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Rapid Environmental Assessment 'Hebei Spirit' Oil Spill – Republic of Korea December 2007

A Joint United Nations - European Commission Environmental Emergency Response Mission

EUROPEAN COMMUNITY
CIVIL PROTECTION MECHANISM

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Executive Summary

A collision between a barge and an oil tanker cause the release of an estimated 12,547 tons of light crude oil into the Yellow Sea off the west coast of the Republic of Korea (ROK) on December 7, 2007. More than 150 km of coastline were affected. Despite difficult weather conditions and heavy seas, authorities of the ROK, lead by the Ministry of Maritime Affairs and Fisheries (MOMAF) and the Korean Coast Guard (KCG), acted swiftly in responding to the emergency. The coast hosts a number of fish farms and an active wild fishery industry, and is home to habitats for a variety of migratory birds. The region is also a popular tourist destination because of its beaches.

The Government of the ROK accepted a joint offer of assistance of the United Nations Joint UNEP/OCHA Environment Unit and the European Commission Monitoring and Information Centre. The UN/EC Assessment Team was deployed to ROK from December 15 to December 22, 2007. The team's primary mission was to assess needs for international assistance to aid with clean up operations, including what equipment, if any, would still be needed. The ROK authorities also solicited advice from the team on measures employed by various national response agencies. Finally, the team was asked to provide guidance on medium and long-term environmental impacts related to the spill. It visited a many locations, by land and sea, and also surveyed the area by helicopter. Team members received extensive briefings from relevant national agencies.

The UN/EC Assessment Team determined that no international assistance was required to aid clean up operations already underway. The majority of beaches were cleaned, a result of strong coordination, considerable effort of personnel from the KCG, MOMAF, Korean Maritime Police, the Navy, the Army, and significant participation of volunteers from the private sector and the general public. Due to the deployment of oil booms very quickly after the spill, many sensitive areas were protected. Natural surf, in the form of tides and wave action, has cleansed some beaches and shoreline and will continue to do so.

Actions taken by authorities of the ROK are consistent with international methods and standards. Dispersants are an accepted method of responding to an oil spill and an effective way of disrupting the oil mat. The use of dispersants was in line with usage in other jurisdictions, and followed appropriate procedures as defined in the National Contingency Plan and ROK law.

Given the speed of the clean up and the quick actions of authorities, the prospect for the rehabilitation of the affected area is good. There remains the chance, as with any oil spill, for re-pollution as oil may be trapped in crevasses that could not be reached by those dedicated to the clean up and therefore could be re-floated and land on beaches. Tar in the form of balls is a residual effect of oil spills and dispersants and can be expected in some areas of ROK. Efforts should be made to collect the tar, if possible.

It is important to monitor for medium and long-term environmental impacts. The team was advised that authorities of the ROK had begun developing an assessment methodology for biological and environmental impacts. It will be vital for efforts in this regard be coordinated across the government. Collaboration is essential.

The UN/EC Assessment Team made a number of practical recommendations, which can be found at the end of this report. Follow up activities began almost immediately after the conclusion of the UN-EC Assessment Mission: The Government of Canada sent a six person team the ROK on December 27, 2007, to provide Shoreline Clean up Assessment Technique training in response to a request for bilateral assistance from the ROK. United Nations Environment Programme (UNEP) and the European Commission External Relations Directorate-General began preparing to collaborate on a "Post Disaster Needs Assessment" scheduled to take place in early 2008.

The **Joint UNEP/OCHA Environment Unit**, integrated into the Emergency Services Branch of the Office for the Coordination of Humanitarian Affairs, is the United Nations mechanism to mobilize and coordinate the international response to environmental emergencies. It also assists countries with response preparedness activities.

The **Monitoring and Information Centre** of the European Commission facilitates the mobilization and coordination of EU civil protection assistance in response to major disasters. It is the operational centre of the Community Civil Protection Mechanism, through which resources from EU Member States may be mobilized to provide immediate assistance in responding to major emergencies. The Mechanism has developed experience in marine pollution response within the EU and in international marine pollution control operations.

Introduction

1.1 CONTEXT

On December 7, 2007, a barge carrying a crane hit the oil tanker *MT Hebei Spirit* off the west coast of the Republic of Korea (ROK), at 0700 local time when the line between the barge and the tug towing it broke. The jib of the crane punctured tanks 1, 3, and 5 on the port side of the tanker causing the spill of an estimated 12,547 tons of Iranian light crude oil.

The *Hebei Spirit* is a single-hull tanker registered in Hong Kong with a dead weight of 269,000 tons and was carrying 150,000 tons of oil. It was at anchor in the Yellow Sea approximately 10 km off the coast Taean County in the province of Chungnam.

Oil began coming on shore late in the night on December 7. More than 150 km of coastline had been identified as being impacted by December 17. Much of the affected area is part of the Taean-gun National Park. The nearest city is Taean. The town of Mallipo, located in the middle of the affected area, is a popular destination for tourists who travel to the well-known beaches in the summer. Along with tourism, aquaculture is a vital industry for the region and the ROK. The area also contains significant habitats for migratory birds.

Weather conditions were poor on December 7, which influenced the response activities. Gale-force winds produced heavy seas with waves of about four meters. The wind that day and for most days after the spill was predominately northwest, which caused the spreading oil to move in a southerly direction.

1.2 RESPONSE ACTIVITIES

1.2.1 National response

ROK authorities rapidly undertook a number of actions in response to the oil spill. On December 7, the ship was healed six degrees to starboard. Oil booms were deployed to protect the sensitive areas of Garolim Bay, Chunsoo Bay and the Taean Power Plant located to the north and south of the tanker's position. The sea conditions obstructed the use of mechanical clean up equipment and dispersants were used instead. On December 8, the flow of oil from the tanker was stopped when the holes were patched. The remaining oil was subsequently removed from the tanker to another vessel. At sea, recovery operations using mechanical methods began only after weather permitted on December 8, and continued for several days. The use of dispersants was continued.
A prediction model developed by the Korean Ocean Research & Development Institute (KORDI), showed that 24 hours after the oil was released approximately 30 percent of the oil had dispersed, either naturally or due to the application of dispersants. The predicted figures also indicated that by 48 hours after the accident roughly 20 percent of the spilled oil would be onshore and only 20 percent would still floating at sea, and that oil remaining at sea would degrade with time. The model also suggested that an estimated 60 percent of the oil had evaporated. These predictions are consistent with actual experiences based on previous oil spills in various countries.

Response operations included national, provincial and local authorities and personnel, the private sector and members of the general public. The Korean Coast Guard (KCG) and Ministry of Maritime Affairs and Fisheries (MOMAF) shared overall command responsibilities, with MOMAF coordinating national and international responses, and KCG controlling operation aspects of the clean up. The affected beaches and shoreline were divided into sectors and command of each sector was given to specific agencies or companies.

Volunteers from the private sector and the general public deserve special mention for their participation in clean up operations. The entire workforce ensured that the clean up progressed at a rate faster than many other oil spills throughout the world.

1.2.2 United Nations-European Commission Cooperation

The United Nations Joint UNEP/OCHA Environment Unit (Joint Environment Unit) and the European Commission Monitoring and Information Centre (MIC) began monitoring the accident through media reports on December 7. On December 10, the organizations made a joint offer of assistance, communicated to the Ministry of Maritime Affairs and Fisheries by the United Nations Development Programme (UNDP) Resident Representative and the European Commission Delegation to the Republic of Korea. ROK authorities accepted the offer of an assessment team on December 13.

