NOWPAP MERRAC

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Marine Environmental Emergency Preparedness and Response
Regional Activity Centre

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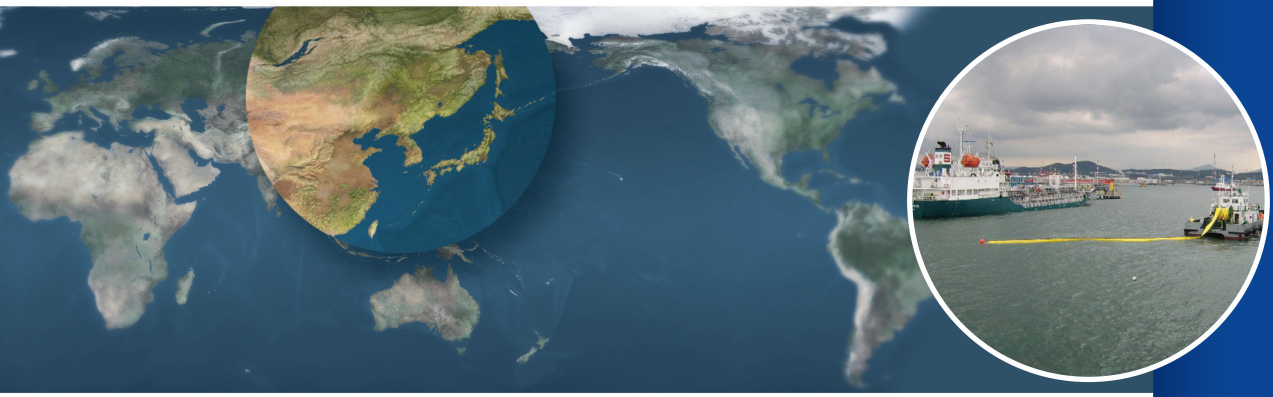
MINIMUM LEVEL OF PREPAREDNESS FOR RESPONSE TO OIL SPILL IN THE NOWPAP REGION



MERRAC Technical Report No. 5

Regional Seas

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Foreword

MERRAC, the Marine Environmental Emergency Preparedness and Response Regional Activity Centre, is one of four Regional Activity Centres of the Northwest Pacific Action Plan (NOWPAP) which was adopted in 1994 as a Regional Seas Programme of the United Nations Environment Programme (UNEP) by the People's Republic of China, Japan, Republic of Korea, and Russian Federation. MERRAC is responsible for regional co-operation on marine pollution preparedness and response in the region.

With technical support from the International Maritime Organization (IMO), MERRAC is currently functioning as secretariat for the NOWPAP MERRAC Focal Points Meeting, Expert Meeting, Competent National Authorities Meeting for NOWPAP Regional Oil Spill Contingency Plan (CNA meeting). The Centre also carries out other special activities including the management of a regional information system, organization of training and exercise, capacity building, co-ordination of research and development on the technical aspects of oil and Hazardous & Noxious Substances (HNS) spills.

As one of main outcomes of MERRAC activities, the NOWPAP Regional Oil and HNS Spill Contingency Plan (NOWPAP RCP) and its relevant Memorandum of Understanding (MoU) were developed and officially came into effect as being signed by all NOWPAP member states. The purposeof the NOWPAP RCP is to provide an operational mechanism for mutual assistance through which the member states will co-operate during major marine oil and HNS pollution incidents in the region

In order to provide practical and technical guidelines to promptly and effectively respond to major marine pollution accidents within the framework of the NOWPAP RCP, it was agreed to carry out the series of MERRAC Specific Projects related to oil spill prediction model, minimum level of preparedness for response to oil spill in the NOWPAP region, HNS response operation guidelines, HNS database in the NOWPAP region.

Through MERRAC Specific Projects, the technical report was developed by NOWPAP MERRAC based upon the decision of the 12th MERRAC Focal Points Meeting (June 2009). The Expert Group consisted of 5 experts who were nominated by MERRAC Focal Points as follows: Mr. Jijun LI (China, Leading Expert), Mr. Tetsuya YAMAJI (Japan), Dr. Moonjin LEE (Korea), Dr. Gennady SEMANOV (Russia, Co-Leading Expert) and Daniel CHAN (*Oil Spill Response*), and contributed to developing the technical report. MERRAC staffs (Dr. Jeong-Hwan OH, and Ms. Hyon-Jeong NOH) finalized and edited the report with technical support of MERRAC Focal Points, NOWPAP Regional Coordinating Unit (RCU), and IMO.

As Director of MERRAC, I would like to thank the MERRAC Focal Points and all experts of the Expert Group for their support and contributions to finalizing the MERRAC Technical Reports.

Seong-Gil Kang
Director of MERRAC

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PART II - EVALUATION AND MINIMUM LEVEL OF PREPAREDNESS

Introduction

The International Maritime Organization (IMO) and the United Nations Environment Program (UNEP) have encouraged co-operation between countries under the Regional Seas Program started in 1974. The spirit of international collaboration is aimed to promote regional progress in oil spill preparedness. There are considerable differences in the range of threats and impact of marine pollutants, ecological balance, and habitat change, according to different geographical regions of the world. Only by concerted actions of partners facing common problems and threats can there be a real prospect of improvement. Recognition of this truth is the heart of the Regional Seas Program, instituted by UNEP and supported by IMO.

Developing an appropriate level of readiness to deal with emergency situations first calls for a clear understanding of the events and the consequences that may occur. This is critical in allowing consideration of various issues that may arise when making decisions on measures to reduce the likelihood of events occurring at the level of preparedness necessary to mitigate their effects. A sound Risk Assessment is therefore an essential first step in enhancing preventative measures and in developing appropriate emergency preparedness and response arrangements.

The purpose of Minimum Level of Preparedness is to set forth key elements in essential preparedness and overall response capability to reduce consequences for any future oil spills in the NOWPAP region. It's also expected that the methodology provided in the report will facilitate each member to carry out their own assessment of their preparedness and assessment of the whole NOWPAP region for future improvement in every respect.

Taking into account the minimum response capability required by both the OPRC convention and the NOWPAP Regional Oil Spill Contingency Plan, and also taking into consideration the different understanding of the Minimum Preparedness in relation to the existing capability of each member and the whole NOWPAP region, it's necessary to provide a commonly accepted guideline for the NOWPAP members.

The 7th NOWPAP MERRAC Focal Points Meeting (MERRAC, Daejeon 18-21 May 2004) decided to initiate a new specific project on the Minimum Level of

Preparedness. The 2004 NOWPAP MERRAC EXPERT MEETING (Qingdao, People's Republic of China, 15 - 18 November 2004) discussed the background, purpose and objectives, the art of relating to the subject, possible organization for future works, and its work plan for this new specific project

Based upon the decision from the 8th MERRAC Focal Points Meeting held in MERRAC on May, 2005 (UNEP/IMO/NOWPAP/MERRAC/FPM 8/18), the new project to develop regional recommendations on the "Minimum Level of Preparedness to respond to oil spills at NOWPAP sea area" wascarried out by China and Russia. Their aim was to develop a regional recommendation and establish proper methodology of risk assessment and Level of Preparedness for the NOWPAP region. In this regard, Japanese delegation expressed his willingness to introduce a Japanese expert on maritime traffics and movement of oil tankers in the region.

This final report included consolidated list of conclusions and recommendations and presented results of work carried out by group of NOWPAP experts.

PART I - RISK ASSESSMENT

Chapter 1. Methodologies for the risk assessment on oil spills in NOWPAP region

The methodology developed in 2007 (see Annex A) describes the general approaches to risk assessment that can be applied to oil spills arising from a range of activities. However, while a generalized approach to risk assessment may be used for each type of activity, the depth of knowledge and information required for each approach will depend on the geographic and regulatory context of the risk assessment, as well as on the final application of the results from the risk assessment. One of the primary objectives of risk assessment, in the context of marine oil spills, is to establish the likelihood and the sizes of oil spills occurring in the considered area. This information can be used as basis for assessing the adequacy of preparedness, the required response capability to deal with that risk, and development investment programs.

It should be always remembered that as with all risk assessments, the risk model is not a precise method for assessing risk, and the results are subject to uncertainties when using the results to support decisions.

Scope of Risk Assessment

In the context of risk management, risk assessment is a technique for identifying, characterizing, quantifying, and evaluating hazards. As such, it is a process in identifying hazards and evaluating the risk of that hazard, whether in absolute or relative terms.

Benefits of Risk Assessment

1. Identification of High Risk Areas
2. Modification of Operations, Maintenance and Repair programs (Prevention)
3. Development of site–specific spill response strategies (Response)
4. Design input into operational factors
5. Development of investment programs

Risk assessment techniques are fundamentally the same whether applied to individual offshore installations, or ports and harbors, or even in a national or regional level. However, the execution and detail will vary considerably depending on the scale of the application. Risk assessment is a threat assessment of oil spills from shipping activities, and offshore oil and gas production in a specified area. It is also the aim to evaluate the adequacy of preparedness to respond, develop of precautionary measures to mitigate the consequences of spills, and reduce the risk of oil spills to an acceptable level. Expert Group has agreed to conduct a risk assessment for oil spills in ports of NOWPAP member states with the biggest oil handling volumes (Table 1-1).

Table 1-1. *Main oil terminals of NOWPAP member states*

NOWPAP country	Name of ports with an oil terminal	Quantity of oil handled ton/year
China	Qingdao	44, 050, 000
Japan	Yokohama oil terminal	16, 040 ,000
Korea	Yeosu oil terminal	22, 396, 000
Russia	Nakhodka oil terminal Vladivostok port	4 ,582, 400 2 ,163, 000

Oil spill risk assessments were conducted based on methods given in Annex A.

1.1. China's self assessment risk of oil spills

Initial data for risk assessment.
China has transported oil and oil products via Qingdao port in NOWPAP sea area.
Amount of oil transported via Qingdao oil terminal – 44,050,000 t/year,
Size of oil tanker (average) – 22,000 tons,
*This average is from a recent traffic record from Qingdao port.
Number of ship calls to and from Qingdao port – 2,000
Leg port of Qingdao approach – 5 miles

Models of estimates for likelihood of oil spills and its size
The evaluation of adequacy of preparedness to respond or development of precautionary measures is necessary to carry out a quantitative assessment of sizes and likelihood of oil spills.
According to the decisions of 2007 MERRAC meeting, every NOWPAP member state agreed to conduct a self assessment of oil spill risk. Methods for calculating the sizes and the likelihood of oil spills in considered area are given below.

1.1.1. Models of estimates on oil spill likelihood and its size

1.1.1.1. Oil spill at terminals

The following categories are used for spill sizes at oil terminals:
- **0 - 10 t**
- **10 - 100 t**
- **100 - 1,000 t**
- **Larger than 1,000 t.**

These are general models for all harbors and oil terminals, and only the number of calls at the installation is used as an explaining variable.

It's based on a statistical data:

- The likelihood of spills less than one ton per year is assessed as 0.5 - 5 spills per 100 million tons of handled oil. This is also mainly dependend on the production culture.

$N_{1.0} = Q*2.5/100$ (1)

Where

$N_{<1.0}$ – number of oil spills less than 1 ton,

Q – quantity of oil handled on oil terminal/port, per year, mil. tons

> ***The likelihood of spills less than one ton for port of Qingdao is***
> ***$N_{1.0} = 44*2.5/100 = 1.1$***

The likelihood of spills of more than 1 ton is based on accident statistics. The estimated number of spills is $5 \cdot 10^{-4}$ per call at the terminal.

$N_{>1} = S*5 \cdot 10^{-4}$ (2)

Where

$N_{>1}$ – number of oil spills on oil terminal/port per year

S – number of ship calls to oil terminal/port per year, taken into account of both empty and fully loaded tankers,

> ***The likelihood of spills of more than 1 t is***
> ***$N_{>1} = 2000*5*10^{-4} = 1$ - for port of Qingdao***

The likely distribution of the size of cargo spills larger than 1 t, determined according equation 2, is shown in Table 1.1-1.

Table 1.1-1. *Conditional likely distribution for cargo spills of more than 1 t*

Reported Interval	1-10 t	10-100 t	100-1000 t	> 1000 t
Fraction	0.79	0.17	0.036	0.008

The numbers for oil spills on oil terminal/port will be as followed:

$N_{>1} * 0.79 = P_1$ – spills less 10 tons,
$N_{>1} * 0.17 = P_2$ – spills more than 10 tons but less than 100 tons,
$N_{>1} * 0.036 = P_3$ – spills more than 100 tons but less than 1000 tons,
$N_{>1} * 0.008 = P_4$ – spills more than 1000 tons

$$P_{1\ qingdao} = 1 * 0.79 = 0.79$$
$$P_{2\ qingdao} = 1 * 0.17 = 0.17$$
$$P_{3\ qingdao} = 1 * 0.036 = 0.036$$
$$P_{4\ qingdao} = 1 * 0.008 = 0.008$$

1.1.1.2. Oil spills from vessels at sea

The estimates for likelihood and size of crude oil spills from vessels at sea are based on models described in (Rømer, 1996). The models are generalized models valid for tanker traffics from all over the world.

The models consist of the following:

- **Likelihood of an accident**
- **Likelihood of cargo/bunker spill**
- **Spill size distribution for cargo and bunker spills.**

The following spill size categories are used:

- **0 - 100 t**
- **100 - 1,000 t**
- **1,000 - 10,000 t**
- **10,000 - 100,000 t**
- **Larger than 100,000 t.**

The NOWPAP's statistics on frequency of accidents per million nautical miles in restricted waters (the distance between shores perpendicular to the direction of the ship lane is less than 75 nautical miles) is absent. It can accept, for the purposes of calculation, frequencies of other regions with heavy ship traffics listed in Table 1.1-2.

Table 1.1-2. *Basic frequency of accidents per million nautical miles in restricted waters*

Accident	Frequencies
Grounding	5.4 per 10^6 n.m.
Collision	1.9 per 10^6 n.m.
Structural Damage	0.48 per 10^6 n.m.
Fire/Explosion	0.063 per 10^6 n.m.

Results of calculation of likelihood of all oil spills and oil spills more than 100 tons are given in Table 1.1-3.

Table 1.1-3. *Likelihood of basic accidents and likelihood of oil spills at sea on approach to port Qingdao*

Accident	Likelihood of incidents (=8miles*Table 5)	Likelihood of oil spills (=Likelihood of incidents * left column of the Table *1.1.-4*)	Likelihood of oil spills more than 100 t. (=likelihood of oil spills* right column of the Table *1.1.-4*)
Grounding	$2.7\ 10^{-5}$	$0.8\ 10^{-6}$	$0.072\ 10^{-6}$
Collision	$9.5\ 10^{-6}$	$0.3\ 10^{-6}$	$0.027\ 10^{-6}$
Structural Damage	$2.4\ 10^{-6}$	$0.1\ 10^{-6}$	$0.009\ 10^{-6}$
Fire/Explosion	$0.3\ 10^{-6}$	$0.03\ 10^{-6}$	$0.003\ 10^{-6}$

According to 'Manual on Assessment of Oil Spill Risks and Preparedness," approved by MEPC 58, likelihood of one occurrence every 100 years can be considered as 'Extremely Rare." Therefore, incidents with oil tankers near port Qingdao are extremely rare

1.1.1.3. Likelihood of cargo spill

The conditional likelihood of a cargo spill of any size on any given accident, and the conditional likelihood that the spill is larger than 100 t are indicated in Table 1.1-4 for double hull tankers.

Table 1.1-4. *Conditional likelihood of oil spills and spills larger than 100 t*

	P(rel.|acc.)	P(rel.>100 t | rel.)
Grounding	0.03	0.09
Collision	0.03	0.09
Structural Damage	0.05	0.09
Fire/Explosion	0.1	0.09

Calculation of likelihood of a cargo spill of any size, caused by an accident, is carried out by multiplying the length of ship routs in territorial water in Table 1.1-2 and 1.1-4. See above for combined Table 1.1-3**.**

1.1.1.4. Distribution of cargo spill size above 100 t

The release size modeling is performed by a multiple linear regression model, except for the releases from groundings without the subsequent fire/explosion. The regression model is:

$$\textbf{\textit{Spill size}} = a \cdot DWT + b,$$

Where ***a*** and ***b*** are the regression constants indicated in Table 1.1-5 and *DWT* is the size of the tanker in dead weight tones.

Table 1.1-5. *Regression constants for spill size modeling*

	Subsequent fire/explosion	a	b
Collision	No	0	2000
Collision	Yes	0.16	3600
Grounding	Yes	0.68	4400
Structural Damage	No	0.034	6200
Structural Damage	Yes	0.16	3600
Fire/Explosion	-	0.68	4400

Sizes of oil spills from groundings without subsequent fire/explosion of tanker DWT = 22,000 tons is given in Table 1.1-6.

Table 1.1-6. *Sizes of oil spills in case of groundings without subsequent fire/explosion of tanker*

DWT =22,000 tons

	Subsequent fire/explosion	Size of oil spill, tons (=***a · DWT + b***)
Collision	No	2000
Collision	Yes	7120
Grounding	Yes	19360
Structural Damage	No	6948
Structural Damage	Yes	7120
Fire/Explosion	-	19360

For groundings without subsequent fire/explosion the likelihood distribution model given in Table 1.1-7 should be applied.

Table 1.1-7. *Likely distribution of fractions spilled from groundings without subsequent fire/explosion and sizes of oil spills*

% of total cargo spilled	Likelihood	Volume of spilt oil for 22000 t. tanker
5	½	= 22,000t*0.05 = 1,100
15	¼	= 22,000t*0.15 = 3,300
25	1/8	= 22,000t*0.25 = 5,500
35	1/16	= 22,000t*0.35 = 7,700
45	1/32	= 22,000t*0.45 = 9,900
55	1/64	= 22,000t*0.55 = 12,100
65	1/128	= 22,000t*0.65 = 14,300
75	1/256	= 22,000t*0.75 = 16,500
85	1/512	= 22,000t*0.85 = 18,700
95	1/512	= 22,000t*0.95 = 20,900

The likelihood of an accident with a spill of more than 100 t being followed by a fire/explosion caused by grounding, collision or structural damage can be determined by multiplying the likelihood of these events with figures shown in the Table 7 Annex A.

