Sea Prince Incident and Changes of Response Scheme after the Incident

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1. Introduction

The Sea Prince Oil Spill Incident which was occurred in South Coast of Republic of Korea in July 1995 was one of the biggest oil pollution incidents that Republic of Korea has ever been experienced, so far. Due to the incident, both Korean Government and it's people came to recognize the seriousness that oil pollution impacted to marine environment. Thus, Republic of Korea has been proceeded establishment of response system such as improvement of national response regimes, enhancement of national oil recovery capability, etc in order to prepare to similar a large oil pollution incidents. Since it is difficult for an individual State to respond effectively to mass oil pollution incident, Republic of Korea also recognized necessity of international cooperation establishment and acceded to the OPRC Convention on November 1999 and has been actively participating in the North-west Pacific Action Plan(NOWPAP) Projects launched on September 1994 by Member States composed of Republic of Korea, Japan, People's Republic of China and Russian Federation, in order to positively cooperate to establishment of such cooperation system.

2. Sea Prince Incident

2.1 Outline of Incident

Crude oil carrier, Sea Prince which arrived at off-shore jetty of Kwang-Yang Port in South Coast of Republic of Korea on 22 July 1995, was discharging 260,000 tons of crude oil loaded at Nastanu Port of Soudi-Arabia on 28 June 1995.

After receiving a Typhoon Warning Message during discharge work of cargo oil, the ship began to shift herself to safety bay in order to avoid the Typhoon without delay at 6 P.M on 22 July 1995. On the way of shifting, the ship firstly collided with a small rock island near Sori Island due to harsh weather and consequently fire occurred in it's engine room, causing to stop main engine. Thus, the exultant Typhoon dragged the weak ship in it's own way and lastly had the ship grounding on submerged-rock of Sori Island twenty-seven miles away from

Gwang-yang Port at 4 P.M on 23 July 1995. After all, this incident resulted in oil spill of 5,035 tons including fuel oil.

Weather condition at that time was under A Class Typhoon Warning with wind speed of 40 m/sec and wave height of 8-10 meters.

Table. 1 Particulars of the Incident Ship

Ship`s Name	Size	Crew	Nationality	Oil on Board (kl)
Sea Prince (Oil Tanker)	144,567 Ton(G/T) Length 313m Wide 56m	20 Persons	Cyprus	Total : 88,481 kl Crude Oil : 86,886kl Bunker C : 1,495kl Bunker A : 100kl

2.2 Response Actions taken

2.2.1 The Polluted Extent

Spilt oil from the ship was spread to the extent of 127 miles along coasts of Geo-je, Pusan, Ulsan and Po-hang from 15 miles off Sori Island. The thin oil was discovered even at sea of 20 miles away from West Coast of Tsushima Island of Japan. It pollutted 73 km of shorelines along many islands in South Coast of Republic of Korea, shorelines in Jeon-Nam Province(47km), and those in Pusan and Gyung-Nam Province(26km). In pariticular, it was very serious in the area of Sori Island, and large amount of tar balls were stranded to the beaches of Pusan and Ulsan.

2.2.2 Initial Actions

The Typhoon, Fay, was A Class Typhoon which had 940 hpa in air pressure of center, 890 km in diameter, 40 m/sec in wind velocity and 8-10 meters in wave height. The laid ship on submerged rock was fired in her engine room, and there were high possibilities that fire of engine room might be transferred to cargo tank and might be resulted hull explosion since the

fire was being magnified.

Under the Typhoon Warning Condition, a salvage & patrol ship in Pusan Maritime Police Station, which is 3,000 tons(G/T) class, arrived on the site in spite of high wave at 4 P.M on 24 July, and carried out fire-fighting for four hours and twenty minutes and the fire was successfully suppressed after all. Thanks to such a successful fire-fighting, it was possible not only to prevent firing to cargo tanks and to transfer most of cargo oil to barges, but also to prevent huge oil spill of cargo 88,000 tons.

With the turn of smoth weather in evening of that day, Korea National Maritime Police Agency(KNMPA) deployed oil boom 864 meters around the ship mobilizing oil recovery ships, but considerable quantity of oil already had escaped to open sea. Due to heigh wave, actual oil recovery works at sea could be started on 25 July.