The UN/EC Assessment Team was composed of experts in oil spill pollution response and environmental assessment. Six of the 10 members arrived within 48 hours of the request for assistance from the ROK. The remaining four arrived within 72 hours. (For a list of team members, please see Annex I)

During the eight-day mission, the UN/EC Assessment Team received extensive briefings from KCG, MOMAF, KORDI, and the Korean Marine Pollution Response Corporation (KMPRC). It made several site visits and survey inspections via boat and helicopter. Team members also met with officials from the Ministry of Environment. (For a detailed itinerary, see Annex II)

Staff at the Joint Environment Unit in Geneva coordinated their activities with other relevant international organizations, such as the International Maritime Organization, the Secretariat of the RAMSAR Convention on Wetlands and UNEP, as well as with various countries and national focal points. Both the Joint Environment Unit and the MIC in Brussels ensured that information about the mission's progress was disseminated to a wide audience. MIC Messages and OCHA Situation Reports were based on daily updates sent by the team to headquarters. Information was also shared using the Virtual On-site Operations Coordinating Centre (V-OSOCC), managed by OCHA.

1.2.3 Other international assistance

The United States of America offered bilateral assistance in the form of an assessment team, made up of experts from the United States Coast Guard (USGC) and the National Oceanographic and Atmospheric Agency (NOAA). Japan provided a six-member team of Japanese Coast Guard staff and Disaster Relief Team members, as well as sorbents. The People's Republic of China also supplied sorbents. The Northwest Pacific Action Plan (NOWPAP) Regional Oil Spill Contingency Plan was activated and coordinated through the Marine Environmental Emergency Preparedness and Response Regional Activity Centre (MERRAC), both of which are programmes supported by the United Nations Environment Programme (UNEP) and the International Maritime Organization (IMO). Two experts from the University of Barcelona were also invited by Chungnam Province of the ROK to provide advice.

1.3 OIL SPILLS

Each oil spill is unique in many respects, and the precise extent of the damage to the environment can only be determined by a methodical scientific investigation covering major components of the ecosystem. It should be pointed out that several major investigations of oil spills have been carried out around the world covering spills in different environments, from tropical to arctic, and involving crude oils as well as refined products. Reviews and summaries of this knowledge have been presented by several well-recognized bodies, including the Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), US Academy of Science, and others. Based on this relatively large amount of scientific data, some general conclusions regarding the likely environmental consequences of the present spill can be made.

1.3.1 Weathering of an oil spill at sea

Oil consists of a complex mixture of hydrocarbons, most of which are degradable by micro-organisms in the environment. Crude oil spilled at sea will undergo a series of chemical, physical and biological processes called weathering. These processes change the characteristics of the oil and have direct and very important influence on the effects of the oil on the ecosystem and on different species of fauna and flora. Weathering processes can be categorized as evaporation, emulsification, natural dispersion, dissolution, photo-oxidation, sedimentation, adhesion, and the formation of tar balls. These processes are listed in order of importance in terms of their effects on the percentage of total mass balance i.e. the greatest loss from the slick in terms of percentage, and what is known about the processes.

1.3.2 The effect of weathering on the potential environmental impacts

Spilled crude oil causes immediate environmental effects due to its chemical composition. Due to weathering, however, these effects are short-term, lasting about 24 to 48 hours. After that period, mainly due to evaporation to the atmosphere and other weathering factors, the chemical toxicity of the oil decrease significantly. Toxic effects may therefore occur close to the site of the spill and only close to the surface, affecting mainly plankton and fish larvae, if such larvae are present. The dilution capacity of the water will reduce these effects rapidly with depth. It should be pointed out that the oil at this stage has a low toxicity and the oily residues, often called tar, that wash up on land several days after an oil spill is mainly a physical and aesthetical problem. It will cause biological effects but these are mainly due to the physical presence of the oil (smothering effects), and rather than its chemical composition.

1.3.3 Response at sea

A skilful response to an oil spill at sea is of the utmost importance since the collection and/or dispersing of oil at sea minimizes the pollution of the shoreline and beaches and reduces the impact on marine-based industries, such as fisheries. It is therefore common practice internationally to respond as quickly as possible with the appropriate tools available for recovery, containment and dispersion of oil.

Every oil spill response operation requires the proper equipment, sufficiently trained crews and a co-ordinated approach. It must be understood that no matter how well prepared a nation is to respond there is no guarantee that an operation will be 100 percent successful. Weather conditions and currents influence response ability as does a spill's proximity to shore. In some cases, it is unavoidable that the majority of the remaining oil (oil remaining after evaporation and dispersion) will contaminate a shoreline. It is also important to realize that cleaning up a spill entirely and removing all oil is an unattainable goal. As a result, the existence of weathered oil for months and even years after a spill is to be expected.

1.3.4 Response on land

It is generally more difficult and time-consuming to clean up shoreline areas than it is to carry out containment and recovery operation at sea. Both offshore and on-shore clean-up capabilities are necessary. Physically removing oil from some types of shoreline can result in more ecological and physical damages than if oil removal is left to natural process. The decision to initiate cleanup and restoration activities on oil-contaminated shorelines should be based on careful evaluation of socio-economic,
aesthetics, and ecological factors. The type of shoreline is crucial in determining the effects of an oil spill as well as the cleanup methods to be used. In fact, the shoreline's basic structure and the size of material present are the most important factors in terms of oil spill cleanup.

Priorities for shoreline cleanup must be based on a shoreline assessment. A systematic evaluation of oiled shoreline can minimize damage to the most sensitive areas. When an oil spill occurs, site assessments are conducted in direct support of spill response operations. These surveys rely heavily on previously obtained scientific data, maps and photographs collected by various actors.

The following are the objectives of site assessment surveys:

- To document the oiling conditions and the physio-ecological character of the oiled shoreline, using standardized procedures;
- To identify and describe human use and effects on the shoreline's ecological and cultural resources;
- To identify constraints on cleanup operations; and
- To verify existing information on environmental sensitivities or compare it with observations from aerial survey.

Clean up activities are commonly divided in two parts: initial cleanup and final cleanup and there are various methods. Often a combination of the two types is required. Manual cleaning done properly has a lower impact on the environment than mechanical cleaning, most of the time. Manual cleaning, however, does require considerably more time and significantly more people.

Observations of the UN/EC Assesment Team

2.1 CLEAN-UP OPERATIONS

In the case of the *Hebei Spirit* incident, it is assumed the oil weathered relatively quickly (in the first 48 hours) and even more was degraded in the days following the incident. The exact effect of this weathered oil on the environment and organisms will take time to assess and can only be determined by a methodical scientific investigation.

2.1.1 At sea

According to information received during briefings with relevant agencies, the KCG and MOMAF responded to the oil spill as quickly as possible. The weather and sea conditions prevented a more robust response, utilizing mechanical equipment offshore. The KGC and the KMPRC, the only agencies allowed to apply dispersants in the ROK, sprayed dispersants (Type 1) in the early stages of the response to enhance the disruption of the oil layer and foster the dispersion of the oil.

KCG and KMPRC reported that dispersants were not used on tar-balls, since their high viscosity makes dispersants ineffective. A total of 261 m^3 of dispersants were used and 71 m^3 remains in stock.

During a helicopter flight and two boat trips 10 days after the spill occurred, no closed oil carpet or large quantities of oil could be found. Only a relatively small amount of minor oil layers (wind roses), numerous small tar-balls and weathered oil (oil mats) were seen. The existence of tar-balls following an oil spill is a normal phenomenon and unavoidable. Tar-balls will remain a source of potential pollution in the coming months. The effective collection of tar-balls and "oil mats" is difficult, however, such recovery operations could be done using nets and similar equipment. As the *Hebei Spirit* was carrying light crude oil, the possibility of having submerged or sunken oil is limited, however, the possibility cannot be ruled out completely. These factors form the basis of the potential re-pollution of the area that may happen in the coming months. There is also the chance that further pollution could occur if other vessels take an opportunity to illegal discharge oil, ballast and bilge water in the accident area, which has happened after some other oil spills in the world.