1.2. Japan's self risk assessment of oil spills

Initial data for risk assessment.
Japan has transported oil and oil products via port Yokohama in NOWPAP sea area
Amount oil transported via Yokohama oil terminal – 16 040 000 t/year,
Size of oil tanker (average) – 70 000 tons,
*This average is from the recent traffic record from port Yokohama.
Number of ship calls to and from port Yokohama – 198
Leg port of Yokohama approach – 4.5 miles
*Yokohama approach[8miles] is about the distance of Uraga suido traffic route.

1.2.1. Estimation of oil spill likelihood and its size

1.2.1.1. Oil spill at terminals

The following spill size categories at oil terminals are used:
- **0 - 10 t**
- **10 - 100 t**
- **100 - 1,000 t**
- **Larger than 1,000 t.**

These are general models for all harbors and oil terminals, and use only the number of calls at the installation for explaining variable. It is based on a statistical data.

The likelihood of spills less than one ton is assessed as 0.5 – 5 spills per 100 million tons of handled oil and depends mainly on production culture.

$$N_{1.0} = Q*2.5/100 \quad (1)$$

Where
$N_{<1.0}$ – number of oil spills less than 1 ton,
Q – quantity of oil handled on oil terminal/port, per year, mil. tons

The likelihood of spills less than one ton for port of Yokohama is
$N_{1.0}$ ***=16.4 *2.5/100= 0.401***

The likelihood of spills of more than 1 t is based on accident statistics. The estimated number of spills is $5 \cdot 10^{-4}$ per call at the terminal.

$$N_{>1} = S*5 \cdot 10^{-4} \quad (2)$$

Where

$N_{>1}$ – number of oil spills on oil terminal/port per year

S – Number of ship calls to oil terminal/port per year, taken into account both empty and fully loaded tankers,

> ***The likelihood of spills of more than 1 t is***
> ***$N_{>1}$ = 198*5*10^{-4} =0.099 – for port of Yokoyama***

The likely distribution of the size of cargo spills larger than 1 t, determined according to equation 2 is shown in Table 1.2-1.

Table 1.2-1. *Conditional likely distribution for cargo spills of more than 1 t*

Reported Interval	1-10 t	10-100 t	100-1000 t	> 1000 t
Fraction	0.79	0.17	0.036	0.008

Quantities of oil spills on oil terminal/port are as followed:

$N_{>1} * 0.79 = P_1$ – spills less 10 tons,

$N_{>1} * 0.17 = P_2$ – spills more than 10 tons but less than 100 tons,

$N_{>1} * 0.036 = P_3$ – spills more than 100 tons but less than 1000 tons,

$N_{>1} * 0.008 = P_4$ – spills more than 1000 tons

> $P_{1\ yokohama} = 0.099 * 0.79 = 0.07821$
>
> $P_{2\ yokohama} = 0.099 * 0.17 = 0.01683$
>
> $P_{3\ yokohama} = 0.099 * 0.036 = 0.003564$
>
> $P_{4\ yokohama} = 0.099 * 0.008 = 0.000792$

1.2.1.2. Oil spills from vessels at sea

The estimates of likelihood and size of crude oil spills from vessels at sea are based on models described in (Rømer, 1996). The models are generalized models valid for tanker traffics all over the world.

The models consist of the following:
- **Likelihood of an accident**
- **Likelihood of cargo/bunker spill**
- **Spill size distribution for cargo and bunker spills.**

The following spill size categories are used:
- **0 - 100 t**
- **100 - 1,000 t**
- **1,000 - 10,000 t**
- **10,000 - 100,000 t**
- **Larger than 100,000 t.**

The NOWPAP statistic of accident frequencies per million nautical miles in restricted waters (the distance between shores perpendicular to the direction of the ship lane is less than 75 nautical miles) is absent. It can accept, for the purposes of calculation, frequencies of other regions with heavy ship traffic listed in Table 1.2-2.

Table 1.2-2. *Basic frequency of accidents per million nautical miles in restricted waters*

Accident	Likelihood
Grounding	5.4 per 10^6 n.m.
Collision	1.9 per 10^6 n.m.
Structural Damage	0.48 per 10^6 n.m.
Fire/Explosion	0.063 per 10^6 n.m.

Results of calculation of likelihood of all oil spills and oil spills more than 100 tons are given in Table 1.2-3.

Table 1.2-3. *Basic likelihood of an accident and likelihood of oil spills on approach to port Yokohama*

Accident	Likelihood of incidents (=8miles*Table 5)	likelihood of oil spills (=Likelihood of incidents * left column of Table the *1.2.-4*)	likelihood of oil spills more than 100 t. (=Likelihood of incidents * right column of the Table *1.2.-4*)
Grounding	4.32 10^{-5}	1.30 10^{-6}	3.89 10^{-6}
Collision	1.52 10^{-5}	0.46 10^{-6}	1.37 10^{-6}
Structural Damage	3.84 10^{-6}	0.19 10^{-6}	0.34 10^{-6}
Fire/Explosion	0.50 10^{-6}	0.05 10^{-6}	0.05 10^{-6}

According to IMO 'Manual on Assessment of Oil Spill Risks and Preparedness" approved by MEPC 58, likelihood of one occurrence every 100 years can be considered as 'Extremely Rare', so incidents with oil tankers near port Yokohama are extremely rare

1.2.1.3. Cargo spill likelihood

The conditional likelihood of a cargo spill of any size in any given accident, and the conditional likelihood that the spill is larger than 100 t are indicated in Table 1.2-4 for double hull tankers.

Table 1.2-4. *Conditional likelihood of oil spills and spills larger than 100 t*

	P(rel.|acc.)	P(rel.>100 t | rel.)
Grounding	0.03	0.09
Collision	0.03	0.09
Structural Damage	0.05	0.09
Fire/Explosion	0.1	0.09

Calculation of likelihood of a cargo spill of any size, caused by an accident, is carried out by multiplying the length of ship routs in territorial water with appropriate figure in Table 1.2-2 and 1.2-4. See above for combined Table 1.2-3.

1.2.1.4. Distribution of cargo spill size if greater than 100 t

The release size modeling is performed by a multiple linear regression model, except for releases from groundings without subsequent fire/explosion.
The regression model is:

Spill size = a · DWT + b,

Where ***a*** and ***b*** are the regression constants indicated in Table 1.2-5 and *DWT* is the size of the tanker in dead weight tones.

Table 1.2-5. *Regression constants for spill size modeling*

	Subsequent fire/explosion	a	b
Collision	No	0	2000
Collision	Yes	0.16	3600
Grounding	Yes	0.68	4400
Structural Damage	No	0.034	6200
Structural Damage	Yes	0.16	3600
Fire/Explosion	-	0.68	4400

Sizes of oil spills caused by groundings without subsequent fire/explosion of tanker DWT = 70 000 tons is given in Table 1.2-6.

Table 1.2-6. *Sizes of oil spills caused by groundings without subsequent fire/ explosion of tanker*

DWT = 70000 tons

	Subsequent fire/explosion	Size of oil spill, tons (=***a · DWT + b)***
Collision	No	2000
Collision	Yes	19600
Grounding	Yes	72400
Structural Damage	No	9600
Structural Damage	Yes	19600
Fire/Explosion	-	72400

For groundings without subsequent fire/explosion, the likelihood distribution model given in Table 1.2-7 should be applied.

Table 1.2-7. *Likelihood distribution for fractions spilled from groundings without subsequent fire/explosion and sizes of oil spills*

% of total cargo spilled	Likelihood	Volume of spilt oil, tons, for 70000 t. tanker
5	½	= 70,000t*0.05 = 3,500
15	¼	= 70,000t*0.15 = 10,500
25	1/8	= 70,000t*0.25 = 17,500
35	1/16	= 70,000t*0.35 = 24,500
45	1/32	= 70,000t*0.45 = 31,500
55	1/64	= 70,000t*0.55 = 38,500
65	1/128	= 70,000t*0.65 = 45,500
75	1/256	= 70,000t*0.75 = 52,500
85	1/512	= 70,000t*0.85 = 59,500
95	1/512	= 70,000t*0.95 = 66,500

The likelihood of an accident with a spill of more than 100 t being followed by a fire/explosion in case of grounding, collision or structural damage can be determined by multiplying the likelihood of these events with figures shown in the Table 7 Annex A.

1.3. Korean self assessment risk of oil spills.

Initial data for risk assessment.
Korea has transported oil and oil products via port Yeosu in NOWPAP sea area
Amount oil transported via Yeosu oil terminal – 22,396,000 t/year,
Size of oil tanker (average) – 56,237 tons,
*This average is from the recent traffic record from port Yeosu
Number of ship calls to and from port Yeosu – 200
Leg port of Yeosu approach – 5 miles

Models for estimates on oil spill frequency and size.
Evaluation of adequacy of preparedness to respond or development of precautionary measures is necessary to carry out quantitative assessment of sizes and probability of oil spills.

According to the decisions from 2007 MERRAC meeting, every NOWPAP member state agreed to conduct self assessment of oil spill risk. Below, you can find methods of calculations for sizes and probabilities of oil spills in considered area.

1.3.1. Models for estimates on likelihood oil spill and size.

1.3.1.1. Oil spill at terminals.

The following spill size categories at oil terminals are used:
- **0 - 10 t**
- **10 - 100 t**
- **100 - 1,000 t**
- **Larger than 1,000 t.**

These are general models for all harbors and oil terminals, and it uses only the number of calls at the installation as an explaining variable.

It is based on statistical data:

- The likelihood of spills under one ton is assessed as 0.5 - 5 spills per 100 million tons of handled oil, and it depends mainly on production culture.

$$N_{1.0} = Q*2.5/100 \qquad (1)$$

Where

$N_{<1.0}$ – number of oil spills less than 1 ton,

Q – quantity of oil handled on oil terminal/port, per year, mil. tons

> ***The frequency of spills under one ton for port of Yeosu is***
> ***$N_{1.0}$ = 22.4*2.5/100 = 0.560***

The likelihood of spills of more than 1 t is based on accident statistics. The estimate of the number of spills is $5 \cdot 10^{-4}$ per call at the terminal.

$$N_{>1} = S*5 \cdot 10^{-4} \qquad (2)$$

Where

$N_{>1}$ – number of oil spills on oil terminal/port per year

S – number of ship calls to oil terminal/port per year, taken into account both empty and fully loaded tankers,

> ***The likelihood of spills of more than 1 t is***
> ***$N_{>1}$ = 7,055*5*10^{-4} = 0.100 – for port of Yeosu***

The probability distribution of the size of cargo spills larger than 1 t, determined according equation 2 shown in Table 1.3-4.

Table 1.3-4. *Conditional probability distribution for cargo spills of more than 1 t.*

Reported interval	1-10 t	10-100 t	100-1000 t	> 1000 t
Fraction	0.79	0.17	0.036	0.008

Quantities of oil spills on oil terminal/port will be as followed:

$N_{>1}$ * 0.79 = P_1 – spills less 10 tons,

$N_{>1}$ * 0.17 = P_2 – spills more than 10 tons but less than 100 tons,

$N_{>1}$ * 0.036 = P_3 – spills more than 100 tons but less than 1000 tons,

$N_{>1}$ * 0.008 = P_4 – spills more than 1000 tons

$$P_{1\ yeosu} = 3.53 * 0.79 = 0.079$$
$$P_{2\ yeosu} = 3.53 * 0.17 = 0.017$$
$$P_{3\ yeosu} = 3.53 * 0.036 = 0.0036$$
$$P_{4\ yeosu} = 3.53 * 0.008 = 0.0008$$

1.3.1.2. Oil spills from vessels at sea

The estimate of likelihood and size of crude oil spills from vessels at sea are based on models described in (Rømer, 1996). The models are generalized models valid for tanker traffics from all over the world.

The models consist of the following:
- **Frequency of accidents**
- **Probability of cargo/bunker spill**
- **Spill size distribution for cargo and bunker spills.**

The following spill size categories are used:
- **0 - 100 t**
- **100 - 1,000 t**
- **1,000 - 10,000 t**
- **10,000 - 100,000 t**
- **Larger than 100,000 t.**

The NOWPAP accident frequencies per million nautical miles in restricted waters (the distance between shores perpendicular to the direction of the ship lane is less than 75 nautical miles) is absent. It can be accepted, for purposes of calculation, frequencies of other regions with heavy ship traffic and listed in Table 1.3-5.

Table 1.3-5. *Basic accident frequencies per million nautical miles in restricted waters.*

Accident	Frequencies
Grounding	5.4 per 10^6 n.m.
Collision	1.9 per 10^6 n.m.
Structural damage	0.48 per 10^6 n.m.
Fire/Explosion	0.063 per 10^6 n.m.

Table 1.3-5a+6a. *Basic accident frequencies and probability of oil spills for port Yeosu.*

Accident	Frequencies of incidents (=5miles*Table 5)	Probability of oil spills (=Frequencies of incidents*left column of the Table 6)	Probability of oil spills more than 100 t. (=Frequencies of incidents*right column of the Table 6)
Grounding	$2.7\ 10^{-5}$	$0.8\ 10^{-6}$	$0.2\ 10^{-5}$
Collision	$9.5\ 10^{-6}$	$0.3\ 10^{-6}$	$0.8\ 10^{-6}$
Structural Damage	$2.4\ 10^{-6}$	$0.1\ 10^{-6}$	$0.2\ 10^{-6}$
Fire/Explosion	$0.3\ 10^{-6}$	$0.03\ 10^{-6}$	$0.03\ 10^{-6}$

According to the "Manual on Assessment of Oil Spill Risks and Preparedness" approved by MEPC 58, likelihood of one event occurring every 100 years can be considered as extremely rare*, therefore incidents with oil tankers near ports Yeosu are* extremely rare

1.3.1.3. Cargo spill probability

The conditional probability of a cargo spill of any size from an accident, and the conditional probability that the spill is greater than 100 t are indicated in Table 1.3-6 for double hull tankers.

Table 1.3-6. *Conditional probabilities of oil spills and spills larger than 100 t.*

	P(rel.|acc.)	P(rel.>100 t | rel.)
Grounding	0.03	0.09
Collision	0.03	0.09
Structural damage	0.05	0.09
Fire/Explosion	0.1	0.09

Calculation of probability of a cargo spill of any size caused by an accident is carried out by multiplying the length of ship routs in territorial water with the figures in Table 1.3-5 and 1.3-6. See above for combined Table1.3-5a+5b.

1.3.1.4. Distribution of cargo spill size if greater than 100 t

The release size modeling is performed by a multiple linear regression model, except for releases from groundings without subsequent fire/explosion.
The regression model is:

Spill size = a · DWT + b,

Where ***a*** and ***b*** are the regression constants indicated in Table 1.3-7 and *DWT* is the size of the tanker in dead weight tones.

Table 1.3-7. *Regression constants for spill size modelling.*

	Subsequent fire/explosion	a	b
Collision	No	0	2000
Collision	Yes	0.16	3600
Grounding	Yes	0.68	4400
Structural Damage	No	0.034	6200
Structural Damage	Yes	0.16	3600
Fire/Explosion	-	0.68	4400

Sizes of oil spills in case of groundings without subsequent fire/explosion of tanker DWT = 56,237 tons is given in Table 1.3-7a.

Table 1.3-7a. *Sizes of oil spills in case of groundings without subsequent fire/ explosion of tanker*

DWT = 56,237 tons

	Subsequent fire/explosion	Size of oil spill, tons (=***a · DWT + b)***
Collision	No	2,000
Collision	Yes	12,598
Grounding	Yes	42,641
Structural Damage	No	8,112
Structural Damage	Yes	12,598
Fire/Explosion	-	42,641

For groundings without subsequent fire/explosion, the probability distribution model in Table 1.3-8 applies.

Table 1.3-8. *Probability distribution for fractions spilled from groundings without subsequent fire/explosion, and sizes of oil spills.*

% of total cargo spilled	Probability	Volume of spilt oil, tons, for 56,237 t tanker
5	½	= 56,237t*0.05 = 2,812
15	¼	= 56,237t*0.15 = 8,435
25	1/8	= 56,237t*0.25 = 14,059
35	1/16	= 56,237t*0.35 = 19,683
45	1/32	= 56,237t*0.45 = 25,306
55	1/64	= 56,237t*0.55 = 30,930
65	1/128	= 56,237t*0.65 = 36,554
75	1/256	= 56,237t*0.75 = 42,177
85	1/512	= 56,237t*0.85 = 47,801
95	1/512	= 56,237t*0.95 = 53,425

The likelihood of an accident with a spill of more than 100 t, followed by fire/explosion in case of grounding, collision, or structural damage can be determined by multiplying the likelihood of these events with figures shown in the Table 7 Annex A.

1.4. Russian self assessment risk of oil spills

Initial data for risk assessment.
Russia has transported oil and oil products via port Nakhodka and port Vladivostok in NOWPAP sea area
Amount oil transported via
Nakhodka oil terminal – 4,582,400 t/year,
Vladivostok port – 2,163,000 t/year,
Size of oil tanker (average) – 20000 tons,
Number of ship calls to and from port Nakhodka – 460
Number of ship calls to and from port of Vladivostok – 220
Leg port of Nakhodka approach – 7 miles
Leg port of Vladivostok approach – 5 miles

1.4.1. Estimates likelihood of oil spill and its size

1.4.1.1. Oil spill at terminals

The following spill size categories for oil terminals are used:

- **0 - 10 t**
- **10 - 100 t**
- **100 - 1,000 t**
- **Larger than 1,000 t.**

These are general models for all harbors and oil terminals, and it uses only the number of calls at the installation as an explaining variable.