2.2.3 Oil Recovery Works at Sea

Oil recovery works at sea were started on a large scale on 25 July 1995, however, there were many difficulties for oil spill response to need lots of personnel and equipment since the spilt oil had already spread to wide sea area. So KNMPA had to mobilize ships, equipment and materials for oil recovery in national wide, which were owned by KNMPA, relevant authorities and private companies. Maximum 500 Ships including fishing boats a day were mobilized to deal with oil spill.

A quantity of oil (1,390?) was recovered by large size skimmers such as trawl skimmer and screw skimmer, however, clean-up operations by absorbent and dispersant were mainly carried out since most of spilt oil was spread to wide sea and most of the ships, KNMPA's patrol ships and fishing boats, were not oil recovery ships. On the other hand, aerial dispersant spray to open sea was carried out by Helicopters and a C-130 Hercules assisted from EARL of Singapore, but over-spray of dispersant in this method became hot issue in Press and Political Circle later. Clean-up operations at sea were carried out for nineteen days from 25 July to 11 August 1995.

2.2.4 Clean-up Operation at Shoreline

Spilt oil at sea was widely stranded to shorelines of 38 coastal villages of Jeon-Nam Province and 13 coastal villages of Pusan and Gyung-Nam Province. Methods of oil recovery

by screw skimmers and portable high pressure pumps were firstly used in order to recover the stranded thick oil in the shorelines of Sori Island, and oil mixtures and the weathered oil were recovered by mechanical methods using boats for sweep and vehicles for wastes recovery and hand methods using shovels and gourdes mobilizing residents, Police Strike Units and Militaries. For the adhered oil to rocks and stones, it was cleaned up using absorbents and dusters. For the sand and graves sucked oil, it was used a cleaning method that was washed by dispersant after excavators recover the polluted sand and graves. Like this, oil recovery works by mechanical methods were carried out mainly around Sori Island which was most seriously polluted, however, the works in the other areas were managed manually by residents. Thus many personnel and much time for clean-up operation were needed.

Especially, since it was Summer Season, the spilt oil penetrated more deeply to graves and the soil and that became to a cause arsing many difficulties for clean-up operations.

Clean-up operations at shoreline were carried out for five months from 25 July to 31 December 1995.

Table 2. Status of the mobilized personnel and equipment for clean-up operations
(From 24 July 1995 to 31 December 1995)

Sources	Personnel	Ship	Aircraft	Skimmer	Oil Boom (m)	Absorbent (kg)	Dispersant (kl)
Total	**166,905**	**8,295**	**45**	**126**	**13,766**	**239,678**	**717**
KNMPA	15,525	826	21	120	864	65,514	302
Relevant Authorities	21,340	574	22	2	670	35,815	51
Civil	130,040	6,895	2	4	12,322	138,349	363

The recovered Quantity

- Waste oil : 1,396 kl
- Wastes : 3,364 tons

Cost of Clean-up and Damaged (exchange rate at present)

- Cost of clean-up : fifteen million dollars
- Damages (cost required by fishermen) : sixty million dollars

2.3 The Response Capability and Problems at that time

2.3.1 Weakness in National Response Capability(NRC)

The National Response Capability(NRC) at that time of Sea Prince Incident was very frail. KNMPA had merely ten oil recovery boats less than 140 tons class(G/T), thirty four oil skimmers, seven kilometers oil boom and other materials such as dispersant and absorbent needed only for initial action. It was more frail in private level than KNMPA, which oil refinery companies owned merely two small oil recovery boats and Contractors for oil clean-up owned small quantity of dispersant and absorbent, thus, NRC was merely 1,200 tons.

2.3.2 Poor Clean-up Efficiency due to the Ununified Command System

At that time, responsibilities of authorities to oil spill response were divided into the Sea Transportation Agency, Provinces, Cities and KNMPA according to scales of the spilt quantity and sea areas of jurisdiction. So, in spite of mobilization of maximum 500 ships a day, clean-up efficiency was very low since there was not a unified command system.