2.1.2 On land

The affected shoreline is varied, consisting of sandy, pebbled, and rocky beaches, rock shore, tidal flats and man-made ports. Some of the impacted areas are very difficult to reach. Most of the affected shoreline had been cleaned by the time the UN/EC Assessment Team arrived, leaving only the low priority areas and those that were hard to access. To reach some of the inaccessible areas temporary roads had to be built.
Most clean up operations were carried out using basic equipment, such as shovels, buckets and absorbent rags and ordinary cloths. Sand beaches were cleared by shovelling the oil in buckets that were then carried to larger receptacles stationed in central locations. The rocky and pebbled beaches were also cleaned with shovels and buckets. Larger rocks were wiped clean people using absorbent rags. On some beaches as many as a thousand people were working to clean a beach.

There was little evidence of secondary pollution on clean areas of beach, or in nearby communities. The authorities set up temporary "cleaning stations" near the affected shorelines that were used to do a preliminary cleaning of used equipment (skimmers), footwear and other personal protective equipment. The cleaning was carried out with the use of dispersants and absorbent rags and seemed effective. It was also obvious at sites visited that considerable care was taken in handling the collected waste.

2.1.3 On-site and coordination

A beach cleaning operation of this scale demands a very thorough and dynamic coordination and management to prioritize areas for clean up and manage personnel, including the logistical details.

The prioritizing process was hard to evaluate as it was not witnessed by the assessment team, but significant tourist and aquaculture sites appeared to be cleaned first and more remote areas were left until later.

Managing the number of personnel involved, between 20,000 and 40,000 people per day, was an enormous undertaking. At all the sites visited, the logistical aspects of the operations were impressive and all elements were considered, including transportation, food and beverages, personal protective equipment, safety and toilets.

Although volunteers can be extremely useful in operations involving large amounts of manual labour, they do come with inherent risks that must be minimized. First and most important, the safety of all personnel must be considered. Second, their lack of specific knowledge can hamper progress as they are unaware about what to do and

require attentive marshalling and direction. Third, they can lead to secondary pollution if they do not handle waste and polluted clothing in an appropriate manner. Fourth, it is a challenge to integrate non-professionals into a command structure with professionals. Finally, many people increase the logistical and supply demands supporting an operation. These difficulties, however, seem to have been overcome by ROK authorities with precision and success. They were clearly capable of capitalizing on the considerable advantage that the volunteers represented.

2.1.4 Environmental Impacts

Several types of shoreline were visited by the UN/EC Assessment Team. Sand beaches like Mallipo Beach were heavily contaminated by oil relatively early after the accident. Fortunately, sand beaches have a relatively low porosity and this characteristic prevents the oil from penetrating deeply into the sediment. Typically, the residence time is likely to be short, except when the oil is buried or carried to the upper tidal area. As sand beaches often do not have high population of animals or plants, they are not considered particularly ecologically sensitive. In recreational area, however, sand beaches are given a high priority for clean up.

Other shorelines of importance in the Taean area are mud and sand tidal flats. These shorelines are important bird and shellfish habitats and are considered to be sensitive to oil spills. While tidal flats are relatively impermeable to oil, oil can penetrate through holes made by burrowing animals. Oil is likely to concentrate in the upper tidal zone. Flats are not accessible to vehicle or response personnel and often cannot be easily cleaned. If left alone, oil is refloated and carried toward land at high tide.

Assessment Results

3.1 CONCLUSIONS

It is important to note that the UN/EC Assessment Team arrived 7 days after the clean up operations had began and could not visit the entire area affected by the oil spill. Therefore the following conclusions are based only on the sites visited by the team, the information provided by authorities of the ROK, and the previous experience with and knowledge about oil spills of each team member. Interactions with local people and meetings with non-governmental organizations also influence them.

All relevant ROK agencies executed a very sound and professional response to the oil spill especially given the magnitude of this spill and the weather. MOMAF and KCG appeared to establish an excellent overall command structure, which included many agencies, national, provincial and local governments, private sector companies and members of the general public. At specific sites visited, the coordination of the work force was excellent.

There is no need for international emergency assistance to aid the ROK with clean up operations. There may be a need for assistance with medium and longer term monitoring, evaluation and analysis. Further details are in the recommendations.

The efforts of all involved in cleaning the beaches and shoreline were incredible. It is important to recognize the role of the authorities in coordinating the response and managing the large work force that was assembled for this operation. The volunteers, in particular, are deserving of recognition and praise, as are the members of the Army and Police for their work in cleaning areas that were difficult to access.

3.1.1 Equipment

The KCG and KMPRC have a comprehensive and high-quality stockpile of coastal and near shore equipment stationed in strategic locations throughout the Korean Peninsula. Neither organization, however, has high sea equipment. After an oil spill in 1995, the ROK established a response programme for marine pollution control focused on near shore areas, harbour approaches and sheltered areas only. The approach of this initiative was correct for establishing a new system. Now that it has been accomplished, the KCG and the KMPRC may want to consider developing a programme for high seas oil pollution response capability, including high-sea vessels with large storage capacity.

3.1.2 Dispersants

The application of dispersants was in accordance with the international standards and the policy, as outlined in the National Contingency Plan (NCP). According to the NCP, the use of dispersants must follow a very strict regime in which the allowance of use is defined by water depth: Zone 1 (water depth > 20 m) - dispersants are allowed to be used; Zone 2 (water depth 10 - 20 m) - limited use of dispersants is allowed on a case-by case basis depending on the presence of sensitive areas; and Zone 3 (water depth < 10 m) - dispersants are prohibited.

The use of dispersants is a proper and effective way to deal with an oil spill, especially when mechanical recovery cannot be performed. Certain facts must be considered when dispersants are used.

Dispersants are effective only in the first few days after an accident. Their effectiveness is determined by measuring the amount of oil that is put into the water column and comparing it to the amount of oil that remains on the water surface. Effectiveness is influenced by many factors such as the composition and degree of weathering of the oil, the amount and type of dispersant applied, sea energy, salinity, and water temperatures. The composition of the oil is the most important of these factors, followed closely by sea energy and the amount of dispersant applied. The viscosity will dramatically increase when the oil is weathered, once the highly volatile components have evaporated and a water-in-oil emulsion has formed. The solubility of the dispersants decreases with time and an acceptable ratio of oil to dispersant is lost.

Dispersion is not likely to occur once the oil has been spread to a thin sheen. It is also important to remember that the performance of adhesion skimmers, like disk and brush skimmers, is reduced in oil previously treated with dispersants. The mechanical recovery after the use of dispersants works better if weir and pump skimmers are used. Dispersants available today are much less toxic than produced in the early 1970s. In fact, oil is more toxic than current dispersants whether or not oil is dispersed chemically or naturally.

During a spill response operation, an effective management system must be put in place and the application of dispersants should not occur any longer than necessary. Appropriate measures must be taken to assess their effectiveness to disperse the oil and the potential toxicity of the resulting oil dispersion in the water column. Aerial surveillance should be used to direct sea-borne applications. Detecting oil from a ship is very difficult, unless an oil spill detection radar system is available. It is important to provide ample information to the vessel, especially in the later stages of an operation.

3.1.3 Further clean-up operations

Jetties or piers will require specific attention. Oil can enter between the rocks or tetrapodes which may resurface in small or medium volumes over months and years to come. The cleanup of jetties and piers is very difficult, but important. After other oil spills, rock jetties or tetrapode piers were dismantled and rebuilt after cleaning.