It is based on statistical data:

- The likelihood of spills less than one ton is assessed as 0.5 – 5 spills per 100 million tons of handled oil and depends mainly on production culture.

$$N_{1.0} = Q*2.5/100 \qquad (1)$$

Where

$N_{<1.0}$ – number of oil spills less than 1 ton,

Q – quantity of oil handled on oil terminal/port, per year, mil. tons

The likelihood of spills less than one ton for port of Nakhodka is
$N_{1.0}$ =4.58 *2.5/100= 0.1

The likelihood of spills less than one ton for port of Vladivostok is
$N_{1.0}$ =2.16 *2.5/100= 0.06

The likelihood of spills of more than 1 t is based on accident statistics. It was estimated that the number of such spills is $5 \cdot 10^{-4}$ per call at the terminal.

$$N_{>1} = S*5 \cdot 10^{-4} \qquad (2)$$

Where

$N_{>1}$ – number of oil spills on oil terminal/port per year

S – number of ship calls to oil terminal/port per year, taken into account both empty and fully loaded tankers,

The likelihood of spills of more than 1 t is
$N_{>1} = 460*5*10^{-4} = 0.23$ – for port of Nakhodka
$N_{>1} = 220*5*10^{-4} = 0.12$ – for port of Vladivostok

The likely distribution of the size of cargo spills larger than 1 t, determined according equation 2, is shown in Table 1.4-1.

Table 1.4-1. *Conditional likely distribution for cargo spills of more than 1 t*

Reported interval	1-10 t	10-100 t	100-1000 t	> 1000 t
Fraction	0.79	0.17	0.036	0.008

Quantities of oil spills on oil terminal/port will be as followed:

$N_{>1} * 0.79 = P_1$ – spills less 10 tons,

$N_{>1} * 0.17 = P_2$ – spills more than 10 tons but less than 100 tons,

$N_{>1} * 0.036 = P_3$ – spills more than 100 tons but less than 1000 tons,

$N_{>1} * 0.008 = P_4$ – spills more than 1000 tons

$P_{1\ nakhodka} = 0.23 * 0.79 = 0.2$	$P_{1\ vladivostok} = 0.12 * 0.79 = 0.09$
$P_{2\ nakhodka} = 0.23 * 0.17 = 0.04$	$P_{2\ vladivostok} = 0.12 * 0.17 = 0.02$
$P_{3\ nakhodka} = 0.23 * 0.036 = 0.008$	$P_{3\ vladivostok} = 0.12 * 0.036 = 0.004$
$P_{4\ nakhodka} = 0.23 * 0.008 = 0.002$	$P_{4\ vladivostok} = 0.12 * 0.008 = 0.001$

1.4.1.2. Oil spills from vessels at sea

The estimates of likelihood and size of crude oil spills from vessels at sea are based on models described in (Rømer, 1996). The models are generalized models valid for tanker traffic all over the world.

The models consist of the following:

- **Likelihood of an accident**
- **Likelihood of cargo/bunker spill**
- **Spill size distribution for cargo and bunker spills.**

The following spill size categories are used:

- **0 - 100 t**
- **100 - 1,000 t**
- **1,000 - 10,000 t**
- **10,000 - 100,000 t**
- **Larger than 100,000 t.**

The NOWPAP statistic of accident applicable per million nautical miles in restricted waters (the distance between shores perpendicular to the direction of the ship lane is less than 75 nautical miles) is absent. It can be accepted, for purposes of calculation, frequencies of other regions with heavy ship traffic as listed in Table 1.4-2.

Table 1.4-2. *Basic accident applicable per million nautical miles in restricted waters*

Accident	Likelihood
Grounding	5.4 per 10^6 n.m.
Collision	1.9 per 10^6 n.m.
Structural Damage	0.48 per 10^6 n.m.
Fire/Explosion	0.063 per 10^6 n.m.

Results of calculation of likelihood of all oil spills and oil spills more than 100 tons are given in Table 1.4-3a and 1.4-3b.

Table 1.4-3a. *Basic likelihood of an accident and likelihood of oil spills for port Nakhodka*

Accident	Likelihood of incidents (=7miles*Table 5)	likelihood of oil spills (=Likelihood of incidents * left column of the Table *1.4.-4*)	likelihood of oil spills greater than 100 t. (=Likelihood of incidents * right column of the Table *1.4.-4*)
Grounding	$3.8\ 10^{-5}$	$1.1\ 10^{-6}$	$3.4\ 10^{-6}$
Collision	$1.3\ 10^{-5}$	$0.4\ 10^{-6}$	$1.2\ 10^{-6}$
Structural Damage	$3.4\ 10^{-6}$	$0.2\ 10^{-6}$	$0.3\ 10^{-6}$
Fire/Explosion	$0.4\ 10^{-6}$	$0.04\ 10^{-6}$	$0.04\ 10^{-6}$

Table 1.4-3b. *Basic likelihood of an accident and likelihood of oil spills for port Vladivostok*

Accident	Likelihood of incidents (=5miles*Table 5)	likelihood of oil spills (=Likelihood of incidents * left column of the Table *1.4.-4*)	likelihood of oil spills greater than 100 t. (=Likelihood of incidents * right column of the Table *1.4.-4*)
Grounding	$2.7\ 10^{-5}$	$0.8\ 10^{-6}$	$0.2\ 10^{-5}$
Collision	$9.5\ 10^{-6}$	$0.3\ 10^{-6}$	$0.8\ 10^{-6}$
Structural damage	$2.4\ 10^{-6}$	$0.1\ 10^{-6}$	$0.2\ 10^{-6}$
Fire/Explosion	$0.3\ 10^{-6}$	$0.03\ 10^{-6}$	$0.03\ 10^{-6}$

According to the IMO Manual on Assessment of Oil Spill Risks and Preparedness, approved by MEPC 58, events with likelihood of ***one occurrence every 100 years can be considered as Extremely Rare, so incidents with oil tankers near ports Nakhodka and Vladivostok are extremely rare.***

According to Russian standard RD 03-418-01, events with likelihood of less than 10^{-4} ***can be considered nearly improbable, so incidents with oil tankers near ports Nakhodka and Vladivostok are practically impossible.***

1.4.1.3. Cargo spill likelihood

The conditional likelihood of a cargo spill of any size in an accident, and the conditional likelihood that the spill is larger than 100 t are indicated in Table 1.4-4 for double hull tankers.

Table 1.4-4. *Conditional likelihood of oil spills and spills larger than 100 t*

	P(rel.|acc.)	P(rel.>100 t | rel.)
Grounding	0.03	0.09
Collision	0.03	0.09
Structural Damage	0.05	0.09
Fire/Explosion	0.1	0.09

Calculation of likelihood of a cargo spill of any size in case of an accident is carried out by multiplying the length of ship routs in territorial water with appropriate figure in Table 1.4-2 and 1.4-4. See the above combined Table 1.4-3.

1.4.1.4. Distribution of cargo spill size, if above 100 t

The release size modeling is performed by a multiple linear regression model, except for releases from groundings without subsequent fire/explosion.
The regression model is:

Spill size = a · DWT + b,

Where ***a*** and ***b*** are the regression constants indicated in Table 1.4-5 and *DWT* is the size of the tanker in dead weight tones.

Table 1.4-5. *Regression constants for spill size modeling*

	Subsequent fire/explosion	a	b
Collision	No	0	2000
Collision	Yes	0.16	3600
Grounding	Yes	0.68	4400
Structural Damage	No	0.034	6200
Structural Damage	Yes	0.16	3600
Fire/Explosion	-	0.68	4400

Sizes of oil spills in case of groundings without subsequent fire/explosion of tanker DWT = 20 000 tons is given in Table 1.4-6.

Table 1.4-6. *Sizes of oil spills in case of groundings without subsequent fire/ explosion of tanker*

DWT = 20,000 tons

	Subsequent fire/explosion	Size of oil spill, tons (=*a* · ***DWT*** + ***b)***
Collision	No	2000
Collision	Yes	6800
Grounding	Yes	18000
Structural Damage	No	6880
Structural Damage	Yes	6800
Fire/Explosion	-	18000

For groundings without subsequent fire/explosion, the likelihood distribution model given in Table 1.4-7 should be applied.

Table 1.4-7. *Likelihood distribution for fractions spilled from groundings without subsequent fire/explosion and sizes of oil spills*

spilled	Likelihood	for 20,000 t. tanker
5	½	= 20,000t*0.05 = 1,000
15	¼	= 20,000t*0.15 = 3,000
25	1/8	= 20,000t*0.25 = 5,000
35	1/16	= 20,000t*0.35 = 7,000
45	1/32	= 20,000t*0.45 = 9,000
55	1/64	= 20,000t*0.55 = 11,000

% of total cargo spilled	Likelihood	Volume of spilt oil, tons, for 20,000 t. tanker
65	1/128	= 20,000t*0.65 = 13,000
75	1/256	= 20,000t*0.75 = 15,000
85	1/512	= 20,000t*0.85 = 17,000
95	1/512	= 20,000t*0.95 = 19,000

The likelihood of an accident with a spill of more than 100 t being followed by a fire/explosion in case of grounding, collision or structural damage can be determined by multiplying the likelihood of these events with figures shown in the Table 7 Annex A.

Chapter 2. Results of oil spill risk self assessment

Calculations of likelihood and sizes of oil spills at oil terminals and at sea while on approach to ports, made by expert group, are summarized in Tables 2-1, 2-2 and 2-3.

Table 2-1. *Oil spills at terminals*

NOWPAP country, oil terminal	Oil handled volume, mln. tons/year	Average size of oil tanker, thousand tons	Number ship's calls	Oil spill size interval, tons	Likelihood per year
China	44.0	22 000	2000	Less 1 1-10 10-100 100-1000 More than 1000	1.1 0.79 0.17 0.036 0.008
Japan	16.0	70 000	198	Less 1 1-10 10-100 100-1000 More than 1000	0.4 0.078 0.016 0.004 0.0008
Korea	22.4	3174	7055	Less than 1 1-10 10-100 100-1000 More than 1000	0.56 2.79 0.6 0.13 0.03
Russia, Nakhodka	4,6	20 000	460	Less 1 1-10 10-100 100-1000 More than 1000	0.23 0.2 0.04 0.008 0.002
Vladivostok	2,2	20 000	220	Less 1 1-10 10-100 100-1000 More than 1000	0.12 0.09 0.02 0.004 0.001

Table 2-2. *Likelihood of oil spills from vessels at sea while on approach to ports*

NOWPAP country, oil terminal	Oil handled volume, mln. tons/year	Average size of oil tanker, thousand tons	Number of ship's calls	Likelihood of oil spill *E-06 all spills/spills more than 100 t., in case			
				Grounding	Collision	Structural Damage	Fire/ Explosion
China	44.0	22 000	2000	0.8 0.072	0.3 0.027	0.1 0.009	0.03 0.003
Japan	16.0	70 000	198	1.3 3.89	0.46 1.37	0.19 0.34	0.05 0.05
Korea	22.4	3174	7055	0.8 2.0	0.3 0.8	0.1 0.2	0.03 0.03
Russia, Nakhodka	4,6	20 000	460	1.1 3.4	0.4 1.2	0.2 0.3	0.04 0.04
Vladivostok	2,2	20 000	220	0.8 2.0	0.3 0.8	0.1 0.2	0.03 0.03

Table 2-3. *Sizes of oil spills from vessels at sea while on approach to ports*

NOWPAP country, oil terminal	Average size of oil tanker, tons	Size of oil spills, t., in case			
		Grounding/ Subsequent fire-explosion	Collision/ Subsequent fire-explosion	Structural Damage/ Subsequent fire-explosion	Fire/ Explosion
China	22 000	/19360	2000/7120	6948/7120	19360
Japan	70 000	/72400	2000/19600	9600/19600	72 400
Korea	3174	This Method is not applicable for tankers less than 10 000 t.			
Russia	20 000	/18000	2000/6800	6800/6880	18000

PART Ⅱ - EVALUATION AND MINIMUM LEVEL OF PREPAREDNESS

Chapter 1. Key elements of preparedness and requirement

Based on the previous spill risk assessment method and taking into account of the charateristics of NOWPAP region, Minimum Level of Preparedness for the NOWPAP region can simply be generalized into four key elememts:

- Coordinating Capability
- Monitoring and Alerting Capability
- Response Capability
- Support Capability

Each key element consists of sub-elements(component), which will further be discussed respectively with their specific requirements listed below.

1.1. Coordinating Capability

Coordinating capability is an essential element in oil spill response preparedness. It’s also the fundamental principle in management of overall aspects in oil spill response. An adequate coordinating capability will make all activities and efforts more stabilized to better mitigate the consequence of emergency pollution accident. To meet this goal, following minimum components must be in place and applicable at all times.

1.1.1. Contingency planning

As a basic requirement, stipulated by both OPRC convention and NOWPAP regional plan, all member states should ensure that effective tiered oil spill response plans are established accordingly. They must also ensure the effectiveness of such plans for implementation in an emergency situation.

Under the internationally adopted system, oil spill incidents are categorized into 3 tiers. Each tier is defined by the scale of response that is required and whether that response comes from local, regional or national/international resources. Henceforth, the tiers are not only related to spill volume but also to the spill site, as different oils in different locations may require significantly different responses. Some countries may require fewer levels of response and thus fewer plans than other states. However, a minimum of two response levels such as tier 1 and tier 2 should be established by each NOWPAP member. And in case of a situation that requires tier 3 response, this shall be dealt with by the NOWPAP regional contingency plan.

Basic requirements:

- Tier 1: Oil terminal, or port and vessel specific contingency plans should cover Tier 1 spills. Individual oil companies and port administrations should develop, implement, and maintain such plans. Members should require ports, oil handling facilities, and offshore oil operations to have the capability to respond to small spills at ports that can be dealt with by local resources
- Tier 2: Tier 2 spills are covered by National Marine Spill Contingency Plans (hereinafter referred to as the National Plan). Each member is obligated to develop, implement and maintain a National Plan. Members should also ensure that there are resources available for dealing with larger spills which, although localized, may require resources to be brought in from national stockpiles or from other sources within the Member. Consideration should be taken as to how to cope with external assistance in dealing with Tier 3 spills, which may be beyond their individual capabilities. But in case of a NOWPAP member, tier 3 may be managed by NOWPAP regional plan through close cooperation with NOWPAP members.

1.1.1.1. Development of contingency plan

The planning process of contingency plan is all the more important than the final one as it provides an opportunity for cross-training and problem-solving among the various response organizations in a less stressed situation. The success of the plan depends on the participation of the response community, as well as from the local resource experts. The local experts are already likely to be involved in the spill as well as being one of the key components for a successful plan. For example, response contractors, who understand the basis for setting protection priorities, can make better decisions in the field as they fine-tune the response to the environmental conditions of each spill. Resource managers, who understand performance limitations and logistical requirements of equipment in their areas, can participate more effectively in developing workable response strategies. There is no benefit to resource managers when they recommend booming strategies in locations where boom is operationally unfeasible or has a high likelihood of failure. However, when operations and natural resource personnel work together in the initial stage, feasible strategies can be developed to protect sensitive resources. Developing the contingency plan is only the first step, and field-check of each priority site and revision of the plan and regular exercise, based on different scenarios, should be carried out so as to make the plan workable and response more effective in a crisis situation.

Requirement:

A successful contingency plan should at least adhere to the following components:

- Follow closely the IMO guideline for contingency planning;
- Practical risk analyses and assessment of the areas in question with thoughtful, deliberate integration of all available and applicable science applied.
- Scenario-based, predefined proper response measures such as mechanical recovery, chemical treatment, in-situ burning and other alternatives to deal with all possible spill situations.
- Contingency plans of different levels should be integrated between vessel, offshore facility, and onshore facility response plans, for easy shift of overall control and management of an accident.
- Be flexible enough to allow for command and control of oil spill to pass to the regional joint command center or for co-operation with industry or contracting parties when required in a controlled and predictable way. With such mechanisms, pollution incident may be escalated to a tier three level of response and passed back to the local authority within the plan without the impact of the response operation.
- Identification of place of refuge and provision of all response resources necessary with all information needed for quick and effective response to each scenario.
- Along with Annex, a list of all available equipments and possible mobilizing resources, as well as the location of the staging should be attached.
- Plans should be reviewed or updated periodically, especially when a major change is deemed significant to the effectiveness of the plan or when incorporate experience is gained from regular exercises and actual incidents.

- Once the plan is ready, it should be adequate enough to serve as a guide for actions to remove the worst case discharge, and to mitigate or prevent a substantial threat of such a discharge from a vessel operating in or near the area, offshore facility, or onshore facility.

1.1.1.2. Training & exercise

In order to ensure that contingency plans work efficiently, training & testing are both essential in making all responders and qualified parties competent for their role in real response. In this regard, it's recommended that NOWPAP members clearly define the requirements for training & testing in their plans, and make other proper arrangements accordingly. Training should be conducted by members approved by each national training organization and by NOWPAP. Competent accredited training provider is necessary, not only for professional spill responders, vessels and aircraft crews, equipment operators, shoreline cleanup personnel, command teams, but also for volunteers, military soldiers and all those that might be used as backup resources for shoreline cleanups. The minimum level of training and content required should be appropriate for risk assessment and present and future roles that participants are expected to take. For example, all the staff members who will operate oil spill response equipments, need to be fully aware of correct and safe deployment techniques. Members shall require holder of plans of each level to ensure that response personnel are trained to perform their jobs as listed in their plans as well as exercises conducted for full implementation and evaluations of all aspects related to the plan.

Requirements:

- Frequency of training of each level is two years from the date of issue from previous training certificate.
- The proposed duration for the training concerned is dependent on the content covered.
- Course content should cover all subjects as long as such content can benefit enhancement of preparedness capability of NOWPAP regional contingency plan, and national and local plan for different participants involved.
- Deployment of tier 1 equipment at least every five month and deployment of Tier 2 equipment at least once a year.
- Exercise is a preferred scenario-based design that could actually test real response capability of client facilities. Scenarios can include oil spill discharge incidents involving vessels, marine/river terminals, facilities, pipelines, offshore facilities, etc.