2.3.3 Social Problems like Post-Pollution, etc due to Poor Specialization of Clean-up Operation

Although oil recovery works in a mechanical method using trawl skimmers and screw skimmers were done around Sori Island that was seriously polluted, most of total 8,295 fishing boats mobilized during clean-up period had to carry out clean-up operations by using only dispersant and absorbent since there were not alternative ways. After all, such clean-up operations caused some problems such as over-spray from scanty of specialization and

recognition in dispersant application, and post-pollution from the missing of thrown absorbents.

2.4 Lesson of the Sea Prince Incident

2.4.1 Recognition of Seriousness of Damages by Oil Pollution

After Sea Prince Incident occurred, each Newspapers and Broadcastings reported as cover story everyday showing the scenes that dark oil was being spread. They explained some examples of foreign countries and pointed out the seriousness of it's damages. All the people and Government officials who saw such scenes came to recognized seriousness of the damages by oil pollution.

2.4.2 Recognition of Weakness of National Response Regime and System

Before the Incident, it was true that order of budget formation for purchase of response equipment was inferior and there were not efforts for improvement of response regimes. Many problems were found through the Incident and Government was blamed from the Presses, environment experts, politicians, etc. Thus, it was a turning point for the Government to seek countermeasures of oil spill response.

2.4.3 Warning to the Possibility of Oil Spill Incident more than 10,000 tons in Republic of Korea

At the incident time, oil of 5,035 tons was spilt from the ship, however, 88,481 tons of oil were still remained in the hull. As below figure 1, middle part of the hull was damaged by submerged rock. Also the hull was continuously hit by harsh wind and wave, being fired in engine room. So there were high risks that the hull might be divided in two parts and all cargo oil might be spilt out by hull explosion on the way for fires to develope, however fortunately the fire was suppressed just before such large oil spill. Thus, it was possible to transfer cargo oil into storage barges after fixing the hull. We were able to avoid the worst situation.

It was a warning that huge oil spill more than 10,000 tons or 100,000 tons could happen in Republic of Korea as those of foreign countries.