Beach cleaning operations were carried out with basic equipment and the results seemed to be good. Construction machinery, hired as necessary, could also be considered. This machinery could be used mainly on sand beaches to make the work easier. On some of the rocky and pebbled beaches seawater with the help of pumps could be used to wash the oil off surfaces. It should not be used with high pressure or high temperature due to the impact on the ecological systems and sediments, unless there is an agreement with local residents. If this method is used it is necessary to place booms around the area to contain the oil cleaned off and prevent re-pollution. There are many options for cleaning and the most appropriate method is defined by what is being cleaned matching the method, with the amount, and condition of oil found, and the type of shoreline.

It has not been possible to get a complete overview of the logistic tasks to handle the collected oil, polluted sediments and other polluted waste at the coastal sites. At some of the sites, the large buckets could pose a challenge when moving them from the affected area to vehicles to take them to treatment facilities, due to their weight and locations. The buckets may have to be moved by sea or by helicopter. It must also be considered how to clean the large amount of equipment that has been used for the clean up over a longer period of time.

3.1.4 How clean is clean?

Ultimately this question is a policy issue for the authorities of the ROK to decide. There are some factors which are useful to remember when discussing the issue. Biota on shorelines is harmed through direct contact with the oil, ingestion of the oil, smothering, and destruction of habitat and food sources. Intertidal life forms are particularly vulnerable to oil spills. It can take several months for an oiled intertidal zone to be re-colonized. However, it should be pointed out that intertidal life may also be damaged by cleanup efforts, particularly by the movement of people and vehicles and by cleaning water that is either too hot or too much under pressure. Clean-up methods should minimize environmental effects of the spill, not simply remove the oil at any cost. Oil should only be removed to prevent it from being re-floated and oiling other shorelines. Oil stranded in the intertidal zone may cause less harm if left for natural degradation, rather than being removed.

The government may wish to consider arranging for a broad-based and inclusive committee involving all interested stakeholders to assist in developing this policy. Such a method has been used in other jurisdictions in the development of a similar policy.

3.1.5 Environmental issues

Environmental impacts studies and monitoring programs in the present case have already been initiated by Korean experts from at least two ministries. To optimize the outcome of these efforts, they should coordinate their activities and work together, particularly sampling (i.e. coordination of sampling periods) choice of methods for sampling and analysis. It is vital that they share and compare their results.

3.1.6 Petroleum hydrocarbons in seafood

Most marine organisms have enzyme systems to metabolize petroleum hydrocarbons and as a result there is no accumulation of such hydrocarbons in the tissue of fish or crustaceans. Instead petroleum hydrocarbons in these organisms are broken down and depurated. However, marine mollusks lack these enzymes and consequently the amount of petroleum hydrocarbons that their body can bare follows an equilibrium partitioning process. This means that as water concentrations of oil drop the petroleum hydrocarbon concentrations in the tissue of oysters and mussels will also drop as a result of partitioning of the hydrocarbons into the water. In this context, it is important to point out that petroleum hydrocarbons are not accumulated and magnified in the food chain as are certain chlorinated hydrocarbons do.

There are no health standards or recommended maximum levels for petroleum hydrocarbons in seafood, as there are for substances such as DDT or mercury. Instead health authorities, backed by World Health Organization recommendations, suggest the use of independent taste panels that are set up in connection with oil spills that threaten fishery and aquaculture resources.

3.2 RECOMMENDATIONS

1. A comprehensive multi-sector Post Disaster Damages and Needs Assessment (PDNA) for a medium and long-term recovery process, as a follow up to the UN-MIC assessment should be initiated and is highly recommended. The European Commission Directorate General for External Relations together with UNEP and the WB are willing to support the relevant ROK authorities with this recommendation.

2. A robust communications plan aimed at providing information to the public should be developed and implemented. It should be underpinned by science and information from the comprehensive monitoring programme mentioned above. Such a programme can provide the information that should be given to the media and the public explaining the background for various decisions regarding strategy and choice of methods in the clean-up after an oil spill.

3. An in-depth analysis regarding the availability and involvement of privately operated and owned high-sea going tankers or bunker vessels with approximately 3,000 - 5,000 m^3 storage capacity should be done. These vessels would enable response to a high sea spill in severe weather conditions in a more suitable manner than is currently possible. These vessels can be dedicated to commercial activities and mobilized for oil spill response only in the case of an emergency. The pre-fitted vessel could be modified to an oil recovery vessel within hours and equipped appropriately with suitable offshore recovery equipment. (A detailed explanation of the main criteria for such a vessel, as well as the gained experience and predicted costs are given in Annex III)

4. The strategy concerning the use of dispersants should be reviewed with respect to the time of application, as well as the negative effects of the dispersant used. Such toxicity data should not only consider the toxicity of the dispersant, but also the toxicity of the entire oil/water/dispersant mixture. In addition to this, it may be timely to review the type of dispersant used given the current need to replenish the stockpiles. Prior to any decision, the compatibility of the dispersant with the predominant oil shipments in this region need to be checked, since the compatibility of the dispersant and oil is essential for the effectiveness of the application.

5. The current Spill (Disaster) Management System and the available tools for guiding the operation from the control centre and on site should be reviewed and the lessons learned integrated as appropriate. The guidance system of the vessels involved in the operation and the aerial assets supporting the at sea activities needs to be refined and improved. (A more detailed description is provided in Annex V)

6. The relevant authorities of the ROK should actively participate in international efforts aimed at phasing out single hull tankers. They may wish to consider closing their territorial waters to single hull vessels before 2011/12, the deadline established in the Single Hull Phase-out Timetable, which is attached to the International Convention for the Prevention of Pollution from Ships now in force. The presence of such vessel in Asia will certainly increase in the coming year after the use of single hull tankers is totally forbidden in North American and European Waters. The ROK, as a significant maritime nation, could be an important voice on this issue and should consider supporting the clean sea philosophy for the sake of the global environment.

7. A longer term clean up strategy must be devised to deal with a number of issues: establishing larger cleaning stations to be equipped with high pressure and temperature pumps to do a final clean of equipment. The stations should be connected to oil/water separating systems to avoid secondary pollution of the environment; and the cleaning of jetties and peers; the cleaning of re-polluted areas, if necessary.

8. A shore line assessment should be carried out as soon as possible, and if it is possible a further assessment in the spring is highly recommended to determine in winter storms have dislodge and re-floated any oil and if it is worth undertaking any clean up activities, especially in sensitive and tourist areas.

9. A lesson learned exercise should be conducted on the response to Hebei Spirit Oil Spill. Of particular interest to the international community will be the method of organizing and the large numbers of volunteers and successfully integrating them into the response effort. Findings of this exercise should be shared with the international community.

10. A strategy for joint training, including exercises, for all relevant agencies involved in oil spill pollution response should be developed and implemented.

11. All cleaning activities should be carefully recorded (time spent, size of work force/numbers of volunteers and professional teams employed, equipment used, waste management, transportation) in order to develop the documentation necessary for compensation with insurance, the Protection and Indemnity Club (P&I Club) and the International Oil Pollution Compensation (IOPC) Fund.