- Careful consideration should be given to ensuring that all those with a role in real response are incorporated in the exercise and the range of equipment cited in the plan is deployed.
- Type of the exercise may include:
  a. Notification Exercise - announced or unannounced
  b. Mobilization Exercise
  c. Table-Top Exercise
  d. Incident Management Exercise
  e. Balanced Program Exercise
  f. Joint Exercise
  g. Post Exercise Review

1.2. Response organizing

1.2.1. Lead agency and commanding system

Different agencies or organizations will be responsible for the organizing of different level of response, but overall coordination by a designated lead agency or authority is most essential for success. In view of different situation of NOWPAP members, with different commanding structure, it's recommended that a lead agency should be clearly designated for the overall coordinating of response, using the proper managing system as deemed appropriate by each member. However, as a basic requirement, Incident Command System is recommended since the system provides a standardized organizational structure that is flexible yet provides compatibility between agencies and events while ensuring accountability and standardized records. The system clearly defines roles and responsibilities, and it provides interoperability between agencies allowing for the greater ability to escalate or downsize the response as it sees fit. Incident Command System lists four major functional task groups that are essential during a marine pollution response: Planning, Operations, Logistics and Finance. These form the main elements of the organizational structure.

In addition, command post and backup should also be defined. It's a location that can be rapidly converted for use by the lead agencies. Requirements include ability to rapidly connect many lines of communication in order to have access to external media (TV coverage), and ability to provide access to crisis management plans, etc. Also, there should be a backup command post located off-site, in the event that evacuation is necessary, so long as the necessary bandwidth for communication and other resources is put in place so that set-up can be swift.

1.2.2. Resource agencies

To deal with an oil spill in a well organized manner, one needs combined efforts from all resource agencies and timely assistance from those potential industrial sectors and stakeholders that have proven most beneficial in a crisis situation. In order to meet situations like Tier 3 oil spill, lead agency of each NOWPAP member should make arrangements to ficilitate available response resources to be more accessable from resource agencies like customs, imigration offices, department of foreign affairs, environment agency, etc, when required by other members. Therefore, as a basic requirement, each NOWPAP member is expected to identify all the resource agencies that are likely to be involved in a spill response with information such as contact person(successor), information sharing method, roles and responsibilities, and working procedures during an emergency. All of this should be clearly defined as early as possible.

1.3. Decision making

Well considered and timely decision is essential for a quick and effective spill response. In fact, there are many unknown factors, both internal and external, that may affect good decision-making. In general, there are some basic elements that must be possessed in making the right decision.
As for internal factors, it’s required that the decision makers should have:

- Reasonable knowledge of policies, response and assessment strategy, problem-solving ability, decision making skills, and the ability to best apply such knowledge.
- Be constantly informed of what is going on, what will happen next, and what the worst case scenario will be.
- Profound experience related to his post.
- Inner quality to remain calm in critical moments.
- Access to technical and legal support from all potential organizations involved.

External factors will likely affect decision making:

- Resources available for mobilization and applicability
- Knowledge of sensitive area locations and protection priority
- Prevailing conditions and time allowed for mobilization and transport of response resources
- Expertise of response personnel
- Assistance from industry and other available sectors
- Experience and lessons gained from previous spills

Chapter 2. Monitoring and Alerting Capability

Monitoring and alerting capability is the ability **to detect** oil spills or discharges at the earliest stage, able to provide information such as site of the spill, its direction, movement, extent, appearance, etc. Such information can help make early and reasonable decisions leading to effective control of response operation.

In fact, monitoring is also one of the response strategies, even though the actual response operations may not take place at sea or on shoreline. As for monitoring and alerting capability, it includes localizing, identification, and tracing of the oil in the aquatic environment, as well as possession of appropriate available vessels, under-water detection facilities, applicable technology, aircraft surveillance, along with every other means for this particular purpose.

For this ability, basic requirements are:

Basic requirements

- Available facilities and equipments for identification of the polluter, observation and measurement of properties of the pollutant, and other required necessary functions.
- Airborne and satellite surveillance. It is recommended that each member have sufficient number of suitable aircraft, trained personnel, and support infrastructure to maintain visual observation of spill response operations within the member's jurisdiction.
- Observers should be able to maintain continuous communications with command and control personnel on the ground and with on-water response resources.
- Side-Looking Airborne Radar (SLAR) is useful for locating oil spills at sea. Infrared and Ultra Violet (UV) Line Scanner imaging equipment is very good for aiding in assessment of the oil spill extent. Micro Wave Radiometer is helpful in defining the thickness of an oil slick. Low-light level camera is helpful for night identification. It would be a great benefit to have such equipments available onboard.
- Suitable navigation equipment like Global Positioning System (GPS) would ensure an accurate display of search areas and spray patterns, and also give control of activities of other resources during counter pollution operations;

- Comprehensive communications equipment such as multi-function VHF FM radio, etc.
- Highly trained and experienced aircrew and relevant personnel who are able to operate and interpret the results of the above equipments.
- Facilities capable of receiving, processing, and distributing of remote-sensing imagery are also necessary.
- Emergency alert systems that can make all the parties concerned informed allowing for quick mobilization and deployment of response resources during the initial stages.

Chapter 3. Response capability

Response capability is a general term referring to the overall effective management of all chains of activities involved in a spill response. Since some of the elements are already addressed, a simple definition in this context will be given. A response capability simply refers to the capability of on-water response and shoreline cleanup, as well as other issues closely related to such operations.

3.1. On-water response

Oil spill response is not an exact science, therefore there are different approaches as to the best response. On-water response should be aimed at reducing surface oil as much as possible before oil comes ashore. There are many related issues like properties of oil, availability of recovery equipment, required expertise, weather conditions, spill site, etc. However, to achieve an effective on-water response, efforts should be made in the early stages of preparedness such as defining response strategy, way of controlling and recovering spilled oil, and equipment likely to be involved.

As basic requirement for effective on-water response, members should meet the following requirements:

- Identify beforehand the high risk areas at sea with regard to the economic and environment value, physical features, ocean current, prevailing wind, water depth, and different marine resources. Be sure to prioritize accordingly;
- Define beforehand the response measures that are acceptable and that are prohibited (maybe) from application in each area, not only based on the frequency and volume of oil being handled, but also on the assessment of the actual situation by the operator concerned and on the collective consensus of all of the parties responsible for protecting the country's resources.
- Be well prepared with response measures in place to respond to different on-water spill scenarios according to the circumstances of the spill and conditions prevailing. Measures used for on-water response may include:
    - Monitoring the oil slick, if marine or coastal resources are not threatened,
    - Attempt to control the source, and contain and recover the oil at sea.

- Protect key resources. Consider application of chemical treatment or in-situ burning, if marine or coastal resources are threatened,
- Any combination of the above.

When applying these measures, assessment procedure should be assured of making such decisions as to possibly mitigate the damage caused by the spill and minimize the environmental damage while taking into full considerations the priority of protecting resources. Also, during a response to an oil spill, attention should be given in the order or priority such as human health and safety, sensitive area, etc.

However, in assessing protection priorities, it is necessary to maintain a balanced view of the potential success of particular response strategies in combination with environment damage. The importance of human health and safety in any response operation cannot be overstressed.

3.1.1. Source Control

In case of an oil spill, the first important attempt is to control the spill at the source as far as possible. Damage can possibly be reduced if such attempt works well in the initial stage. Various measures can be taken to stop the flow of oil, such as capping, shutting off of valve, blocking, surveying of under-water, transferring, emergency towing, etc. These approaches can be used individually or used in combination based on the prevailing conditions at the time of the incident.

Transferring Capability

In most cases, transferring of operation is needed for removal of oil from one place to another in case of marine casualties, or in places where tank cargo is loaded or unloaded. For a smooth transferring operation, especially during an emergency situation, members shall meet the following minimal preparation requirements.

- Be ready with empty tanks, together with lists of contacts for existing equipments and predetermined ways of access to them. In the case of oil tankers, barges and other vessels, which can be readily accessible for receiving cargo oil, they can be listed for use in emergency transferring operations when called upon.
- The equipment may include pumps, power packs, hoses, fenders, communication equipments, protective clothing, breathing apparatus, and

still gas generators. And such preparedness should be sufficient for an operation and applicable to the types of oil mostly handled.

- Operation platform (barge, response vessels, etc)
- Sufficient Storage facilities for transferring, and disposal of removed oil and oil-contaminated materials.
- Other tools or facilities required in source control.
- Each member should select an adequate strategic means for transferring available resources for assistance to other member states upon requests.

3.1.2. Emergency towing

In situations such as lost propulsion or steering, grounding, or a hull breach resulting in release of cargo or bunkers, the distressed vessel may often require emergency towing so as to prevent spills or minimize its impact. Thus, the assistance of an emergency towing vessel is usually required.

As required by the International Maritime Conventions, tanker ships operating in international waters should have on board an emergency towing equipment and should conduct emergency towing drills. The International Convention for Safety of Life at Sea (SOLAS) Chapter 5, Regulation 15.1 requires all tankers, of 20,000 deadweight tons and above and built after January 1996, to be fitted with emergency towing arrangements at both ends of the ship.

In view of the existing situation in each NOWPAP member, it's recommemded that investigations are first carried out on the largest vessels operating in their sea area, especially in the major oil transport ports. Additional focus will be given to status of readiness, range of operation, availability of replacement parts in cases of repairs, possibility of regional or national co-operation, and combining of existing capacity. This will be followed by selection of response vessel most suitable for the area in question. Emergency towing can be fulfiled, not only by the designated emergency towing vessels, but also by random vessesls at hand if the latter is capable enough for the operation specific to the situation.

Basic requirement:

- For designated emergency towing vessel: In general, ETOW vessels should be able to tow away the largest tanker in emergency situation. And additionally, they must meet the following reqiurements:
  - Port for the ETOW vessel

- Permanent or limited readiness (i.e. sail within 1 or 2 hours)
- Speed, draught, bollard pull, maneuverability, endurance at sea
- Rough sea capabilities (operations possible in at least Beaufort 9)
- Modern navigation, On Scene Commander-facilities (communication and documentation equipment, etc.)
- Experienced crew, training, sufficient personnel for boarding assistance
- Special features for safety (i.e. explosion proof deck machinery)
- Multi-purpose tasking features.
- Equipped with towing facilities installed on board

➢ For other vessels likely used for towing: Tug boats and other rescue vessels, that provide emergency towing, are equipped with tow lines that can be passed to a disabled vessel. However, under adverse weather conditions, it may not be possible to successfully pass a tow line to the deck of a disabled vessel. Thus, vessels designated for temporay towing operation should also maintain a towing pennant or bridle of adequate strength that may be attached to a strong point or points and passed through a chock or chocks to the water. A brightly colored floating buoy should be secured to the end of the pennant or bridle so the tow vessel can easily locate, retrieve, and secure it to their tow line. A disabled vessel with no power for deck winches will have to pay out one or more tow lines to the tow vessel in a controlled manner. Many ships today use Spectra, Plasma, or other strong synthetic mooring lines which may be adequate to arrest the drift of the vessel until a stronger tow line is deployed. Other types of mooring lines are not recommended for emergency towing. All emergency towing gear should be approved by the official authorities and endorsed by the appropriate classification society prior to use. This is essential to ensure the safety of personnel deploying these equipments.

➢ Recommendations for ships without emergency towing equipment on board: There are some vessels without dedicated emergency towing equipment installed on board, but may be mobilized for towing operations during crisis situation. Therefore, such vessels are required to identify its strong points and aft to which an emergency tow line can be attached. Mooring bitts and aft must be secured to structural members to be strong enough to withstand the force of a tow line in the event of an emergency. A towing bridle of suitably strong material may be used to distribute the force between mooring bitts. Another strong point used successfully for emergency towing is the anchor windlass on the bow. A large chain may be secured around the base of the windlass with shackles so that an emergency tow line can be attached. The anchor chain itself may be used as an attachment point for the tow line if the chain is secured from running out. It is important to identify the strong points on your ship that can be used for emergency towing before an emergency towing situation occurs.

➢ Emergency towing procedure

The best way to ensure full readiness for emergency towing vessels is to have a clearly written out emergency towing information and procedures. And, the crew members should be regularly trained (at least every six months). Emergency towing drills to safely connect and deploy the equipment under emergency conditions should be scheduled. An emergency towing drill is recommended when a significant number of crew members are replaced. The emergency towing procedures shall include:

- Identification of the location and capacity of each strong point.
- Locations, capacity, use of shackles, connecting links, and other connection equipment.
- Connection procedures, including the use of a line throwing gun if available.
- Basic towing safety, including emergency release procedures.
- Lights and day shapes to be displayed along with radio broadcast warnings.

In addition to clearly written procedures, it is essential for the crew members to be trained to safely connect and deploy the equipment under emergency conditions. The crew should conduct regularly scheduled emergency towing drills. An emergency towing drill is recommended at least once every six months or when a significant number of crew members are replaced.

3.1.3. Mechanical recovery

Mechanical recovery is one of the most popular and effective oil spill response techniques currently used for recovering oil from the sea surface. It can reduce large amounts of surface oil at sea from coming ashore, if the conditions allow it. Mechanical recovery is a system with a set of booming and skimming equipments such as boom, skimmer, recovery vessels, temporary storage facilities, emergency discharge pump, power pack, steam generators (for cold area), and even at times a trawling net for recovery of very viscous oil under certain conditions. Each of these devices has a defined "window of opportunity" for most successful application. This is determined by the specific environmental conditions and oil properties such as water temperature, high waves, strong winds, as well as the formation of water-in-oil emulsion may dramatically change oil slick properties within a short period following the spill. This in turn leads to a decrease in the mechanical recovery efficiency. As a basic requirement, NOWPAP member should have at least the following basic requirements:

3.1.3.1. Booming

Booming equipment can vary, but containment boom are commonly used nowadays. As an essential component in forming a mechanical recovery system, containment booms should be adequate to facilitate the recovery operation. The length of the boom capacity could be orientated based on the facts in major spread of oil (a spill caused by 10,000 m3 of oil will, after 24 hours, cover an area of 30-60 km2). But the main part of the total outflow is concentrated mostly on an area covering only 10 percent of the whole contaminated surface. Assuming that this slick concentration is drifting within the down-wind side of the moving slick, then the total length of 2,000 m is needed to ensure that most of the slick concentration is surrounded. On average, manufacturer boom amounts to 100 meters per skimmer. In order to provide assistance, within the framework of the Plan, minimum requirements only consider the capabilities to respond in a large persistent oil spill in the high sea.

So the minimum requirements are as follows:

- For offshore spill site, the total boom length of 2,000 m is normally recommended for containment, and such length may be shortened, to an extent, as long as it meets the recovery capacity required.
- Keep adequate length of effective booms in place at all times (including parts & accessories) with auxiliary recovery devices and platform, such as vessels for deployment to contain and recover spills at the port or oil terminal.
- Boom used for ports and oil terminals, offshore recovery operations should be designed to meet the working and weather conditions so that it can be arranged to facilitate a quick deployment, towing, and skimming operation.

3.1.3.2. Skimming

The typical equipment used for skimming is the skimmer. To ensure basic applicability for recovery operations at sea, skimmers used in different areas must define itself as to whether it is applicable for both near-shore and offshore operations that are performance and efficiency orientated. This is not only for the maximum wing tank capacity of the biggest tanker calling on a port or a terminal or in anchorage, but also for oil properties handled in these areas with a sweeping performance. For example, as for 2.5 km2 of sweeping performance, the calculated area is hereby based on a working speed of 1-2 knots of the sweeping or skimming vessels. A sweeping area of 4.5 km2 has to be covered by those members that mainly use autonomous drive skimmer ships.

- Skimmer should have compatible components (hoses, suction and skimmer head, couplings, connectors, etc) compatible with other equipments.
- Skimming capacity should be sufficient to recover at least 50% of the tank contents within 24 hours. The skimming capacity must be part of the standard response set together with hydraulic generators suitable for operation in explosive environments.
- Port or terminal operator should update this calculation in close cooperation with the Port Authority in order to adjust the skimming capacity to changing tanker dimensions.
- Oil recovery systems and booms shall be designated to be operational under the conditions:
  - of wave heights up to two (2) m and current velocity of up to one (1) knot in open sea terminals.
  - of wave heights up to one (1) m and current velocity up to one (1) knot in enclosed and/or semi-enclosed ports.

3.1.3.3. Temporary storage

Since oil recovery operations are rarely conducted near existing waste management facilities, temporary storage options must be identified, evaluated, and selected. Decisions concerning storage will depend on the size of the spill, location, oil properties, and operation requirements. As a basic requirement, members shall try to meet the following requirements:

- Temporary storage capacity should be at least twice that of the recovery capacity for continuous field operation
- Temporary storage can be in a form either as a barge, floating bag, or oil tanker, as long as they can be applicable to operation conditions

without causing secondary spillage and pollution.

- Equipment storage should be in an easily accessible place, no matter the time, so that when an emergency response is activated, loading/unloading activities in confined port areas, semi-enclosed port areas, and open sea terminals will be made easy.
- Special arrangements such as heating system should be considered in order to make temporary facilities operative even during winter and icy conditions, in addition to those conditions described above. Equipments, which are liable to be used for storage under ice conditions, should be well tested for this purpose.

3.1.3.4. Response Vessel

Response vessels are integral part in almost every response, especially on response operations on water. They can arrive on spot in a short amount of time, and deploy boom and skimmer, spray dispersant, and even serve as a command platform at sea.

It's recommended that each NOWPAP members evaluate their current on water response capacity and make arrangements for both dedicated response vessels and non-dedicated response vessels. Also, those vessels designated as dedicated response vessels should be plotted within an easy access sites of high risk area for timely response when operation is required.

