damage comparatively.

(3) The paper summarizes the emergence response systems of marine pollution in the US, Japan, UK, France, German, Sweden and Australia. Then the paper gives a detailed comparison of the emergency response system of marine pollution in our country and the one in the US from five aspects including legal support, institution setting, emergency resources, coordination mechanism and compensation mechanism.

The main contents of suggestions on the establishment of emergency response system are as follows:

(1) Improve the legislation of preventing marine pollution which consists of two aspects including the legislation of marine pollution from vessels and establishing the legislation of marine oil platforms and offshore equipment pollution.

(2) Establish the permanent institution of the emergency reaction of marine oil spill which takes national emergency reaction centre of marine vessel pollution as the governing body. The permanent institution should consist of specific people in charge sent from departments which are related to the sea including fishery department, and army environmental protection department. In peacetime, they are in charge of the maintenance and improvement of the prevention and treatment system of oil spill from vessels. When oil spill accidents happen, they can establish the command committee of emergency handling according to specific circumstance. Based on the actual situation, the people in charge of the permanent institution

command, lead and coordinate different departments to deal with the oil spill accidents.

(3) Establish the emergency device library for pollution prevention. The professional teams of emergency management and oil cleaning organized and established by salvage department can establish, manage, and maintain the team and equipment of pollution prevention and emergency response.

(4) Put forward the following suggestions on the coordination of emergency response work of marine pollution accidents.

First, improve the authority of current laws and regulations.

Second, improve the relevant regulations of emergency response plan.

Third, local government departments associate with enterprises to establish coordination group of emergency response reaction to take charge of the actual coordination work in marine pollution accidents.

Fourth, establish the emergency response reaction joint conference of oil spill of sea area.

(5) Put forward specific suggestions on capital resources of emergency response.

We can establish the compensation fund for vessel oil pollution damage by learning from the US. The fund should guarantee the capital of emergency response in priority, such as the cost for oil cleaning and emergency rescue.

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