Further information
Further technical information may be obtained from the Joint UNEP-OCHA website at: http://ochaonline.un.org/ochaunep/

Annex I: Composition of UN/EC Assessment Team

Mr. Vladimir Sakharov (co-Team Leader)
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Annex II: Mission Itinerary

December 15

Arrival of Mr. Vladimir Sakharov, Mr. Jonathan Waddell, Mr. Kenn Christensen, Mr. Peter Kragh, Mr. Bernd Bluhm, Mr. Xavier Kremer
Meeting with UNDP Resident Representative and EC Delegation
Briefing by the Ministry of Maritime Affairs and Fisheries (MOMAF)
Discussion of the mission plan with MOMAF and Korean Marine Pollution Response Corporation (KMPRC)
MIC Video Conference at EU office

December 16

Departure to Taean
Briefing by Korean Coast Guard (KCG) and Korean Ocean Research and Development Institute (KORDI)
Boat tour of coastline immediately across from the Hebei Spirit location
Site visit to Mallipo beach
Press conference at the KCG Regional Headquarters
Arrival of Mr. Olof Linden, Mr. Georges Long, Mr. Daan van Gent, and Mr. Frank Jongejan

December 17

Meeting of UN/EC Assessment Team Mission with UNDP liaison officer
Meeting with KORDI liaison official
Site visit to Garolim Bay, Woo-do
(Bernd Bluhm undertook a helicopter flight for aerial survey of affected coastline of Anmyeon-do, south of Hebei Spirit location)
Boat tour south of Hebei Spirit to observe clean up operations at sea, and survey coast line of Anmyeon-do, Hwasa-do and Cheonsu Bay

December 18

UN/EC Assessment Team divided into three groups:

Group 1: Clean up operations (Christensen, Bluhm, Kragh, van Gent, Jongejan)
Site visits to various areas

Group 2: Environment Issues (Sakharov, Linden, Long)
Site visits various areas
Meeting with local environmental non-governmental organization

Group 3: Waste Treatment, Clean up operation (Kremer, Waddell)
Site visit to Shindaehan Refined Fuel co. LTD - waste treatment facility for solid waste
Site visit to Gurun Beach

Entire UN/EC Assessment Team met with the US Assessment Team, the Japanese Assessment Team, MOMAF, KCG, KORDI, and KMPRC
Press Conference of representatives from UN/EC Assessment Team (Sakharov, Linden), US Assessment Team, Japanese Assessment Team
Sakharov, Christensen, Bluhm, Kragh, van Gent, Jongejan, Waddell departed Taean for Seoul
Linden, Long, Kremer remained in Mallipo

December 19

Meeting of Linden, Long, and Kremer and KORDI official, site visit to affected shoreline to explain shoreline assessment
Briefing of UNDP representative by Sakharov
Meeting of Bluhm, van Gent, and Jongejan and KCG officials
Linden, Long, Kremer departed Taean for Seoul
Meeting of UN/EC Assessment Team to discuss report

December 20

Briefing of Minister of Maritime Affairs and Fisheries, and Director Generals of UN/EC Assessment Team
Meeting between Linden, Long and Ministry of Environment officials
Drafting of report
Meeting of UN/EC Assessment

December 21

Press Conference
Finalizing of report

December 22

Departure of UN/EC Assessment Team

Annex III: High Seas Oil recovery Vessels-Recommendation 3

Prepared by Bernd Bluhm, EMSA

Main Considerations

Analysis of previous large scale spills, particularly of the *Erika* and *Prestige* incidents in Europe, showed that "specialised" response vessels using sweeping arm oil recovery systems, in general, achieved the best performance during an incident. High daily recovery rates were realized when vessels were on scene early in the response. It was noted that a supply-type vessel provided a suitable platform from which to deploy booms and skimmers. However, the exposed nature of large open decks made conditions uncomfortable and hazardous for the crew in heavy sea conditions. Also vessels with a large storage capacity, like coastal tankers or bunker ships, were successfully used since these vessels are able to remain at sea for longer periods recovering oil before discharge is required. Time in port was reduced as vessels had heating coils and pumps of sufficient capacity to discharge oil from their tanks more readily. In addition to the aforementioned advantage, a specialised vessel with a large storage tank capacity of approximately 5,000 m^3 has usually a higher ability for sea-going operation in severe weather conditions.

Since the capital investment required to build or to buy such dedicated specialised response vessels could hardly be justified from the economical point of view; consequently, chartering and modification of existing vessel is advisable. In such cases, the normal running costs associated with maintaining the operational capability of vessels and their crew will come from the normal commercial activity of the vessel. Some States, facing financial constrains and mobilisation challenges, offset the investment cost by multi-tasking the vessels for different types of activity under their mandate. For example, these ships might undertake a combination of at-sea oil recovery, fire-fighting, buoy tendering and/or emergency towing leading to a so called "multipurpose vessel".

A variation on the multipurpose vessel concept is to combine the pollution response activity with those of commercial shipping. In this case, it is also been possible to establish a relatively flexible system of a "pool" of vessels from which a number could be called upon for spill response operations. Advantages of such a system include reducing the mobilisation time as well as the financial impact of tasking a specific vessel away from its main commercial trade.

The utilisation of such vessels requires a "tailor made" two-contract structure. Firstly, the Vessel Availability Contract (VAC) between the State and the Contractor addresses "peacetime" issues such as bringing the identified vessels and equipment into operation and maintaining the service during the contract period. One of the key objectives of the VAC is to secure the continued availability of the vessel on a priority basis for short notice spill response activities.

In a case of an accident, the Incident Response Contract (IRC) or Charter Contract will be used. In order to minimise any delay in mobilization due to negotiations between the parties concerned, the terms and conditions had been pre-agreed with the Contractor and are reflected in the IRC. This contract includes the relevant daily rates for the vessels.

Technical Aspects of the Oil Recovery Service

Taking into account the "top-up" approach in combination with the major spill scenario, the focus has to be on mobilising response capacity of the heaviest category. In practical terms, this means ships with an on-board recovered oil storage capacity in the order of thousands of cubic meters as opposed to hundreds, the category which is more commonly found at the disposal of States.

The technical specification the service endeavours to incopororate the lessons learnt from previous incidents. Each arrangement has a number of common characteristics. With regard to equipment, the primary oil recovery system should be based around the "sweeping arm" concept with an additional "ocean going boom and skimmer" system also available. This means that two independent oil recovery systems are available. The State or the requesting administration/authority can select the system in accordance with the incident characteristics. All the specialised oil spill response and associated equipment should be containerised in order to facilitate rapid installation onboard the vessels.

With respect to the vessels, each has to have a top speed greater than 12 knots for prompt arrival on site and should have a high degree of manoeuvrability. Decanting systems for excess water should be in place to maximise the utilisation of the onboard storage capacity. Additionally, each vessel should have the ability to heat the recovered cargo and utilise high capacity pumps in order to facilitate the discharging of heavy viscous oil.

In order to improve the positioning of the vessels and the specialised equipment in the floating oil, a local radar-based slick detection system should be available on-board. This enables the vessel to operate in low visibility conditions as well as to guide operations of a pool of vessels by directing them to the polluted area, as a complement to aerial surveillance support.

The crews must be trained appropriately regarding the equipment and, importantly, working under an international command and control structure. For these types of activities, the vessels should be available to participate in at-sea spill response exercises.

Adapting Commercial Vessels for Spill Response

A number of technical adaptations need to be carried out in order for the ships to be classed as oil recovery vessels. Experience has shown that a range of feasible solutions can be implemented. Some of the more frequent issues are identified below.

Different supports, foundations and pipes have to be installed to properly and safely stow the equipment onboard including the onboard slick detection system. Piping work will need to be undertaken to address a number of aspects. In particular, as most of the pollution response equipment is hydraulically driven and is spread out along the deck, supplementary fixed hydraulic piping could be required. In terms of safety, the oil on deck must be limited to certain “dirty” areas by installing steel plates.

To be classed as an oil recovery vessel, an issue for non-tankers is that tanker ventilation rules are applicable. In addition, the electrical system of the vessel may have to be upgraded in order to comply with the applicable tanker rules. Depending on the flashpoint of the products to be recovered and stored, above or below 60oC, this regulation will be more or less stringent.

Installing the pollution response equipment on the weather deck above the vessel’s centre of gravity has a negative effect on its overall stability. Accordingly, and as a minimum, the vessel stability needs to be recalculated. When the additional permanent weight is over 2% of the ship’s lightweight then a stability test (inclining test) has to be performed.