Basic requirements:

➢ Dedicated response vessels:
  - 20 feet in length at least. Vessels shorter than 20 feet in length are limited in their utility in semi-protected waters.
  - Permanent or limited readiness (i.e. sailing within 1 or 2 hours).
  - Make ensure that speed, draught, bollard pull, maneuverability, endurance at sea be compatible with regional assistance.
  - Rough sea capabilities (operations possible in Beaufort 7, at least).
  - Modern navigation. On scene commander-facilities (communication and documentation equipment, etc.) is necessary for the vessels.
  - Speed over 12 knots for prompt arrival on site;
  - Fitted with primary oil recovery system, sampling mini-lab, and radar based oil slick detection system;
  - Ability to heat a recovered cargo and utilize high capacity screw pumps

in order to facilitate the discharging of heavy viscous oil.
- To ensure crew with experience, training, and sufficient personnel for boarding assistance.

➢ Non-dedicated vessel:

Non-dedicated vessel is an opportunistic vessel for multi-purpose use where as even fishing fleet could be useful in a spill response. The selection of opportunistic vessels for oil spill response operations should take into account safety, deck space, deploying and recovering platform, working areas, mooring/positioning, accommodations and dining facilities, medical facilities, and other services potentially required for spill response. Members shall establish a standard for evaluating the response vessel capacity and availability. Such response from opportunistic vessels should be predetermined and contracted with stipulations clearly defining with at least the following:

- Large deck space, enough for recovery operation at sea.
- Capable of speed over 13 knots for prompt arrival at site.
- Has a high degree of maneuverability capable of carrying out oil recovery operations.
- All the equipments specialized and associated with oil spill response should be containerized, in order to facilitate rapid installation onboard the vessels.
- Able to empty excess water in order to maximize the utilization of the onboard storage capacity.
- Other complementary equipment is comprised of flashpoint tester, oil/water interface system, gas detector (fixed and portable), and portable cleaning machines.
- The crew will be trained appropriately regarding the equipment and working conditions under an international command and control structure. They will be able to provide service at a notice, 24 hour a day.
- The vessel will operate as an oil recovery vessel on the basis of a pre-agreed contract model with fixed fees and conditions developed by the Agency for this purpose.
- The contractor is obliged to respond positively to all requests for assistance to an oil spill response, regardless of the spill location.
- Each vessel will be available for participation in an at-sea spill response exercise (minimum 1 per year).
- Well-defined access points, removal of pollution, selection of cleanup options, and good management of recovered oil and debris.

- Safety and protection equipment for dedicated response vessel.
  - Protective clothing (oilskins, gloves, full protective suit, breathing hood, goggles, respirators, canister-type mask, oxygen breathing apparatus, face mask or hood)
  - Devices for measuring toxic atmosphere (chemical reaction tubes)
  - Explosive meter
  - Photo or flame detector
  - Sampling devices
  - Flash point meter
  - PH-meter
  - Electric conductivity meter
  - Radiation meter
  - Oxygen meter
  - Thermometer
  - Test kit.

3.1.4. Chemical Treatment

Following an oil spill, various response measures may be attempted to reduce the environmental impact. Though physical control and recovery techniques are the most traditional response measures for removal of surface oil, other countermeasures such as use of dispersant and other chemical agents may also be applied when the prevailing conditions permit. Dispersants are chemicals that orient at the water-oil interface and by reducing the surface tension, it will cause all or part of the slick to be dispersed into the water column. Scientific studies indicate that using dispersants can, under certain conditions, significantly reduce the negative short-term and long-term environmental impacts of oil spills. Therefore, in combating an on-water oil spill, use of dispersant may also be taken as one of the options when necessary.

As a minimum requirement:

- Have enough dispersant and other chemical agents for use in the initial response.
- The staging area of chemicals should be within easy access for application.
- Permanent spraying devices should be mounted on the dedicated response vessels and spared spraying devices should be tailored for quick mounting on opportunistic vessels. It also needs to be able to

adjust for correct dosage.
- Be ready with a portable plan and guideline on use of different chemical agents on defined areas.
- All dispersants must be approved and included on the NCP Product Schedule with all necessary information for reference.

Chemicals that may be applied include:
- Dispersants. Dispersants contain chemicals which reduce the surface tension between oil and water. They therefore result in breakup and dispersal of an oil slick throughout the water column.
- Emulsion Breakers. Used to break down the water/oil mixture which develops as oil weathers. This mixture, called mousse, is around 80% water and is very difficult to skim, pump, or separate.
- Gelling Agents. These are chemicals which increase the viscosity of the oil slick. They therefore reduce its rate of spread on the surface of the water.
- Herders. They are also called collecting agents. Herders work by affecting the surface tension of the oil, causing the oil to herd to a collection point.
- Viscoelastic Additives. It includes Solidifying Agents and Gelling Agents. They convert liquid oil into a solid form, thereby facilitating recovery by manual means or nets. Gelling agents increase the viscosity of the oil slick and thereby reducing its rate of spread. These agents are rarely used because the quantity required to gel an oil are extremely high in relation to the volume of oil, and it may take as long as 8 hours before the gel is strong enough to allow for recovery.
- Bioremediation Chemicals. These are biological agents. They are a combination of enzymes, natural organisms, and nutrients which increase the rate of natural degradation of oil. This is a long term technique because it may take months and years to be effective.
- Burning Agents. Burning agents are substances that make it possible to ignite oil on water or on shoreline. Getting oil on the surface of the water to burn is often very difficult. Typical examples of burning agents are gasoline and light crude oils.
- Neutralizing Agents. These are used to treat spilled oil and they work by reacting chemically with the oil to form less harmful substances.
- Sinking Agents. These are special materials applied to oil which adsorb oil to their surface. This combination of oil and the sinking agent is heavier than water, thus causing it to sink.

3.1.5. In-situ burning

Comparing conventional response methods to beach cleanup, in-situ burning is a more efficient option in removal of surface oil, provided all conditions favor such operation. In-situ burning can reduce the number of people required to clean the beaches, and reduce the injuries associated with this hazardous work. By eliminating the oil at the source of the spill, chances of contact with oil by marine birds and mammals can be reduced. Burning of oil can also generate substantial amounts of combustion by-products, mostly carbon dioxide. Therefore, many countries still don't consider this as a mature technique since in-situ burning is a type of technique that requires special expertise, governed by many factors. In this regard, it's necessary to develop a guideline for NOWPAP region, so that each member may use it according to their own situation and the actual condition at the time of the spill.

Factors that influence in-situ burning:

- Government policy
- Burning techniques,
- Equipment requirements
- Trained people
- Oil thickness,
- Environment considerations
- Health & safety. Residue containment & recovery

3.2. Onshore response

No matter how effective the on-water recovery can be, oil will inevitably come on shore. The purpose of onshore response is to reduce the threat and possible damage caused by the oil to the shoreline resources. In general, onshore response involves shoreline protection and shoreline cleanup.

3.2.1. Shoreline protection

To minimize the damage caused to shoreline, early and effective measures of shoreline protection are very essential, while the recovery operation is being carried out at sea. For effective shoreline protection, the key operational consideration may include protective boom and cleanup resources, and strategy and waste management.

- Adequate length of boom, and other equipment such as sorbent, boats, skimmer, workboat, anchors of different types specific to the site characteristic, stakes, shovels, hammer, and other special equipment likely used with specifications appropriate for the sea state and shoreline type.
- Appropriate response strategies that were tested for best protection of the shoreline.
- Contracts in place for quick mobilization of external resources when needed.
- Preplanned effective shoreline plan with all options (Confined port areas, Semi-enclosed port areas, Open sea area).
- Staging area with response equipments within easy reach.
- ESI map for each segment of shoreline, used for reference.

3.2.2. Shoreline Cleanup

In spite of all our efforts on water response and shoreline protection, oil will come ashore. For best result of shoreline clean-up, clear strategy needs to be carried out in accordance and with consideration of the characteristics of the oil, the level of contamination, and the relative environmental, economic, and amenity sensitivities of different locations. Many of these issues can be best addressed during the preparation of an oil spill contingency plan, such as possibility of limited availability of equipments and manpower in the early stages of a spill, it is often necessary to prioritize sensitive areas, which can result in conflicts between economic and environmental interests.

Shoreline clean-up is usually carried out in stages, starting with the removal of the heaviest accumulations of oil. Ideally, secondary clean-up should not begin until heavy accumulations have been removed and the risk of recontamination by floating oil has receded. The need for secondary cleaning and the degree to which it is carried out must be judged in light of the shoreline, economic, and environmental sensitivities. The final traces of oil are often difficult to remove and time consuming. Often times, natural degradation processes deal with them quickly and effectively, especially where wave action and tidal water movements are strong. In special circumstances where beaches are heavily used by the public, final 'polishing' to a very high standard may be justified, even though some of the techniques which may be required, like high-pressure hot water washing, can cause environmental impacts.

Requirement:

- Predefine the measures likely to be taken on each types of shoreline in their shoreline cleanup plan
- Equipment for shoreline survey and assessment.
- Cleanup equipments like buckets, shovels, skimmers, booms, earth moving equipment, pumps, vacuum equipment, absorbents, and temporary storage.
- Proper arrangement for temporary storage and disposal of different materials
- Personal protecting gear
- Decontamination facilities
- First aid
- Signs for instructions and directions
- Preparation of food and water supply

Strategy:

Nearly all shoreline cleanup methods have some kind of environmental impact, so selection of a cleanup method inherently forces us to make some kind of tradeoffs on the effects of the oil versus the effects of the cleanup. In order to facilitate shoreline cleanup, as a basic requirement, members shall base the on site survey and seasonal features, with the following minimal information included:

- Policy and strategy for shoreline protection and cleanup
- Types of shoreline, and priority of protection
- Predefined possible temporary storage site and backup sites
- Mobilization source of resources for operation required
- Logistic support for shoreline operation
- The recovery technique should be tailored to oil spills of heavy grades.

Cleanup measure:

Possible options are listed below in a sequence of extent of damage to the environment from low to high:

- No action
- Manual removal
- Passive collection sorbents
- Debris removal
- Trenching
- Sediment removal
- Cold water flooding (deluge)

- Cold water low/high pressure
- Warm water moderate/high pressure
- Hot water pressure washing
- Slurry sand blasting
- Vacuum
- Cutting vegetation
- Chemical
- Burning
- Nutrient enhancement
- Microbial addition
- Sediment reworking
- Shoreline removal, cleansing, and replacement
- Other techniques
- Beach cleaners
- Bioremediation.

3.2.3. Wildlife Rescue

In the event of a spill, wildlife may often be polluted or contaminated with oil, especially due to oil on the surface of the water or along the shorelines. The number of individuals and species affected will depend on a number of variable factors, such as size of the spill, weather, wind and currents, habitats affected, and time of year the spill occurs. Wildlife most likely to be affected are birds, although aquatic or marine mammals can be affected as well. Terrestrial mammals are more likely to be secondarily affected when they scavenge other animals that are stressed or have died.

The most important considerations in any wildlife response are to:

- Ensure the safety of the workforce
- Coordinate with local government agencies and experienced rehabilitation organizations

Capturing and caring for wildlife contaminated with oil can be a hazardous activity, and a rescue program can only be successful if people are placed out of harm's way. Additionally, success of a rescue program will depend on the level of cooperation between government agencies and wildlife rehabilitators. Consideration should be given to the following issues:

- Develop safety guidelines
- Designated care center with transportation means

- Reduction of surface oil
- Applying hazing techniques
- Wildlife treatment

Basic requirements:

- Wash tubs
- Heavy duty conference type tables
- Hot water system
- Various pumps
- Protective suits, gloves, goggles
- Water pressure pumps
- Heat lamps
- Medications
- Storage/transport of contaminated water
- Dishwashing detergent

3.3. Waste management

Response, both on water and shoreline, will generate oily waste by different oil and contaminated material. Basic requirements to achieve a successful waste management:

- A waste management plan should be drawn up during the contingency planning stage when there is time to consider all options so that right decisions can be made as soon as incident occurs.
- Research should be carried out locally and regionally to establish the best solutions to the potential challenges, and it should include means of determining final treatment/disposal methods, locating suitable long-term storage sites, and identifying qualified transport and storage companies. The most appropriate action can then be taken instantly during a crisis.
- Waste generated from response activities shall be disposed of only at approved disposal sites. All waste disposal sites shall be marked to the best of ability, and all components of waste shall be identified. The location and operation of waste storage, treatment, and disposal facilities shall be avoided in wetlands in all practicality. And, best practical techniques shall be used to minimize adverse impacts which may result from such practices.
- Designated emergency and long term intermediate areas should be identified, such as routes to and from the storage sites and suitable

access in relation to the location of potential spills. Suitable emergency storage will allow time to undertake disposal, in a systematic manner.

- For easy access, the site is preferably a one way traffic flow to (e.g. to allow receipt of equipment needed for pit/shed construction) and from the area (e.g. for transport vehicles carting segregated wastes to more appropriate long term or final disposal sites).
- Sufficient flat-pan area to allow for the efficient segregation of lightly and heavily contaminated items of various natures.
- Emergency storage should be in such a position that easy access is provided. Precautions should be taken to avoid oil spills on the road, and suitable absorbent material should be on-hand to mitigate environmental harm should this occur.
- The land-based disposal arrangements and sufficient storage capacity of the recovered mixture close to the potential sea areas must also be secured and have temporary storage capacity equaling twice the effective daily recovery capacity
- Methods of storage for recovered oil should be secured, including procedures for obtaining authorization to empty the water collected during removal operations. A description of other various equipments, methods, and contractors that would be employed for the offshore and onshore transport of such materials should also be secured, as well as a listing of potential disposal sites including their locations and the types of materials they will accept.

3.4. Response Time

All response times are based on from the time of discovery of the discharge. Due to the fact that distance of the oil spill sites from inshore, offshore, and in the open sea varies considerably, the response time will differ also. However, in computing a response time, members shall take into account the following factors:

- The time needed for a resource to move from its staging site to a designated point is the sum of the notification, mobilization, and travel times.
- The time to notify and mobilize resources at a site is largely based on how much control the member has over those resources.
- Because of the potential for non-dedicated resources to be committed to other functions, only dedicated resources are presumed to be able to

mobilize within these time requirements. Since non-dedicated resources may not be available to respond immediately, longer notification/mobilization times are assigned to these resources to account for their possible non-availability. The availability of non-dedicated barges by contract or other approved means in quantities equal to twice the requirement of the dedicated resources.

Basic requirements:

- In responding to major oil spillages, members shall ensure that in open sea, response times in NOWPAP shall be less than 48 hours.
- Travel times are computed using standard speeds as noted below.
- Travel speeds of 35 miles per hour (mph) for land and 5 knots for water are used. Expected dispatch time is 12 hours for experts and 24 hours for equipments.
- Each member shall maintain readiness, permitting the first response unit to start from its base within two hours of having been alerted and reach any place of spillage in the response region of the respective country within six hours.
- To ensure well organized adequate and substantial response actions at the site of the spill as soon as possible, preferably within a time not exceeding 12 hours.
- A capacity to ascertain the endurance of an operation until the oil is recovered, while in cooperation with other contracting parties.
- To make available sufficient and suitable storage capacity for recovered or lightered oil within 24 hours after having received precise information on the outflow quantity.
- To continue with the development and improvement of their response capacities, taking into account:
  - relevant factors such as the length and configuration of the coastline, suitable places of refuge, vulnerable ecological areas, probability of adverse weather conditions, ice, etc.
  - that this capacity should be considered, in connection with other salvage and lightering capabilities.
  - that the targets specified above, concerning response capacities, should be addressed with high priority.
- Oil recovery devices with an effective daily recovery capacity of 50 m^3 or greater should be available at the transfer site within 2 hours of the detection of an oil discharge.
- Containment boom, in a quantity equal to twice the length of the largest

vessel involved in the transfer, must be capable of being deployed within 1 hour of the detection of a spill at the site of oil transfer operations. If the transfer operation is more than 12 miles from shore, the containment boom must be deployed within 1 hour plus the travel time from the nearest shoreline at a speed of 5 knots.

- Oil recovery devices necessary to meet the applicable maximum "Most probable discharge volume planning criteria" must be located in such way that they should arrive on scene within 12 hours of the discovery of a discharge in higher volume port areas, 24 hours in all other rivers and canals, inland, near-shore, and offshore areas, and 24 hours plus travel time from shore in all open ocean areas.

Table 3. *Resource Notification/Mobilization Response Times in Hours*[1)]

Resource Status	Response Personnel Availability	
	On-Site (OS)	Recall (R)
Owned/Dedicated (O/D)	1	2
Contract/Dedicated (C/D)	1.5	2.5
Letter of Intent/Dedicated (LOI/D)	2	3
Owned/Non-dedicated (O/ND)	2.5	3.5
Contract/Non-dedicated (C/ND)	3	4
Letter of Intent/Non-dedicated (LOI/ND)	3.5	4.5

Travel times are computed using standard speeds as noted below.

– Travel speeds of 35 miles per hour (mph) for land and 5 knots (kts) for water are used.

3.5. Effective Daily Recovery Capacity (EDRC)

Determining EDRC involves many factors. It's hard to calculate it just by the figures provided by manufacturers because in most cases such figures are based on extremely favorable circumstances such as calm sea conditions and unrealistic layer of oil thicknesses. Therefore, those figures are neither comparable nor reliable; however, as a guide of reference, the nameplate capacity of each skimmer should be de-rated by 70 % or more without an actual test being conducted by competent agency.

1) Guidelines for the U.S. Coast Guard Oil Spill Removal Organization Classification Program, 2001, P15

Additionally, EDRC can also be closely related to types of booms and skimmers. And, the storage capacity of the proposed recovery system in an operation can also be interrelated with one another. In spite of the existing difference where NOWPAP members operate various types of skimming systems, the total EDRC should satisfy the demand of EDRC 20%–50%. Such demands are one side tank capacity of the largest oil tanker calling at the port or oil facility, or meeting the recovery demand of the potential largest spill in the area concerned.