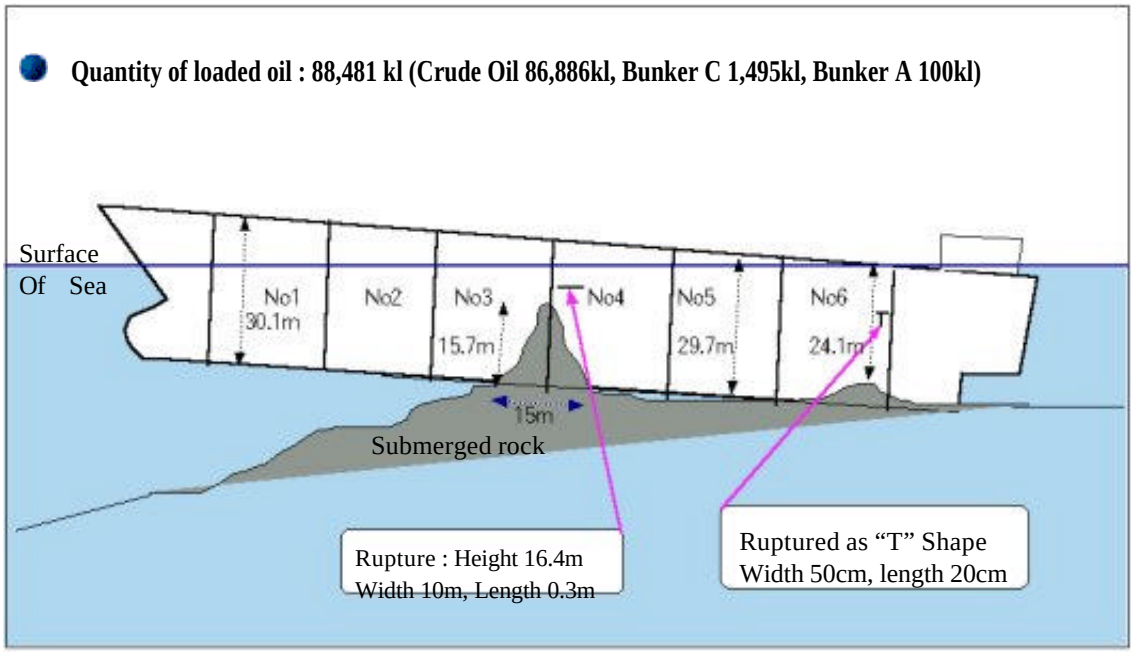

Fig. 1 Drawing of ruptured situation of Sea Prince by grounding

3. Improvement of National Response Policy since Sea Prince Incident

3.1 Improvement of Response System as Model of the Advanced Countries

3.1.1 Establishment of Response Command System giving Response Control to KNMPA

The Government of Republic of Korea unified the related works in cotrol of several authorities with oil spill response into KNMPA and set it's legal basis on establishment of the Response Countermeasure Head-Quarter(RCHQ) which the Commissioner of KNMPA become Chairman of that, so that he can overall take control of personnel and equipment at response scene.

3.1.2 Establishment of National Contingency Plan according to Standard of the OPRC Convention

According to necessity of a synthetic plan establishment for preparedness and response to disaster by mass oil pollution in national-wide since Sea Prince Incident and requirement of establishment of National Contingency Plan in ratifying the OPRC Convention, Republic of Korea began to establish the Plan in 1998 and the prepared Plan by two years was deliberated and settled at the Cabinet Meeting on 11 January 2000.

This Plan was established basing the OPRC Convention and accepting domestic Laws such as the Law on Marine Pollution Prevention, the Law on National Disaster Control, etc. Also this Plan systematically defines all the items on response of oil pollution incident such as organization and command system of national response, establishment of the Regional Contingency Plan, mapping of Environment Sensitive Index(ESI) Map, arrangement and maintenance of response equipment, choice of response method and the Scientific Support Unit(SSU) for pollution response advice, investigation of damages and restoration, duty of each authoritiy, protection of fishing areas and relief of wildlife, etc.

3.1.3 Establishment of Regional Contingency Plan fitted to Characteristics of each Sea Area

In accordance with establishment of National Contingency Plan, also the Project for establishment of Regional Contingency Plan was began in 1999 in order to regionally prepare and respond to marine pollution, which defines reponse organization and procedures, preparations, etc including ESI map.

Especially, ESI maps is being made as a method that relevant information, fishing and aquaculture area, type of shorelines, resources of tour, location of important facilities, etc, are marked on the digitalized sea chart, considering International Guideline and regional situations. So the completed ESI maps will be effectively used for decision of shoreline protection priority and effective response method in case of large pollution incident.

KNMPA has been proceeding the Project for establishment of Regional Contingency Plan since 1999, which was divided whole Korean waters into twelve parts and entrusted

with Research Institute. In 2000, the Plans to Inchon and Yeosu area that are frail in oil pollution were firstly completed. At present, the Plans to Pusan, Ulsan and Tong-young areas are being made and the Plans to all the waters will be completed by 2002.

3.1.4 Establishment of Support System by Response Experts

The Scientific Support Unit(SSU) for advice of response technique and research of scientific response method was established in 1997 according to the revised Law on Marin Pollution Prevention. The members of SSU is nominated by the Commissioner of KNMPA, and SSU is composed of twenty-eight experts in six devided field from nine Research Institutes at present.

3.2 Reinforcement of National Response Capability

3.2.1 Reinforcement of KNMPA's Response Equipment

Since Sea Prince Incident, Republic of Korea has been reinforcing National Response Capability(NRC) targeting 20,000 tons of oil recovery capability, allocating 10,000tons for Government(KNMPA), 5,000tons for KMPRC and 5,000tons for private companies. KNMPA had planned a Five Years Plan for reinforcement of response equipment and has been proceeding the Plan. Consequently, response capability was remarkably reinforced than previous.

Followings are additionally increased;

- Eight oil recovery ships(five ships of 300 gross ton class, three ships of 500 gross ton class)
- Thirty-two oil skimmers
- Three oil storage barges
- Eleven kilometers oil boom
- Forty officials of response field in KNMPA.