Depending on the geographical area to be covered, the vessel may need to have unrestricted navigation certification by the competent authorities. It would not make sense to delay the response because of the limitation of the vessel to sail at a certain distance from the coast.

A key objective of any large-scale pollution response operation is, obviously, to be at the spill site for as long as possible to take advantage of the window of opportunity to recover oil at sea. One of the limiting factors is the storage capacity of the vessel. Once the tanks are full, they must be discharged as soon as possible. Within this context, cargo heating capacity can play an important role. Due to the weathering process of the oil and the emulsification with water, the products recovered at-sea may reach exceptional levels of viscosity. In such a situation it maybe impossible to pump the product or, in the best of the cases, the rate will be very low. Having effective and powerful tank heating systems can decrease the viscosity significantly so improving discharging rates.

Consideration should also be given to the actual pumping capacity. There should be sufficient capacity as well as the ability to pump high viscosity products. As predicting the specific type and physical characteristics of the product to be pumped, European Marine Safety Agency (EMSA) decided to consider the worst case scenario, when screw-type pumps are recommended and the capacity should be such that the vessel, if filled with water, could be discharged in two hours.

The propulsion system of the vessel must also be appropriate for the pollution response services. The oil recovery devices are only effective up to a certain relative speed of the sea surface. Therefore, the vessels performing this service must be able to sail at low speeds i.e. from 1 to 3 knots, for long periods of time. This means that appropriate propulsion systems, such as a Dynamic Positioning system (DP), electrical propulsion or Controllable Pitch Propeller (CPP) must be installed onboard.

In parallel, the manoeuvrability of the vessel must be considered. Oil slicks are not always compact and, therefore, the vessels involved in the recovery operation have to change their course frequent and rapidly when recovering oil. Manoeuvrability is also an essential factor when the vessel is requested to deploy the boom and work in co-operation with an auxiliary vessel. A maximum speed requirement should be also in place for specialised vessels as in most scenarios the vessel will have to sail to the affected area. Given previous considerations, the sailing time should be minimised.

In terms of communications and given the potential area of oil recovery operations, full A3 coverage is needed. To have effective communications with surveillance airplanes that may be on the scene, it is recommended to have aeronautical band radios onboard. Communication onboard is also a key factor and accordingly the EMSA service requires that there is a dedicated an officer onboard to co-ordinate the recovery operations. This officer should be in contact with the relevant authorities leaving the Master free to be concentrate on the overall safety of the vessel.

Depending on the objective of the specialised vessel, "first" or "second" line, the flashpoint (FP) should be considered. The vessels with a FP<60°C are able to recover any kind of oil at any stage. Achieving this capability may require modifications to the ventilation and electrical equipment. In addition, the power-packs and the other equipment stored and operated on deck must have the adequate safety devices e.g. over-pressurized containers. However, it should be considered that once the oil is spilled at-sea, the most volatile components i.e. the components that decrease the overall flashpoint of the oil concerned, are the first to be evaporate.

Most of the modifications to be made to the vessels will have to be supervised and approved by the classification society concerned. It is therefore advised to discuss in advance all the modifications foreseen with the classification society in order to assess the feasibility of the new notation. Experience has shown that this dialogue reduces delays with respect to the issuing the final oil recovery certificate. The safety manuals of the vessel will need to be updated for the new notation.

The costs of such modification varies from ship to ship, but generally it will be around 500,000.00 US$/vessel. In addition to this also the costs for the equipment need to be considered. The equipment costs depend on the model and quality chose, however, the cost could be assumed to be around 1,500,000.00 US$. Consequently the investment costs are much cheaper and more economical than building, buying or even operating own vessels. It should also taken into account, that such investment could be shared by a group of States inside a regional agreement as the operational cost (in a chase of utilising the vessel in a spill) are separately defined in the IRC or Charter Contract.

Conclusion

The modification of "normal" vessels with sufficient tank capacity like coastal product tankers as well as bunker and supply vessels into oil recovery vessels is challenging but generally feasible. Innovative solutions combined with comprehensive planning makes it possible for vessel conversions that will not have an exaggerated impact on the main commercial activities. Due to the clear "win-win" situation for both sides, it seems to be a suitable way to establish, in a cost effective way, additional oil recovery capacity for offshore operations.

Annex IV: Emergency preparedness and Response Management System/Recommendation 5

Prepared by Daan Van Gent, Port of Rotterdam

1. DEVELOPMENT OF AN INCIDENT RESPONSE ORGANISATION

Incident response should not be a matter of improvisation but a matter of organisation, pre-planning and training. Everything that can be arranged beforehand should be arranged. For this aspect safety is usually defined as the possible consequences of occurrences. By means of hazard identification a Maximum Credible Accidents can be defined which can be used as a basis to develop the incident response organisation.

Prevention does matter. Prevention measures reduce the frequency of incidents and limit the possible consequences of incidents. Up to a point, prevention and response seem to be interchangeable. Extensive preventive measures can lead to a relatively small incident response organisation, minimal preventive measures to a large one.

It should be kept in mind, however, that reductions in frequency alone should not automatically lead to a reduction in the incident response arrangements.

In the balancing of prevention and response, economical considerations play a large role. Generally both the total costs and the distribution of the costs over the parties involved determine the outcome of this balancing. This balance may be different for different types of incidents:

- High frequency - small consequence incidents (daily)
  For these types of incidents prevention (with the objective to reduce the frequency of incidents) seems to be the most cost-effective approach. Firstly because of the high frequency leads to heavy (therefore costly) demands on the incident response organisation, secondly because of the disruptive influence of these incidents on the economic process.

- Low frequency - major consequence incidents (once 1-5 years)
  This type of large-scale accidents seems to be the basis that the incident response organisation should be developed. Prevention (with the object of limiting the consequences) can also be used. Land use planning may also be considered in this scheme, as a preventive measure.

- Catastrophes

Generally it is not possible to develop the incident response organisation on this type of incident. Therefore the only option open is prevention, both to reduce the probability and the consequences. The matter of cost-effectiveness is a very difficult one for this type of incidents as it becomes a n issue of risk acceptance: does the economic benefits of activities which may cause catastrophes outweigh the risks involved. It is therefore a strategic discussion.

2. EMERGENCY RESPONSE

Emergency response involves the coordination of several organisations, like police, medical services, fire brigade, terminal operators among others. The basis of emergency response should be a balanced emergency plan. This emergency plan should cover:

- General management
  The tasks and responsibilities of the parties involved should be clearly stated. The command and communication structure should be defined. Arrangements should allow for quick decision-making. The scale of the incident should determine the scale of the emergency response. Criteria for this purpose and standard procedures should be established.

- Co-ordination
  Depending on the size of the incident, several levels of coordination may be necessary. In any case, there should be an on-scene command team in which all "core parties" are represented.

- Response plans
  It is useful to develop response plans for different types of emergencies. In a port area, such plans should be developed for both on-land and marine emergencies. Marine emergencies may include spills, gas releases, fire and/or explosions on ships and nautical accidents, like collisions or groundings in the port area. Emergencies never become routine. Even with excellent planning improvisation plays a large role in emergency response. Training and regular exercises are a necessity. People and organisations should be prepared to deal with unexpected situations.

3. TECHNICAL MEANS

3.1 Fire and/or explosions on ships

Standard land based equipment for fire fighting is generally insufficient for dealing with ship related emergencies, even when ap¬proachable from land (which is not always the case). The size and especially the height of ships call for more powerful tools. This means heavy and unwieldy machinery. It is very practical to put this kind of machinery aboard boats. There are several advantages to be gained from this:

- Easy transport;
- The ability to approach an incident from the water;
- In some cases even a shortening of response time may be achieved.

For incidents on land these boats may be used in a supportive role, for instance their ability to deliver large quantities of water may be very useful, permitting environmental considerations.