On the above account, the following two approaches are provided to calculate the EDRC:

Formula one:

R = T x 24 hours x E
R = Effective daily recovery capacity
T = Throughput rate in m^3 per hour (name plate capacity)
E = 30 percent (efficiency factor).

Formula two:

R = D x U
R = Effective daily recovery capacity
D = Average oil recovery throughput rate in m^3 per hour
U = 6 (hours of effective operation). 6 hours is used as potential limitations due to available daylight, weather, sea state, percentage of emulsified oil in the recovered material, and other unknown factors.

Therefore it's recommended that each member may request an alternative EDRC by providing all of the following information:

(a) Description of the recovery system which includes skimmer, boom, pump, work boats, and storage associated with the device.
(b) Description of deployment methods that will be used to enhance the recovery system to maximize oil encounter rate during spills.
(c) Documented performance during verified spill incidents.
(d) For each skimming system, identify the oil storage associated with each recovery system. State the storage capacity integral to the oil recovery system, if applicable.
(e) Describe how recovered oil is to be transported to/from interim storage.

Chapter 4. Support capability

4.1. Logistics support

Logistics support is an integral part of a successful response operation. Depending on the size and extent of a spill, logistics support could range from simple notification of the Tier 1 emergency response team to securing the Tier 2 resources from national wide locations. Logistics support will consist largely of procuring response equipment, response people to the cleanup sites, and providing food, shelter, and transportation for the oil spill. And, ensure a smooth running of response operation.

Basic requirements:

- Arrangement for procurement of response resources in a cost efficient manner. Response equipment should be containerized as far as possible in order to facilitate rapid installation onboard vessels or planes.
- Predefined field operations support (shelter, transport of people and equipment, food, potable water, fuel, equipment, staging area, equipment assembly and maintenance, supporting response operations on site) .
- Predefined mobile medical care and contracting hospitals, etc.

4.2. Financial support

To ensure a rapid and effective response to oil spills, proper financial support is of utmost importance. With finacial support, immediate response can be ensured by the responsible party or any other parties designated by the government. These financial support will cover expenses associated with mitigating the threat of an oil spills, as well as the costs of oil spill containment, countermeasures, cleanup, disposal activities, and other activities essential for best response.

Each member should make such arrangements as to how best to allocate funds. Special agreements should be made between interested parties for funding of joint response operations, joint training programs, loaning of resources, as well as for other activities related to the enhancement of response capability. More importantly, securing financial support should be taken into full consideration to achieve timely activation of contingency plan and effective emergency operations. Members should be aware of international regimes and voluntary schemes applicable in the region for obtaining compensation for oil spill clean-up costs, etc.

4.3. Communication

Effective communication is of vital importance to emergency operation because it can make all persons and organizations involved understand the given message; thus, being able to respond correctly to the command post, response teams, and all parties concerned to keep the whole response operation under sound management. As a general requirement, arrangement should be made to provide appropriate communications equipment to meet operational requirements, ensure appropriate communications, and provide support facilities to provide technical support for all response communications.

Minimum requirement:

- Communications network: Either internal or external communication should be clearly predefined with a clear, operational, and effective network, including daily network and emergency network. Standby channel and frequency should be pre-approved by the competent authority of each member state, while at same time, keep MERRAC updated with this information. Management of such networks should also be established to ensure each link is properly maintained at all times.
- Communication facilities: Provision of communication facilities should be appropriate to the level of response involved and the real conditions one might possibly confront. Types of communication facilities should be applicable for effective response operation.
- Mobile Satellite Communications Trailer for field command if possible.

4.4. Technical support

Good technical support is expected to provide things like reliability, availability, and service ability with confidence in the solution for spill incident. When an oil spill occurs at sea, the first and primary concern of response planners is the path of the oil. In other words, what is the direction of the slick, speed of movement, weathering and spreading characteristics of the oil under the influence of prevailing currents, and weather conditions? In near-shore marine environment, the movement of oil spills is likely to impact the shoreline. This is of prime importance in an effective deployment of oil spill response personnel and equipment to protect environmentally sensitive areas and in clean-up planning. Best response depends largely on good technical support which provides reliable information to the command post and field operators. In short, technical support may include expertise and other software that may assist in decision making.

Basic requirement:

➢ **Expertise resources**

Members should make arrangements that enable all experts from various fields and interests to join together and provide information and share opinion in determining the best biological, physical, and chemical response strategy. Typically, the following technical assistance should be involved:

- Marine salvage
- Ship operation
- Meteorology
- Aircraft operation
- Scientific expertise of various kinds, especially in oil industry
- Fisheries
- Environment protection
- Oil spill response strategy
- Civil engineering
- Legal
- Customs and immigration arrangements
- Health and safety

➢ **Software resources**

- Oil Spill Prediction Model (OSPM) should provide essential decision support that is practical and usable for emergency responders and incident planners. Each member shall at least have his OSPM to assist response operations for his own regions. Such models should provide:
  - Reasonable spill prediction for both forecasting and hind casting.
  - Rapid output of results regardless of spill geographic location.
  - Ability to adjust inputs based on changing conditions and field observations.
  - Use in remote field locations or effective transmission of model outputs to field operators.
  - User friendly software and its ease in generating model outputs.

– Environmental Sensitivity Mapping (ESI Map) should serve as quick reference for oil and chemical spill responders and coastal zone managers. It should contain such information as shorelines that are ranked based on their physical and biological character, indicating their sensitivity to oiling, sensitive biological resources like seabird colonies and marine mammal hauling grounds (They are depicted by shaded polygons and symbol icons to convey their location and extent on the maps), and sensitive human-use resources. In general, good ESI map will help responders find out easily which areas would be affected the worst by the spill and which areas can be protected.

The basic requirements for an easily understandable and usable ESI map are listed below.

- Instant messages that does not require too much specialist knowledge to understand.
- Enough information to be of value, yet not cluttered to prevent confusion.
- Not unnecessarily separate natural features. For example, a bay or estuary should, where possible, be shown on one map rather than divided between two maps.
- Suitable symbols which do not conflict or convey the wrong message.
- Set a suitable scale within the inherent accuracy of the data set.
- Clearly marked scale, direction, legend/key, date of production, and title.
- A location map that shows the relationship between any sub area and the area as a whole.

Chapter 5. Method for Preparedness Evaluation

5.1. Current status

The purpose of preparedness is to take early actions that will minimize the impact of a future disaster. In the case of an oil spill, the specific goal is to prevent or minimize the consequences of that spill to the stakeholder or national interests. While the term “preparedness” is widely used, the activities necessary to be well prepared are rarely defined. IMO developed the Manual on Oil Spill Risk Evaluation and Assessment of Response Preparedness which lays out the framework for a standard approach to risk-based planning for emergency pollution events, and for USA developed software in which quantitative approach is applied. Helcom also developed guidelines on minimum ability to respond to oil spillages in oil terminals (refer to Annex B). Each approach may have advantages here and there. While each spill is unique and each contingency planning area such as ports, rivers, bays, and oceans may have unique aspects of response, the general factors needed to succeed in a response have broad applications. Therefore, a common preparedness assessment method will enable oil spill responders and contingency planners to better manage preparedness and ultimately achieve a successful response. In addition, by establishing and following a defined preparedness measurement system, a more definitive link can be established and reviewed in the area of effort, resources, and results.

5.2. Evaluation Method Intended for NOWPAP region

With the four key elements capability, coordinating, monitoring, and alerting, response and support that was previously addressed and highlighted as fundamental to preparedness, a balanced measurement system would be semi-qualitative approach. Therefore, a preparedness assessment system may include “hard” measures such as quantity of boom needed to protect shorelines, and “soft” measures such as team cohesiveness and capability at the response level involved. These measures, when placed against the other fundamental requirements, will provide the assessor with a reasonably accurate gauge of how ready the response system being assessed is to respond. So in terms of evaluation of preparedness for NOWPAP region, two-step approach is recommended. First, ‘Self Assessment’ questionnaire is provided for each member to complete based on their own evaluation of their existing resources. The results of the evaluation, which will be carried out by members, may show the status of preparedness in individual member and the NOWPAP region. Second, recommendations are offered for future arrangements of response capability for the whole NOWPAP region. This is based on a rough and overall evaluation of preparedness in the NOWPAP region, although the main purpose of the report is to provide methodology to facilitate each member to do an assessment of their own preparedness.

Preparedness Evaluation Questionnaire

As for the preparedness evaluation, NOWPAP members are kindly requested to refer to 'Self Assessment Questionnaires,' provided in Annex C. It is highly recommended that the questionnaires be completed based on the methodology in the report. A guideline of how to complete the questionnaires is provided in its preface. All the questions in the questionnaires are simplified to be easily answered, in order to provide a clear profile of preparedness in each member. The leading experts will clarify the items in the questionnaires, if you have any questions. To answer the questions, member may carry out an assessment and produce relevant reports. These reports (in English) are provided to facilitate the leading experts to finish the final evaluation of preparedness in the NOWPAP region.

With the support from the experts from Russia, Japan, Korea, and Oil Spill Response, the final analysis and recommendations for the self assessment questionnaire is provided as follows:

Guidelines for completion

The 'Self Assessment' is divided into four sections dealing with each aspect of response preparedness. The sections include:

Management Organisation & Training • Planning • Notification and Mobilisation • Response

Process for completion

A number of questions are asked to gauge the levels of preparedness, particularly in the context of interface with the member countries. The aim is to conduct a quick and simple gap analysis of the relationship and identify any action that should be completed to ensure that member country's resources could be effectively integrated into the response.

Responses to the questions are recorded on a numerical matrix indicating whether the issue has been adequately addressed. Certain aspects are considered critical factors for success, and failure in these areas would damage the ability of the member country to assist other member countries, or more importantly, for the member country to be able to provide an effective response.

The responses should be dependent upon the context of the question. Hereinafter is the conclusion of the responses from four members. The number in the right three columns is the sum indicating how many members think that is the answer for their situations.

Response	Status
Yes / Satisfactory / This year	1
In need of action / Review / Last year	2
No / Unsatisfactory/ Before last year	3

Section 1. Management, Organization & Training Analysis and Recommendations

It is essential that there is a robust management structure to lead the response in any incident. The responsible agencies in member countries should be aware of their individual roles and responsibilities and be trained in the oil spill response. The responsible agency should be aware of how the supporting agency from member countries fits in with their management organization. The organization should be regularly tested.

Reference document – Regional OSCP / National OSCP

	1	2	3
M 1 Is there a Management structure for dealing with an oil spill incident?	3		1
M 2 Are all member countries aware of their individual Roles and Responsibilities?	2	1	1
M 3 Is there a Response Management System in place?	3		1
M 4 Have all of the team members been trained in oil spill response?	3		1
M 5 Have members of the Management team been briefed on how Regional plan operates and the respective responsibilities of the lead country and the supporting country?	2	1	1
M 6 When was the last time Management team exercised?	1	2	1

Recommendations for Section 1 Management Organization & Training
M2 Refer to Regional OSCP – Section 3 (RESPONSE ELEMENTS AND PLANNING) 1. Review National OSCP to include roles and responsibilities outlined in the Regional OSCP.
M5 Refer to ROSCP – Section 3 (RESPONSE ELEMENTS AND PLANNING) 1. Conduct Regional integration workshop for National stakeholders, based on OPRC IMO Level 3 format, customized for the Regional OSCP.

Section 2. Planning Analysis and Recommendations

There should be a contingency plan in place to coordinate the response to an oil spill. The plan brings together the various elements of the response, and it should be kept up to date and tested on a regular basis. The national plan should interface with other adjacent plans. The national plan should have an appropriate and relevant risk assessment and identify where resources to support Tier 1, 2 and 3 responses can be accessed.

Reference document – Regional OSCP / National OSCP

		1	2	3
P 1	Is there a national contingency plan in place?	**3**	**1**	
P 2	When was NOSCP last reviewed / updated?	**1**	**1**	**2**
P 3	When was the last time NOSCP was tested?	**2**	**2**	
P 4	Does NOSCP integrate with NOWPAP ROSCP?	**2**		**2**
P 5	Does NOSCP interface with other NOSCP member countries?	**2**		**2**
P 6	Does the risk assessment plan reflect the scope of the operation and anticipate the credible level of NOWPAP member countries involvement?	**2**		**2**
P 7	Is the Risk Assessment conducted based on the methodology identified in the report?	**2**	**1**	**1**

Recommendations for Section 2
Planning

P2 Refer to Regional OSCP – Section 1.2 (pg 6-7) & Section 1.3.4 (pg 8)

1. Conduct review of National OSCP with emphasis on operational integration for tiered response within the region.
2. Identify logistical arrangement and lead time for equipment sharing.
3. Consider training personnel to operate shared equipment.

Section 3. Notification and Mobilization Analysis and Recommendations

An effective response is dependent upon an effective notification and mobilization system to alert the supporting country to the nature and scope of the emergency. This section deals with the system used for alerting the supporting country to the emergency, ensuring that both parties are aware of the information required and the authorities needed to mobilize support. Critical information is required by the supporting country to evaluate the best response options for the lead responding country, which ultimately will be translated into an agreed plan of action.

Reference document – Regional OSCP / National OSCP

		1	2	3
N 1	Is there a procedure in place to notify NOWPAP member countries of an incident?	3	1	
N 2	Is there an agreed process to update the notification and mobilization procedure?	3	1	
N 3	When was the procedure last tested?	2	2	
N 4	Is there a procedure in place to mobilize NOWPAP member countries in the event of an incident?	3	1	
N 5	When was it last reviewed / updated?	1	2	1
N 6	When was the system last tested?	2	2	
N 7	Can you obtain advice and information support from NOWPAP member countries?	3	1	
N 8	Are you aware of the response time likely to be achieved in the event of a mobilization?	1		3

Recommendations for Section 3 Notification and Mobilization
N5 1. In the next review of the National OSCP, alignment should be made to incorporate the "notification and mobilization" procedures as defined in the Regional OSCP.
N8 Refer to Regional OSCP – Section 1.2 (pg 6-7) & Section 1.3.4 (pg 8) 1. Recommend to develop a quick reference matrix, highlighting the minimum response times for both equipment and personnel.

Section 4. Response Analysis and recommendations

In order for the supporting country to be able to respond effectively at the request of the leading country, there is a need for infrastructure items to support the response. This section deals with these elements.

Reference document – Regional OSCP / National OSCP

		1	2	3
R 1	Is there a safety management plan in place for response operations?	3	1	
R 2	Have response personnel been trained in the safety aspects of oil spill response?	3	1	
R 3	Is there an effective communication system to enable the coordination of response?	4		
R 4	Have the secure equipment stockpile areas been identified for the imported equipment?	1	1	2
R 5	Have the logistical and customs arrangements been identified for equipment importation?		1	3
R 6	Is there capability to deploy additional equipment delivered by NOWPAP member?	3	1	
R 7	Is there a common standard on oil spill response strategies?			
	● Monitoring and evaluate	1	3	
	● In-situ burning		3	1
	● Dispersant usage		3	1
	● Offshore containment and recovery	1	3	
	● Shoreline protection		3	1
	● Shoreline cleanup		3	1
R 8	Has the waste management plan been developed for the response operation?		3	1
R 9	When was the system last tested?	2	2	

Recommendations for Section 4 Response
R4 Refer to Regional OSCP – Section 6.1.2 (pg. 36) 1. Identify the port of entry for equipments being brought in to the country.
R5 Refer to Regional OSCP – Section 6.1 (pg. 36) & Section 6.3 (pg. 41) 1. Identify logistical arrangement for equipment designated for regional deployment. 2. Obtain advanced customs clearance for designated equipment for regional deployment.
R7 1. Member countries may like to establish a common approach for each of the response strategies within the geographical coverage of the NOWPAP Regional OSCP. Refer to IMO publications on Oil Spill Response and other technical sources. (NOAA, IPIECA, HELCOM)

Chapter 6. Current Capability of Preparedness and Recommendation for NOWPAP region

6.1. Current status

Base on the questionnaire completed so far, the current status of each NOWPAP member is as follows:

Japan

There is no legal rule on risk assessment and minimum response level in Japan. But "Oil Spill Incidents Emergency Response Plans (here in after referred to as "ERP")," based on OPRC convention and "the Law relating to the Prevention of Marine and Air Pollution from ships and Maritime Disaster (here in after referred to as "Marine Pollution Prevention Law")," has been developed for 16 sea areas and will prescribe envisioned incidents in such sea areas with necessary quantity of equipment, concrete response measure, etc, in accordance with the envisioned incidents.

Although the tiered response strategy is one of the better methodologies, Japan doesn't employ the tiered response strategy. The reason being is that response measures are decided based unforeseeable incident and situation, such as site of incident, geographical situation, type of oil, amount of oil spilled, situation of spilled oil, atmospheric phenomena, and convergence of vessels.

But, as a matter of course, Japan has made provisions against Tier1, 2, 3 incident, through the development of National Contingency Plan(here in after "NCP") and ERP for 16 sea areas, deployment of necessary quantity of equipment, development of Oil Spill Prediction Model, and Environmental Sensitivity Map.

The NCP of Japan was developed based on the OPRC convention and the ERPs for 16 sea areas, which in fact was based on the Marine Pollution Prevention Law. The NCP prescribes response system which includeds, system on communication, deployment of equipment, training, and international cooperation. The ERPs prescribe envisioned incidents in sea areas that has necessary quantity of equipment, and a concrete response measure in accordance with envisioned incidents.

The JCG has about 70 aircrafts including helicopters and patrol vessels that patrol in territorial sea and EEZ, with the aim of preserving the order of ocean, marine environment protection, and ensuring navigation safety. In addition, the JCG is asking from the Ministry of Land, Infrastructure, and Transports their cooperation on surveillance of marine environment and communication.