Table. 3 Status of KNMPA's Response Capability since Sea Prince Incident

	At the Incident Time	February 2001	Tarket by 2004
Oil Recovery Ship	10	18	23
Oil Skimmers	34	71	84
Oil Boom(km)	7	19	30 km
Oil Storage Barge	-	3	6 (500G/T Class)
Capability of Recovery (kl)	1,200	5,100	10,000
Response Personnel (official)	140	180	220

Note : NRC was calculated with following considerations such as efficiency, mobilization efficiency and operating capability of response personnel after calculating mechanical recovery capability of oil recovery ships and oil skimmers.

NRC(kl) = Recovery Capacity(kl/h) x Working Hours(3days x 8 hours/day)
x Mechanical Efficiency(0.2) x Mobilization Efficiency(0.33)
x Operating Efficiency(0.65)

Also it was targeted as 20,000 tons, which was calculated as one third of 60,000tons of maximum spill in case of pollution incident of 200,000tons
(Contingency Planning Guide of IPIECA).

3.2.2 Reinforcement of Response Capability in Civil Level

In order to reinforce response capability in Civil Level, Republic of Korea established Marine Pollution Response Corporation (KMPRC) on 13 November 1997, putting legal basis in the Law on Marine Pollution Prevention. At present, KMPRC is composed of four

departments and ten branches with 398 staffs, and Members of that are composed of ninety-seven companies as follows

- Five oil refinery companies
- Seven oil storage facility companies
- Sixty-seven oil shipping companies
- Seventeen non-tanker shipping companies

KMPRC's activities are as follows.

- Oil spill response operation and collecting oily waste from vessel and oil storage facialities
- Stockpiling and rental service response equipment and materials.
- Maintaining and stationing oil recovery vessels
- Implementing projects entrusted by the central or local Government
- Operating port cleaning vessel and waste oil storage facilities
- Research and development oil spill response technology, etc.

Also response capability of the clean-up Contractors has considerably raised for recent few years according to registration of twenty-three Contractors by registration regime for clean-up business.

Table.4 Status of National Response Capability (February 2001)

	Oil Recovery Boat	Oil Skimmer	Oil Boom (km)	Response Capability(ton)
Total	105	191	228	12,300
KNMPA	18	71	19	5,100
KMPRC	49	75	29	4,600
Others	36	42	180	2,600

3.3 Strengthening of Training and Exercise

Since Sea Prince Incident, KNMPA and relevant Research Institutes, in order to raise capability of response adaptation, have been providing response personnel with various training programs such as operational level courses for scene responders, administrative level courses for on-scene commanders and managers, oversea training courses, etc.

Also KNMPA has been raising adaptation capabilities to the National Contingency Plan and the Regional Contingency Plans through the joint exercises conducted by Civil and Authorities, and has been continuously improving problems coming from such exercises.

3.4 Promotion of Response Technology Development

Concerns to technology development in the response field has been magnified since Sea Prince Incident, and it has been actively proceeding many researches and developments such as the Response Supporting System(RSS) of oil spill incident, the Oil Spill Prediction Model to oil spill incident in Research Institutes, many kinds of absorbent and dispersant in private companies, etc.

RSS has beens developing by the Korea Ocean Research and Development Institute (KORDI) in cooperation with KNMPA and Pu-kyung University. The Oil Spill Prediction Models, which were developed by KNMPA, KORDI and Pu-kyung University respectively, are being used for response operation predicting oil spread in case of pollution incident.

On other hand, various equipment and materials, which are oil skimmer, oil boom, absorbent and dispersant, have been developing and commercializing.

Table.5 Status of Development of Response Equipment, Materials and Dispersant

	Total	Ship	Skimmer	Boom	Absorbent	Dispersant	Gel
Companies	67	1	3	12	39	9	3
Kinds	106	1	6	23	61	13	3

3.5 Establishment of International Response Cooperation System

3.5.1 Accession to OPRC Convention

Republic of Korea improved response regimes and established National Contingency Plan under the procedures required to join to OPRC Convention, and acceded to the Convention on 9 November 1999. The Convention in Republic of Korea entered into force on 9 February 2000.