3.2. Spills

The incident response organisation should also be equipped with the means to handle spills on water. This may involve the capability to place oil-booms to restrict the spreading of pools or, depending on the nature of the substance spilled, the capability to cover the pool with foam to prevent evaporation. (This may lead to the use of several types of foam, or the use of an expensive all-purpose foam.)

3.3. Collisions and groundings

These events can also take place with ships carrying dangerous cargo. Even when not resulting in a loss of containment, these incidents should be handled carefully. In general, it should be stated that any personnel involved in dealing with chemical incidents should have adequate personal protection, (respiratory aids, gas protection suits and chemical protection suits) as well as the ability to use these protective devices.

4. INFORMATION

In incident response the availability of adequate information at all levels is crucial:

- Operational personnel;
- Specialists;
- Decision makers.

An information process governing a port should include the necessary information for incident response. All information should be available and accessible to the incident response organisation. Therefore compulsory notification about the transportation of dangerous goods to a central authority is highly recommended.

It seems advisable to centralise this information to make co-ordination and control possible. In a large port this may mean that computerised data-banks have to be used to keep track of the enormous quantity of data.

Once an incident has occurred information is vital. It forms the basic input for an incident response information system. This incident response system should give quick estimates on the nature of the hazard to the public and the extent of the threatened area.

A system like this may take the form of a handbook or be automated. It should be able to give a very quick first estimate based on limited data with the possibility of improving estimates as more information becomes available.

5. CRISIS MANAGEMENT SYSTEM

It is advisable to prepare a disaster act (legally binding regulation) in which a control plan for every potential disaster in the responsible area, the nature and consequences of the accident or incident are described.

Legally, a Disaster Act defines an event as a crisis if two criteria are met:

a. If it has occurred or has a distinct probability to occur and its consequences pose a serious threat to public safety, endangering the lives or health of a great number of the population or creating a serious risk of extensive damage to property.

b. A co-ordinated effort by various relief-services and organisations is necessary.

Avoiding the necessity of developing separate disaster control plans. A "Master plan for disaster control" should be developed. This plan should offer guidelines for all relief services covering:

- The entire area;
- All 'foreseeable' accidents;
- Linking to already existing arrangements:
  - Of all operational services;
  - The (overall) Municipal Disaster Plan.

This leads to:
I) Co-operation with other organisations or units,

This demands:
- Co-ordination of actions;
- Information exchange;
- Adapted ways of operating.

II) Situations that are beyond the daily routine,

This demands:
- Training and preparation;
- Correct handling of stress.

III) Impact upon an area outside the port boundaries, and/or consequences for crucial functions of the port.

5.1 The overall system

All actions that have to be carried out by the units, services or organisations in case of an accident can be seen as parts of a comprehensive system. These sub-systems might be the responsibility of individual units.

The following sub-systems can be identified:

a: fighting the source and resulting effects;

b: rescue;

c: warning, evacuation of the population;

d: traffic control;

e: logistics.

5.1.1 Fighting the source and resulting effects

All incidents have a source or source area and an area that might be affected by the resulting effects. In order to handle these consequences, emergency-units are to be deployed by the operational services. For this deployment standardised procedures are applied. The intention of their actions is to restrict the direct effects to the source area and to minimise the effects upon the area outside this source area. The threats or dangers may result from:

- Explosions;
- Fires;
- Spills;
- Dispersion of toxic gas clouds;
- Cave-ins.

These sub-systems apply to a source area and an impact or endangered area. This total area must be considered as an unsafe area wherein protective measures are necessary to take before entering.

5.1.2 Rescue

The sub-system rescue represents the function of actually saving the (direct) victims of the incident and those who need medical care. This module consists of a series of actions and procedure from the moment a victim is idetified in the disaster area (see figure 3) until further treatment is no longer needed or possible.

This procedure has the following steps:

- Identifying victims;
- First aid on the spot;
- Transport of the wounded to a location designated as an assembly point;
- Further medical attention;
- Supervised transport to a hospital
- Medical aid in hospital.

5.1.3 Traffic control

Inside the disaster area a large number of responders and vehicles could be possible. The ambulance service has to transport victims to hospitals. The designated incoming and outgoing routes are used for this traffic. The units operating in the source and effected area may need the supply of material. The area is approached using assembly and departure points. In case of an evacuation, people are transported following special routes. The police are co-ordinator of the use of roads and control the access to the various areas.

5.1.4 Logistics

A logistic system must be set up in order to provide the units deployed in the disaster area with food, drinks, fuel and all the other supplies they might need. Also repair work and replacement of materials is an important item that has to be covered.

5.2 Operational command and control structure

5.2.1 The 'scaling-up' principle.

The commander of the disaster control organisation is responsible for the functioning of the system as a whole. Therefore he or she is also responsible for the preparation of all plans, procedures and arrangements that are part of the system (the sub-systems). Given the system, individual organisations or units are responsible for the functioning of sub-systems. It is highly improbable that the complete system will be in operation regularly, as large-scale disasters are not frequently occurring. Small incidents that are more frequent might occasionally result in more extensive accidents.

The crisis or disaster management organisation should be able to follow these develop¬ments and grow from a limited scale to a complete deployment of all units or organisa¬tions. At every stage it should be considered whether or not to expand the structure to the next level of deployment.

The existing command structures should be related to these various stages.

5.2.2. Operational command and control structure

The operational command and control structure should been set up according to the common line/staff model. This structure for disaster and crisis control fits in the existing normal civil structure.

The organisational structure should contain the following characteristics:

- Simplicity and transparency;
- Right span of control;
- Rapid decision making;
- Promptness and flexibility in action;
- Optimal utilization of specialist knowledge.

For each level in the structure specific tasks and objectives are defined.

a) Supreme Command (SC)

The overall responsibility for accident, disaster or crisis control can be a political choice. Generally this is a high-ranking representative of the civil administration, a governor or a mayor.

Supreme Command carries the final administrative and political responsibility. In general, SC assigns the tasks and responsibilities by mandate or delegation to the organi¬sational units in the structure.

During crisis or disaster situations SC assi¬sted by a disaster staff. This staff consists of heads of the organisational units and they advise the SC on the strategy to be followed. Often, the SC will work at a (municipal) centre for civil defence, which should have a conference room and a communication centre. The heads of the various organisations should have direct communication to their respective operations centres.

b) Operational Command (OC)

For effective disaster or crisis management it is crucial that a single person is responsible for leading the operation. This person should be identified in advance.

A fire brigade commander often fulfils this position. In certain cases, such as ships in distress, a senior officer could hold this position from the maritime administration or by the Harbour Master.

The operational commander is responsible for all disaster control operations. The OC performs the co-ordination of operations, information, employment of personnel, logistics. He or she is the co-ordinator of the deployment of all groups involved to make the sub-systems function. It is this person's task to create optimal conditions to control the disaster or crisis, and ensures the employment of specialists required for short and long-term risks.

It is important to identify a unit responsible for observation and reconnoitring. This unit has the tasks of collecting information, reporting and warning regarding chemical and nuclear accidents and explosions. It should assess and demarcate contaminated areas.

The command usually operates at the regional command centre of the maritime administration, Coastguard of municipal fire brigade, which is connected to the operational/emergency command centres of all services involved, such as:

- Police;
- Port authority;
- Medical service;
- Ambulance service;
- Environmental control agency.

The operational commander follows policy and instructions set out by a higher command level. He or she keeps the SC informed about the situation and the progress made in abating the crisis or disaster situation.

c) Emergency site command

The commander at the emergency site represents the operational authority on the actual scene of a crisis or disaster. This authority puts him or her in a position of giving binding instructions to the commanders of the independent services operating in the field. However, he or she cannot infringe on the authority of those commanders with regard to the actual execution of their tasks. Together these commanding officers build the operational staff at the emergency site.

d) Operational force at the emergency site.