ETV system is not employed in Japan. But, certain vessels which navigate in busy sea traffic areas, including Tokyo Bay, are obligated to follow an escort ship. Furthermore, certain tankers are obligated to navigate with a fire fighting ship that has a towing ability. Therefore, in the case of incidents, it is possible to tow and extinguish fires with those ships. The performance of the escort ships in the area of speed, radio, and extinguishing agent, is decided by the Maritime Traffic Safety Law. Approximately 210 vessels are stationed in Tokyo Bay, Ise Bay, and Setonaikai.

Japan has Over 100 kilometers of protective booms in total length that belong to JCG, Maritime Disaster Prevention Centen, and Petroleum Association of Japan. And they are set at main points in Japan to respond to oil spill incidents. In addition, based on a related law, port managers in oil terminal facilities must possess relevant length of protective boom.

There is no institution that has the ability and the qualification that of a person that responses to an oil spill incident. And this will not change. In private sectors, the Maritime Disaster Prevention Center (MDPC) was established on the grounds of the Marine Pollution Prevention Law, as an authority that can undertake responses to pollution incidents.

MDPC executes oil-removal and fire-fighting operations in an incident of disasters at sea, such as spilling of oil and other noxious liquid substances that can cause fires on board ships. With the aim to swiftly conduct these measures and other related procedures, MDSC has entered into contracts, for the execution of oil removals, with 159 disaster prevention companies from all over the country. By doing so, they have established a national disaster prevention system. MDPC also carries out a yearly practical training for companies in order to heighten their disaster prevention consciousness and improve their skills.

The JCG has and holds patrol vessels, aircrafts, oil recovery ships, protective booms, and other equipments. In case of an incident, JCG responds by using those equipments, as they see fit. In addition, the National Strike Team performs the role of a coordinator by organizing the response measures of incidents. There are people in the NST group, divided into three groups of four, that are ready to respond to incidents around-the-clock.

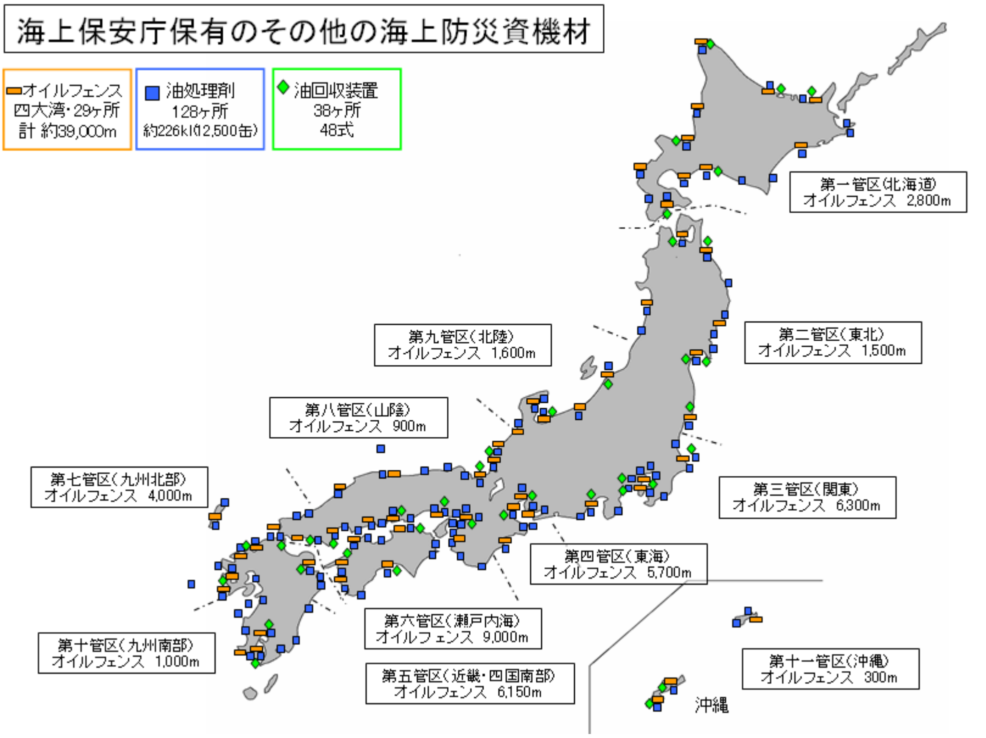
Japan made the following comments:

The ERPs don't mention the standard on the capacity of temporary storage, but they do mention the specifications about spilled oil recovery vessels that have the ability to conserve recovery oil, temporary storage vessels, barges, waste oil handling facility, and vacuum car.

In terms of key response resources, it seems that the concept of key clean-up resources, and items mentioned on this report is one of the more efficient methods. However, we believe that there are various others methods that can't be completely dismissed. Therefore, it is not necessary to amend this report, but just knowing that the method proposed on this report should be considered as one example.

In addition, as mentioned above, the JCG has developed the ERPs for 16 sea areas, with the worst case scenario in mind. Within this assumption, we believe that if an oil spill incident occurs the spilled oil can be collected or resolved within 3 days by means of mechanically collecting 80% of the oil with absorbing mats, and dispersing the remaining 20%. by oil dispersant. The target amount of equipments necessary is decided in accordance with such strategy.

As for the minimum requirements for Effective Daily Recovery Capacity (EDRC), Temporary Storage Capacity, and Response Time, it seems that the concept of the EDRC mentioned on this report is one of efficiency methods. However, we believe it is apparent that there are many other various methods that cannot be completely dismissed. Therefore, it is a priority that EDRC method, proposed on this report, should be considered as one example.



China

For the moment, China has no specific legal rule or guideline on risk assessment and minimum response level. However, as a member state to the OPRC convention, China has done a lot of fundamental work to enhance the response capabilities such as strengthening of oil spill preparedness and response through establishment of domestic law, developing contingency plan, reinforcing supervision and control of vessels, building up of maritime response capability, carrying out regional activities, and cooperating with outside world.

As stipulated in *The MARINE ENVIRONMENT PROTECTION LAW OF THE PEOPLE'S REPUBLIC OF CHINA,* the competent state administrative department in charge of marine affairs shall be responsible for drawing up state contingency plans to deal with major oil spill accidents in the sea that is caused by offshore oil exploration and exploitation. And furthermore, they will submit the plans to the competent administrative department in charge of environment protection in the State Council for the record. The competent

State administrative department, in charge of maritime affairs, shall be responsible for drawing up the contingency plans to deal with nation-wide major vessel oil spill accidents on the sea, and report to the competent administrative department in charge of environment protection under the State Council. All units, in the coastal areas, where potential marine environment pollution accident may happen shall, in accordance with the State regulations, draw up contingency plans to deal with pollution accidents, and submit the plans to the local administrative department in charge of environment protection and marine affairs for the record.

China MSA, as the only authority responsible for controlling of pollution by vessels, has done quite a lot. Namely, they supervise and urge ports, terminals, and vessels to draw up pollution contingency plan, equip response facilities, set up response teams, revise the existing national contingency plan for waterborne pollution from vessels, and strengthening international cooperation such as cooperation with NOWPAP countries to deal with vessels pollution accidents, while pushing forward the establishment of oil pollution fund and compulsory insurance against ship pollution. More investment (58 million RMB) has been allocated for the prevention and management of ship pollution in order to set up the Yantai Oil Spill Response Technical center in China MSA. Area contingency plans like *National Contingency Plan For Oil Spill From Vessels At Sea, Oil Spill Contingency Plan for China Northern Sea Area, Oil Spill Contingency Plan for East Sea Area, Oil Spill Contingency Plan for the south Sea Area and Oil Spill Contingency Plan for the Taiwan Strait* was also developed a while ago.

China, even though it's a big country, is still rather weak in response to its oil spill preparedness at sea, establishment of provincial oil spill contingency plan, and a coastal municipal level contingency plan that promotes establishment of response centers in high risk areas, building up stockpiles in major ports and sea area, enhancing capability of oil monitoring, and establishing ship pollution funds.

According to previous statistics, China has 281oil and waste recovery vessel, 213 oil recovery device, boom 172658m, 3 planes, 360 tons of dispersant and sorbent. At present, there are organizations that can conduct oil spill response training such as Yantai Oil Spill Response Center and China MSA. And they are the only formal agency that carries out the response training, oriented on the three levels and executes oil-removal operations upon disasters at sea like spilling of oil from ships. With the aim of swiftly conducting these measures and other related procedures, there will be more response centers built in the high risk areas along the coast.

Russia

There are no legal rules on risk assessment and minimum response level in the Russian Federation. We have industrial methods for risk assessment. Russian Federal law "on protection of the population from natural and technogenic" emergencies, two government orders from 2000 and 2003 determine the necessities and requirements for structure and content of Oil Spill Contingency Plan (here in after referred to as "OSCP"). Russia is not a member of OPRC convention but Russia voluntary fulfills its provisions. Based on these documents, National Oil Spill contingency plan and 6 regional (basin) oil spill contingency plans were developed. Russian Federation has a wide marine borderline on Far East, and that is why two Regional oil spill contingency plans were developed for this region. They cover Sea of Okhotsk area and NOWPAP sea area.

Russia applies the tiered response strategy in the contingency planning as well as oil spill response. It allows for adequate response capability in case of major oil spills. The Russian legislation admits that the majority of potential oil spills are relatively small; therefore the oil company resources can be sufficient for adequate response without any external assistance. According to the international practice, this kind of response is classified as Tier 1 Response. In accordance with the Russian Laws, this kind of response corresponds to the Local Oil Spill Response (oil spill less than 500 t).

In case of any local oil spills occurring in the sea area of the company's responsibility, irrespective of the spill source and the owner, the company will provide an adequate response using its resources on the basis of an unconditional compensation of the costs incurred as long as the oil spill was not caused at the company's facilities. The company will provide its resources and equipments to respond to the oil spills caused at other operators' facilities, and beyond the area of the company's responsibility on the basis of an agreed procedure and complete cost compensation.

According to the above mentioned tier approach to oil spill response, the company, in the event of a regional (more than 500 t but less than 5000 tons oil spill) or federal (oil spill more than 5000 tons) level caused at the company's facilities, will have to involve the relevant resources and equipments of regional and federal tier of response. Management of oil spill operations is executed by Regional management body, headed by vice-governor of region of the Russian Federation, in case of regional oil spill. Management of oil spill operations is executed by Federal management body, headed by Minister of Transport, in case of federal oil spill at sea. Companies will provide their OSR resources and equipments for the response to oil spills of regional and federal levels with all the costs compensated by polluter.

All types of OSCP (local, regional, and federal) are based on a risk assessment and should include sensitivity maps. There is no standard for sensitivity mapping. Most maps included in OSCP are prepared based on a methodology recommended by Arctic Council (project carried out be EPPR working group of Arctic Council).

The National Regional OSC plans prescribe a response system that includes communication system, deployment of equipment, training, and international cooperation. The local OSCP describes the most susceptible incidents in sea areas, necessary quantity of equipment, and relevant response tactics, in accordance with evaluation.

In the NOWPAP area, Russia has a total of over 7 km booms that belong to the Far East and Sakhalin Salvage and Towage Companies (here in after referred to as "BASU"), Maritime Port Administrations, and oil companies. In addition, based on related orders, port managers and oil terminal facilities possess relevant length of protective boom. Russia has oil skimmers with total capacity of over 1000 m^3/hour. These equipments are located in ports Nakhodka, Vladivostok, DeKastry, and Vanino.

Regional vessel traffic information and management system (VTMIS) is employed in Russia. All main ports in the NOWPAP area are covered by VTMIS.

The State Marine Pollution Control, Salvage and Rescue Administration (SMPCSA), and Ministry of Transport are responsible for oil spill combating at sea and near shore waters.

The Sakhalin BASU has been delegated as superior in executing operational responsibility for response action to oil spills at NOWPAP area.

SMPCSA is responsible for updating the national Regional Oil Spill Contingency Plans and coordinating local contingency plans.

The departments of Federal Supervisory Natural Resources Management Service in Primorsky and Khabarovsky regions, which are under the Ministry of Natural Resources of the Russian Federation, shall monitor and control the spill incidents and response actions, assess the extent of the pollution, identify the polluter, and estimate the environmental damage and other consequences of the pollution.

Ministry of Civil Defense, Emergencies, and Elimination of Consequences of Natural Disasters (EMERCOM of Russia) have established an Inter-Agency Commission on emergency situations at the federal level. It has established notification procedures to EMERCOM of Russia, concerning oil spills.

The responsibilities of the territorial EMERCOM bodies are to co-ordinate the different organizations involved in oil spill combating operations (e.g. the navy, frontier guard, air forces, local authorities, etc), and in particular to manage the on shore clean-up operation.

SMPCSA has a Far East Regional Contingency Plan for the NOWPAP sea area defining responsibilities, and warning and co-ordination procedures. The Plan also includes response techniques, and listing of equipments and personnel.

The Municipalities are responsible for oil pollution cleanup activities on their coastlines and beaches. The port authorities and oil handling facilities are responsible for oil spill response action within their own area.

Korea

(Hereinafter is the conclusion from the questionnaires submitted by the expert from Korea.)
There is a contingency plan in place to co-ordinate the response to an oil spill, which is kept up to date and tested on a regular basis. However, it is not well interfaced with other adjacent plans with no appropriate and relevant risk assessment to identify where resources to support Tier 1, 2 and 3

responses can be accessed. An effective response is dependent upon an effective notification and mobilization system to alert the supporting country to the nature and scope of the emergency. Korea has a procedure in place to notify NOWPAP member countries in case of an incident with an agreed upon process to update notification and mobilization procedure. However, an arrangement to obtain advice and information support from NOWPAP member countries is not made very well. In order for the supporting country to be able to respond effectively at the request of the leading country, safety management, personnel training, and communication system must be in place, where the supporting agency from member countries can be expected to fit in with their management organization. But the equipment stockpile areas haven't been totally secured for the imported equipment, nor have the logistical and customs arrangements been properly identified for equipment importation. There is also a need for establishment of waste management plan and a common standard on oil spill response strategies regarding different response options. Moreover, Korea is in need of a robust management structure to lead in response to incidents. This is essential for the success of incident management where individual roles and responsibilities are not so well trained and identified, in meeting the crisis situation.

Conclusion and recommendation

1. Self assessment of likelihood and sizes of oil spills was conducted by each NOWPAP member state for NOWPAP sea area.
2. It was shown that significant likelihood of oil spills at oil terminals in all NOWPAP member states does exist. More probable sizes of oil spills at oil terminals went up to 10 tons.
3. Likelihood of oil spills from vessels at sea on approaches to ports in all NOWPAP member states were Extremely Rare according to IMO classification.
4. Taking into an account of the likelihood and sizes of oil spills in the NOWPAP sea area as well as of the current preparedness and response capability based on the questionnaires, the four key elements of capability coordinating, monitoring and alerting, response, and support, are taken as the fundamental approach to maintaining a minimum level of preparedness and response capability, in the initial stage. Of course, each individual members may take into consideration their own situation while followoing these guidelines.
5. However, in view of the whole region's current situation of responding to major oil spill, coordinating capability and other issues related, recommendations are offered here for immediate actions.
   - Further improvement on the efficiency of information sharing among NOWPAP members. This would be beneficial, not only for project implementation and technical exchange at a certain period, but also in future joint operation and other cooperation concern. Such goals would enhance the response capability and preparedness of the whole NOWPAP region.
   - Development of a guideline on the evaluation of NOWPAP member's response vessels and their technical specifications, typically applicable to the characteristics of NOWPAP water area.
   - Set up of expert exchange program in the overall enhancement response personnel's expertise.
   - Conducting joint training at a certain level on a rotational basis for better understanding and implementation of NOWPA regional contingency plan. The content for the training shall include emergency towing procedures and requirement, in addition to the existing subject required by IMO.
   - Reinforcement of the hardware capability of airborne surveillance and on water response.

- Highly recommended that each NOWPAP members should have certain number of Emergency Towing Vessels (ETOW vessels) available for emergency towing operations available for all weather conditions.
- Establishment of routine patrolling, remote sensing, and scheme reporting on high risk water area.

References

Australian Maritime Safety Authority, February 2000. Risk Assessment of Pollution in Australian Ports and Waters, 23 p

COWI, 1998a. Accident and release frequencies. EU Tacis/Baltic Pipeline System, BPS. Technical Report.

COWI, 1998b. Existing and future shipping through the Baltic Sea. EU TASIS Programme Baltic Pipeline System, BOS: Technical Report. 85 p

COWI, 2002. Risk Analyses of Navigational Safety in Danish Waters. Report No. P-054380-2. 23 p.

Det Norske Veritas et al., 1996. Prince William Sound Marine Transportation System Risk Assessment. Final Report.

DETR, 1999. Identification of Marine Environmental High Risk Areas (MEHRA's) in the UK. Department of the Environment, Transport and the Regions. Doc. No.: ST-8639-MI-1-Rev 01. 83 p.

Egan, G.R., Castle, R.W., 1999. Risk management strategies for pipeline spill prevention and response. In Proceedings of the 1999 International Oil Spill Conference.

Guidelines for applying HELCOM Recommendation 11/13 on development of national ability to respond to spillages of oil and other harmful substances, HELCOM Combating Manual, Chapter 12.

Guidelines for Preparing Regional and Subregional Oil Spill Response Plans October 1, 2002. U.S. Department of the Interior Minerals Management Service Gulf of Mexico OCS Region.

Guidelines for the U.S. Coast Guard Oil Spill Removal Organization Classification Program, 2001.

HELCOM, 2004. Maritime Accident Response Information System (MARIS). (http://www.helcom.fi/maris.html)

HSE, 2002. Marine Risk Assessment. Offshore Technology Report 2001/063. UK Health and Safety Executive. Publ. HM Stationary Office. 86 p.