3.5.2. Active Participation in NOWPAP Projects

According to the recommendation of United Nations Environment Programme (UNEP), Northwest Pacific Action Plan(NOWPAP) for protection, management and development of the marine and coastal environment of Northwest Pacific Region, which was agreed by five Member States, was launched by holding the First Intergovernmental Meeting on September 1994, in Seoul, Republic of Korea.

In order to effectively proceed this Plan, the priority projects of six areas were designated and inter-alia the NOWPAP/4 Project for development of effective measures for regional cooperation in marine pollution preparedness and response is being most actively proceeded and the Forum Meeting for proceeding of NOWPAP/4 Project is held by Member States in turn and the First, Second and Third Forum Meetings were held in Toyama, Japan, on July 1997, in Taejon, Republic of Korea on May 1998 and in Yuzno-Sakhalinsk, Russian Federation on July 1999, respectively.

Initial Tasks in the field of marine pollution preparedness and response as Forum Projects were almost accomplished and two important Projects, the NOWPAP Contingency Plan that defines joint response procedures by Member States and Memorandum of Understanding(MOU) that defines basic principles of response cooperation in case of mass oil pollution incident, are being proceeded and actively discussed among Member States. With regard to legal status of the MOU, although there are different views more or less, Member States are making efforts to establish a substantial cooperation system.

On other hand, the Marine Environmental Emergency Preparedness and Response

Regional Activity Center(MER/RAC), which was established in Taejon, Republic of Korea on 22 March 2000, has been doing it's activity works and four staffs of that are making efforts to establish a response cooperation system in this Region.

3.5.3 Proceeding of Response Agreement Conclusion between Republic of Korea and China

Necessity of response cooperation system to marine pollution incidents between Republic of Korea and China has been raised according to that sea traffic has been increased in accordance with industrialization in China and tendency of development of West-Coastal Zones in Republic of Korea and consequently danger of sea casualties have been increased more and more.

Republic of Korea and China agreed with each other to conclude the Agreement on Oil Pollution Preparedness, Response and Cooperation in Yellow Sea in accordance with the agreement that was done at a Summit Conference between two States when President, Kim Dae-Jung, visited in China in November 1998.

In order to conclude the Agreement, two States have been contacting each other since1999. Being prepared and discussed Draft Text of the Agreement at present, it is expected that the Agreement will be soon concluded.

3.5.4 Regular Joint Exercise between Republic of Korea and Japan.

KNMPA and Japan Coast Guard agreed to hold the Joint Exercise for rescue and oil spill response every year in turn every year according to the Arrangement that two Agencies agreed to jointly cooperate to sea crimes and casualties in April 1999. On the basis of this Arrangement, the First Joint Exercise, which was consisted of contents such as oil pollution response, fire suppression, rescue and salvage under the assumption of sea casualty, was held in Pusan Port of Republic of Korea in October 1999, and the Second Exercise was successively held in Moji Port of Japan in September 2000. This Exercise has a very important meaning as a commencement of substantial cooperation among neighboring States and as a arrangement of basis of cooperation promotion within the framework of OPRC Convention and NOWPAP.

4. Conclusion

Sea Prince Incident caused much damages and gave us pains, however it was a turning point that gave us an epochal opportunity to improvement of response system in Republic of Korea. All the people in Republic of Korea recognized the seriousness of oil pollution damages and the weakness of National Response Capability through this Incident. It also let us know that Republic of Korea has possibility of huge oil pollution more than Sea Prince Incident. As a result, we came to have a chance to check and analyse problems from response works. It was true that everything, which were organization of response, command system, response capability, response technology, international cooperation system, etc, were not arranged before the Incident.

We have established response systems on a level with the Advanced Countries through improvement of laws and regimes, reconstruction of response organization and command system, reinforcement of equipment and personnel, accession to International Convention, establishment of National Contingency Plan and Regional Contingency Plan. We are now improving capability of response implementation, focusing on the scheme of how the arranged equipment can be appropriately used and how NCP and RCP can be effectively applied for an actual situation.

In the near future, risks of marine oil pollution incident would be increased with the increase of sea traffic in coastal water of Korean Peninsula. Therefore it is very important that international cooperative system among neighboring States like Japan, China and Russia is firmly established, as well as improvement of response capability in Republic of Korea.