The work force in the field consists of those units that traditionally provide the operational duties, such as the fire brigade, police, port-authority, medical and ambulance services.

6. OIL SPILL REMOVAL

Spills are common in busy areas especially harbour approaches or ports. Causes of relatively small spills are usually the loading and unloading of ships, bunker operations, shore operation, and operational mistakes on shore on board. More severe spills are caused by collision and/or loss of the vessel.

The consequences of a spill vary according to the properties of the substance spilled:

- Evaporation
- Sinking
- Emulsification
- Spreading
- Chemical reaction with water

This section will concentrate on oil only, because it is the most commonly spilled substance.

<u>Behaviour of oil spills</u>

The behaviour depends of the amount spilled, the properties of the oil, as well as the environment in which it is spilled, e.i. water- and air temperature, wind and wave conditions. In general terms, the following may happen within hours:

- Spreading: The oil spreads rapidly over a large area and breaks up in windrows, which are long, narrow slicks with the same orientation as the wind.
- Evaporation: The spreading causes the lighter fractions of the oil to disappear rapidly, leaving heavier parts in the water
- Emulsification: Wave action mixes water into the oil, forming a heavy and sticky water-in-oil emulsion.
- In addition it may mix with all types of floating debris, such as kelp, seaweed, wood, cans, rope, plastic, etc.

The described behaviour of the spilled oil sets the demands for a successful oil spill response:

- Minimal response time;
- Efficient and fast concentration of the spreading oil;
- Protection of vulnerable areas;
- Skimmers and pumps which can handle high viscosity emulsion and debris;
- Appropriate temporary storage capability;
- Appropriate treatment facilities for recovered oil and debris.

Marine Oil Spills

Marine Oil spills have been in the news in the last year, the most recent major spill being the Prestige, which has covered large parts of the north coast of Spain with high-density crude oil. In the case of the Prestige spill, the response organisation proved inadequate to control the spill, resulting in extensive pollution of the coast-line, and extensive damage to fishing grounds and the fishery sector.

It is very difficult to generalise on marine oil spill situations. Each spill has its own set of characteristics: Location, close to shore or far off shore, degree of environmental sensitivity, shallow or deep water, waves, current, wind speed and direction, temperature, size of spill, type of oil, time after spill, debris. There are several factors which influence how successful the clean-up operation will be, and they are all incorporated in an appropriate contingency plan:

- Availability and capability of properly maintained equipment and products (ships, skimmer systems, booms, pumps, storage, dispersants, absorbents);
- Availability of trained and untrained manpower;
- What to protect first of all;
- Communication;
- Information;
- Surveillance;
- Command;
- Strategy/Planning.

Regarding the equipment and personnel involved in an oil spill response operation, the most important factors for success are:

- Maintenance and Training
  Equipment for cleaning up oil pollution should be treated as emergency equipment. These tools should be maintained and kept in a state of readiness. Continued training is the only way to ensure the full return on an investment in oil spill combat equipment. This is especially true for large spills.

- Health and Safety:
  Oil spill responders are dealing with several hazardous situations. It is extremely important that an appropriate Health- and Safety Plan (HSP) has been prepared and that all involved personnel have received proper HSP education

Annex V: Principles of Initial Clean-up

Prepared by Xavier Kremer, Cedre

SCOPE

Substrates : all types

Pollution : all types

Pollutant : fluid to highly viscous

Coastline

Manual collection – the Prestige spill

Mechanical recovery, the Erika spill

Pumping oil at the bottom end of the foreshore – the Tanio spill

EQUIPMENT NEEDED

Fluid oil: sewage suction systems / cleaning trucks / vacuum trucks, skimmers, skimming heads, pumps

Viscous oils:
- manual collection: shovels, forks, pokers, rakes, buckets, scrapers, etc.
- mechanical collection: back-hoe loader, power shovel, grader, sand screener machine (highly viscous to solid pollutant).

Storage facilities, personal protective equipment suitable for oil spills.

DESCRIPTION/PRINCIPLE

Initial response and clean-up (removing the bulk of the oil) aims at recovering as quickly as possible as much of the bulk pollutant as possible that could be remobilised and pollute other sites that are protected or that have already been cleaned up, pushed by wind and currents. Final clean-up and restoration should only start once responders are sure that there will be no more massive beachings of oil on the coastline unless weathering processes complicate the clean-up operation.

Priorities

Once responder safety is secured, initial clean-up techniques have been defined and accepted and limits have been set:

- for beaches: pump floating slicks by the water's edge and collect the biggest patches deposited on the foreshore to avoid them being covered by incoming sand or being moved out by wind and tide action. Collect polluted macro waste, heavily oiled seaweed and oil that is easy to recover in sheltered waters. Every response operation has to be as selective as possible to avoid disturbing the geomorphological balance of the coastline in addition to reducing quantities to be treated.
- for rocky areas: collect accumulated oil from nooks and crannies in rocky areas where there is little wave action.
- for quaysides and beach access roads: clean up whatever may cause people or vehicles to skid or slide or else cordon the area off.

Tar balls on beaches, slightly polluted seaweed, accumulations of oil in rocky areas where there is a lot of wave action can be removed subsequently during final clean-up operations.

Methods
In the event of liquid oils, contain the slicks and pump them with honey wagons/vacuum trucks and other specialised clean-up equipment (such as sewage suction systems and clean-up trucks) or else use specific recovery systems. With oils that are viscous and unpumpable, recover can be done by hand (scrapers, shovels, forks, rakes, pikes, buckets) but when oil coverage is very extensive and the site is amenable (easy access and load-bearing capacity) access will be possible for heavy duty equipment (screening machines, back hoe-loaders, power shovels and graders). Public works equipment and farming equipment can be used for facilitating the disposal of collected pollutants. Vehicle circulation lanes and access areas have to be clearly marked out to avoid burying the collected pollutant or causing harm to the environment. To begin with, waste will be prestored near the collection points in tanks or ditches. These storage areas will be dug, lined and protected by plastic tarpaulin sheets and must not be reachable by the tides.

These pre storage sites also have to be easy to get to for the lorries that are to remove the collected waste. Be careful you do not overfill the storage capacities (skips, tanks) to ensure they do not spill over.

CONDITIONS OF USE

Pollution: massive beaching, heavy pollution, weathering processes may complicate the clean-up operations.
Substrate: sufficient load bearing capacity for men and machines.
Site: Access is suitable for the resources you are using and the site has been cordoned off.

IMPACT ON THE ENVIRONMENT

In a bid to limit the impact of clean-up operations on the environment (and especially erosion phenomena) you are advised to recover as little sand as possible when collecting oil and especially if you have to use public works equipment.
Furthermore, access areas and circulation lanes have to be clearly marked out. Always use already existing access areas and marshal machines and responders accordingly. If need be, protect the ground from heavy traffic (use tarpaulins, geotextiles and wickerwork fencing).

PERFORMANCE

Yield: variable depending on the type of pollutant and the size of the spill (volume, surface area), what human resources and machines you have in addition to sea state and weather conditions.
Implementation: optimise the collection - transfer - storage - evacuation chain for transport to the treatment centre
Waste: pollutant + sediment + macro waste + soiled personal protective equipment + waste water

OBSERVATION

- Bar access to the public so as to protect them and avoid disseminating oil elsewhere (burying, polluting surrounding areas...): set up signposts and posters that people can see and read.
- In the interest of safety for all concerned, vehicles and responders will use different circulation patterns and lanes.
- Solid preparation and good knowledge of the area will be the key to the success of the operation.
- Knowing what the oil is going to do next depending on weather conditions, sea state and tidal coefficients will always be essential to the overall strategy and response.

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