Huijer, K., 2005. Trends in Oil Spills from tanker Ships 1995 - 2004. Proceedings of the 28th Arctic and Marine Oilspill Program (AMOP) Technical Seminar, Calgary. 319-332 p.

IMO., 1997. Interim guidelines for the application of formal safety assessment (FSA) to the IMO rule-making process. MSC/Circ.829, MEPC/Circ.335. 17 November 1997.

IMO., 2006. Interim guidelines for risk assessment. 4th OPRC Technical Group. 14 March 2006.

IMO., 2006. Draft Manual on Oil Spill Risk Evaluation and Assessment of Response Preparedness. 5th OPRC Technical Group. 30 August 2006.

ITOPF, 2006. A database of oil spills from tankers. (http://www.itopf.com/stats.html)

Jorma Ritkonnen, 2006. Risk assessment and risk management. BOSSS project report, 169 p.

Maritime and coastal agency, UK, 2002. Contingency Planning for Marine Pollution Preparedness and Response Guidelines for Ports.

Matter T, Molloy F, Thomas H., 2006. Oil Spill Risks and the State of Preparedness in the Regional Seas. The International Tanker Owners Pollution Federation Limited, INTERSPILL-2006.

Merrick, J.et al., 2002. The Prince William Sound Risk Assessment. Interfaces. 16 p.

National Academy of Sciences (NAS), 2003. Oil in the sea III: Inputs, fates, and effects. National Academy Press. Washington, D.C. (http://www.nap.edu/openbook/0309084385)

Novack, S.D., Siu, N.O., Hill, S.G., 1997. The use of event trees in oil spill prevention applications. In Proceedings of the 1997 International Oil Spill Conference.

Rømer, H. G., 1996. Risk Assessment of Marine Transport of Dangerous Goods. European Commission, Institute for Systems, Informatics and Safety, ISPRA (VA) - Italy. Report EUR 16430 EN. Joint Research Centre. 159 p.

Semanov, G., 2005. Risk assessment and risk management. Transportation of Russian oil and oil products. BOSSS Workshop on Detection and Combating Oil Spill in Ports. June 7-8, 2005. St. Petersburg, Russia. 15 slides.

Stand-by Oil Recovery Vessels for Europe, Information Note 29 November 2005

Yudhbir, L., Iakovou, E., 2001. A maritime oil spill risk assessment model. In Proceedings of the 2001 Internationbal Oil Spill Conference.

Annex A. MODEL on oil spills risk assessment

Models on estimates for oil spill likelihood and size

To achieve and evaluate the adequacy of preparedness to respond, or development of precautionary measures, it is necessary to conduct a quantitative assessment of sizes and likelihood of oil spills.
The appropriate model was developed by a group of experts established on 2006 MERRAC Meeting. It was based on a model used by COWI (Denmark) and CNIIMF (Russia) for TASIS project “Baltic pipeline system” and IMO “Manual on Assessment of Oil Spill Risks and Preparedness,” adopted by MEPC 57 in 2008.

The IMO Manual provides information in regard to the assessment of risk as a basis for consideration and development of the preparedness and response capacity of a national or local contingency plan. The Manual also provides guidance, which may be useful to Governments, in connection with the assessment of the adequacy of a contingency plan established as a requirement under the provisions of national rules and regulations. The information is intended for Governments, particularly those of developing countries and industries, to use them for consideration when assessing risk, and preparing the basis for the development of a national, regional or local preparedness and response plan.

The manual for quantitative risk analysis gives specific data points for each parameter. Likelihood may either be expressed as likelihood or probability. Likelihood would be expressed as the number of times a hazard is expected to result in an actual event over a chosen time frame: two times per three years, once a decade, three times every 100 years, etc. Probability uses the same data, but is expressed as a decimal number between 0 and 1 (or as a percentage between 0 and 100%). The following examples would have annual probability of 0.66 (66%), 0.1 (10%) and 0.03 (3%).

Table 1 gives an example of qualitative terms for likelihood. This is just one example of a number which could be devised. The actual range of terms or values used is not necessarily important, as long as all hazards are assessed against the same scale. The process is measuring *relative* likelihood or consequence, which enables prioritization during the risk management process.

Table 1. *Example of qualitative likelihoods**

Descriptive term	Likelihood Ranges	
	Chance of occurring in a given year	One occurrence every...
Certain	>99%	Year (at least)
Likely	50 to 99%	1-2 years
Possible	5 to 50%	2-20 years
Unlikely	2 to 5%	20-50 years
Rare	1 to 2%	50-100 years
Extremely Rare	<1%	>100 years

Likelihood is a generic term covering either frequency or probability, depending on the analyses used.

Frequency is a statistical number of times an event will occur within a defined sample size over a specific period (e.g., the likelihood of an oil spill greater than X tons in a port is Y times per Z years).
Probability refers to a single event and is expressed as a number between 0 (zero chance) and 1 (certain).

1. Models for estimates of an oil spill likelihood and size.

1.1. Oil spill at terminals.

The following spill size categories at oil terminals are used:
- **0 - 10 t**
- **10 - 100 t**
- **100 - 1,000 t**
- **Larger than 1,000 t.**

These are general models for all harbors and oil terminals, and use only the number of calls at the installation as explaining variable. It is based on statistical data.

The likelihood of spills less than one ton is assessed as 0.5 – 5 spills per 100 million tons of handled oil and depends mainly on production culture.

$$N_{1.0} = Q*2.5 \quad (1)$$

Where

$N_{<1.0}$ – number of oil spills less than 1 ton,
Q – quantity of oil handled on oil terminal/port, per year

The likelihood of spills of more than 1 t is based on accident statistics. The estimated number of spills is $5 \cdot 10^{-4}$ per call at the terminal.

$$N_{>1} = S*5 \cdot 10^{-4} \quad (2)$$

Where
$N_{>1}$ – number of oil spills on oil terminal/port per year
S – number of ship calls to oil terminal/port per year, taken into account empty and fully loaded tankers,

The likely distribution of the size of cargo spills larger than 1 t, determined according to equation 2 is shown in Table 2.

Table 2. *Conditional likely distribution for cargo spills of more than 1 t.*

Reported interval	1-10 t	10-100 t	100-1000 t	> 1000 t
Fraction	0.79	0.17	0.036	0.008

Quantities of oil spills on oil terminal/port will be as followed:

$N_{>1} * 0.79 = P_1$ – spills less 10 tons,
$N_{>1} * 0.17 = P_2$ – spills more than 10 tons but less than 100 tons,
$N_{>1} * 0.036 = P_3$ – spills more than 100 tons but less than 1000 tons,
$N_{>1} * 0.008 = P_4$ – spills more than 1000 tons

1.2. Oil spills from vessels at sea

The estimates of likelihood and size of crude oil spills from vessels at sea are based on models described in (Rømer, 1996). The models are generalized models valid for tanker traffics from all over the world.

The models consist of the following:
- **Accident likelihood**
- **Likelihood of cargo/bunker spill**
- **Spill size distribution for cargo and bunker spills. Model used in this report**

is not applicable for calculation of spill sizes for tankers with deadweight less than 10000 tons, as statistic was considered only for tankers above 10000 tons deadweight.

The following spill size categories are used:

- **0 - 100 t**
- **100 - 1,000 t**
- **1,000 - 10,000 t**
- **10,000 - 100,000 t**
- **Larger than 100,000 t.**

The NOWPAP statistic of accident frequencies per million nautical miles in restricted waters (the distance between shores perpendicular to the direction of the ship lane is less than 75 nautical miles) is absent. It can accept, for the purposes of calculation, frequencies of other regions with heavy ship traffic, listed in Table 3.

Table 3. *Basic accident frequencies per million nautical miles in restricted waters*

Accident	frequencies
Grounding	5.4 per 10^6 n.m.
Collision	1.9 per 10^6 n.m.
Structural damage	0.48 per 10^6 n.m.
Fire/Explosion	0.063 per 10^6 n.m.

1.3. Cargo spill likelihood

The conditional likelihood of a cargo spill of any size any given accident, and the conditional likelihood that the spill is larger than 100 t are indicated in Table 4 for double hull tankers.

Table 4. *Conditional likelihood of oil spills and spills larger than 100 t*

	P(rel.|acc.)	P(rel.>100 t | rel.)
Grounding	0.03	0.09
Collision	0.03	0.09
Structural Damage	0.05	0.09
Fire/Explosion	0.1	0.09

Calculation of likelihood of a cargo spill of any size caused by an accident is carried out by multiplying the length of ship routs in territorial water with appropriate figure in Table 6 and 7.

1.4. Distribution of cargo spill size if above 100 t

The release size modeling is performed with the multiple linear regression model, except for releases from groundings without subsequent fire/explosion. The regression model is:

Spill size = a · DWT + b,

Where ***a*** and ***b*** are the regression constants indicated in Table 5 and *DWT* is the size of the tanker in dead weight tones.

Table 5. *Regression constants for spill size modeling*

	Subsequent fire/explosion	a	b
Collision	No	0	2000
Collision	Yes	0.16	3600
Grounding	Yes	0.68	4400
Structural Damage	No	0.034	6200
Structural Damage	Yes	0.16	3600
Fire/Explosion	-	0.68	4400

The model is not applicable for calculation of spill sizes for tankers with deadweight less than 10000 tons.

For groundings without subsequent fire/explosion, the likelihood distribution model in Table 6 applies.

Table 6. *Likely distribution for fractions spilled from groundings without subsequent fire/explosion.*

% of total cargo spilled	Likelihood
5	½
15	¼
25	1/8
35	1/16
45	1/32
55	1/64
65	1/128
75	1/256
85	1/512
95	1/512

The likelihood of an accident with a spill of more than 100 t being followed by a fire/explosion is given in Table 7.

Table 7. Likelihood of fire/explosion following an oil spill of more than 100 t

	P(fire/explosion/rel > 100 t)
Grounding	0.17
Collision	0.03
Structural Damage	0.1

It means that in case of grounding, collision, or structural damage. likelihood of fire/explosion can be determined by multiplying the likelihood of these events with figures shown in the Table 7.

Annex B. HELCOM RECOMMENDATION 11/13, Adopted 14 February 1990

DEVELOPMENT OF NATIONAL ABILITY TO RESPOND TO SPILLAGES OF OIL AND OTHER HARMFUL SUBSTANCES

THE COMMISSION RECOMMENDS that Governments of the Contracting Parties to the Helsinki Convention should, in establishing national contingency plans, aim at developing the ability of their combating services.

a) To deal with spillages of oil and other harmful substances at sea so as to enable them.
   (i) To maintain readiness for permitting the first response unit to start from its base within two hours of being alerted.
   (ii) To reach any place of spillage in the response region of the respective country within six hours.
   (iii) To ensure a well organized, adequate, and substantial response at the site of the spill as early as possible, within a time not exceeding 12 hours.
b) To respond to major oil spillages
   (i) Respond within a period of time not exceeding two days from combating the pollution with mechanical pick-up devices at sea. If dispersants are used, it should be applied in accordance with HELCOM Recommendation 1/8, taking into account the time limit for efficient use of dispersants.
   (ii) To make available sufficient and suitable storage capacity for disposal of recovered or lightered oil within 24 hours of having received the precise information on the outflow quantity.
c) To respond to spillages of harmful substances other than oil with suitable countermeasures.
   (i) To consider the provisions in Volume III of the Helsinki Commission Manual on Co-operation in Combating Marine Pollution.
   (ii) To make the necessary efforts to recover floating chemicals (floaters) with a reasonable retention time, using adequate mechanical pick-up devices at sea and not exceeding 2 days for combat at sea.
   (iii) To use their best endeavors in research and development activities to develop suitable techniques or methods for recovering sunken chemicals from the sea bottom , if they have a long retention time

without dissolving tendencies.

d) Should continue with the development and improvement of the combating services, taking into account:
   (i) Relevant factors such as the length and configuration of the coastline, safe haven harbour approaches, vulnerable ecological areas, probability of adverse weather conditions, ice, etc.
   (ii) That this capability should be considered in connection with the national salvage and lightening capacity.
   (iii) The targets specified above, concerning oil response ability, being reached as soon as possible no matter the case, within the early nineties.
   (iv) The targets specified above, concerning chemical spill response ability, being reached as soon as possible no matter the case, before the end of the nineties.

*) The given response time limit can also be fulfilled with an agreement between regional cooperation of other Contracting Parties.

HELCOM RECOMMENDATION 20/5, Adopted 23 March 1999

GUIDELINES ON MINIMUM ABILITY TO RESPOND TO OIL SPILLAGES IN OIL TERMINALS

INTRODUCTION

The purpose of these guidelines is to outline the technical and operational means concerning the implementation of HELCOM Recommendation 20/5 for minimum ability to respond to oil spillages in oil terminals.
The Guidelines should be implemented in close co-operation between the Port Authority and the operators of the oil terminal while taking into account whether the terminal is at an open sea, within a semi-enclosed sea area, or in an enclosed port area.

Pollution emergency plan (Oil spill contingency plan) for an oil terminal should be part of the safety arrangements of the port, with a primary goal of preventing accidents and oil spills. Safety arrangements shall be based on systematical risk assessments and analysis, and with a goal of reducing the identified risks by minimizing the possibility for an oil spill during oil tanker operations in ports and terminals.

In a port area, there are normally several private operators in addition to the Port Authority, with the operators being responsible for their own activities. It is important that one of the actors, mostly the Port Authority, takes care of the coordination of the safety arrangements of various private operators. In a similar manner, the Port Authority should prepare an overall contingency plan for the port and make sure that the pollution emergency plans of the various operators correspond with the overall contingency plan. The Port Authority and the operators shall exchange information about these plans and organize exercises on regular basis.

Nevertheless, it must be realized that due to adverse weather conditions and probable local limitations, the outlined operational and technical means can not always ensure a successful cleaning operation.

***POLLUTION EMERGENCY PLANS* (Oil spill contingency plan)**

The Port Authority should ensure that each oil terminal has its own pollution emergency plan, elaborated in accordance with both Chapter 2 of Section II of the IMO Manual on Oil Pollution and with national regulations. These plans are part of the overall port contingency plan to establish an organization, communication, and other procedures to respond to marine oil spills. Due consideration should be given to all emergency incidents which could occur during ship's movements and oil handlings on jetties and terminals.

The pollution emergency plan must take into account:
- The type and quantities of handled oil (crude oil and oil products). Special attention has to be paid to persistent oils.
- Maximum dimensions of laden tankers and their dwt, and the dimension of the biggest cargo tank in m3.
- Oil terminals situated “at open sea” also includes offshore terminals.
- Maximum discharge rate (m3 per hour) and description of emergency stopping device.
- Location of the terminal or jetty, such as open sea terminals, and enclosed or semi-enclosed terminals.
- Access from the port approach to the terminal.
- Currents and its relation to sea swell.
- Weather and ice conditions.
- Maneuvering space for terminal berthing tankers and tug boat regulations.
- Description of the fairway from the open sea to the oil terminal.

POLLUTION RESPONSE EQUIPMENT

The pollution emergency plan should appoint the exact storage place for the combating equipments and its access.

Equipments should be located nearby the oil piers and jetties in case of an open-sea loading platform or mooring buoys on a stand-by supply vessels. The response measures should be taken immediately by the terminal operator. Other supporting measures, within the overall contingency plan, should be a part of the pollution emergency plan, inter alia, tugs boats, and fire fighting vessels.

The total capacity of the equipments should correspond with the spill expectancy and the rate of unloading or loading.

The equipment for combating operations should fulfill the following requirements:

- Oil recovery systems and booms shall be designated to be operational under the following conditions:
- Wave heights up to two (2) m and current velocity of up to one (1) knot in open sea terminals.
- Wave heights up to one (1) m and current velocity up to one (1) knot in enclosed and/or semi-enclosed ports.
- Combating equipments, which is liable to be used under ice conditions, should be well tested for this purpose.

Dispersants

The use of dispersants in an enclosed port area is restricted except in case of where no other adequate means can be applied, and if the use of dispersants has no impact on the coastal Baltic Sea Area. Any such use is subject to authorization by the competent national authorities.

BOOM AND SKIMMER CAPACITIES

a) Confined port areas

In a case of a serious outflow. Closing of the port entrance is recommended, if the width of the channel or entrance does not exceed 1,000 m. The closing of the port entrance requires at least a coastal sea boom.

b) Semi-enclosed port areas

Within semi-enclosed port areas, coastal booms should be stored for easy access and for fast deployment to ensure the surrounding of the maximum tanker size.

In the case of both confined and semi-enclosed port areas, a specialized port cleaning boat is recommended if the wind direction and wind force lead to an oil-concentration in port regions or corners, where booming and recovery with skimmers could be difficult. Vacuum trucks could also be useful for land-based clean-up operations.

c) Open sea terminals

A high-sea boom is recommended for open sea terminals and in ports with an entrance to the open sea or with an entrance exposed to the open sea.

Regular training with tugboats or other powerful auxiliary vessels should ensure a fast deployment of the booms.

If the current, along the terminal or jetty, exceeds 0.7 knots the boom configuration should be adjusted to maximum deployment angles to direct the flow at different current strengths for bottom tension booms to prevent the escape of oil.

Technical information paper No. 2 of ITOPF contains further details on various boom deployments. The two-fold length of the maximum tanker should be the basis for orientation when deciding the length of the booms within the port. Thus making it possible to prevent the oil already in the berth from spreading. This requires a high alert time and a trained tugboat crew.

In case of open sea terminals, the length of high-sea booms should be no less than three (3) times the length of the maximum tanker visiting the terminal.

The skimmer performance should be orientated on the maximum wing tank capacity of the biggest tanker calling at the port or the terminal. The skimming capacity must be part of the standard response set, together with hydraulic generators suitable for operation in explosive atmosphere.

The skimming capacity should be sufficient to recover at least 50% of the tank contents within 24 hours.

The port or the terminal operator should update this calculation in close co-operation with the Port Authority, in order to adjust the skimming capacity to changing tanker dimensions. A permanent readiness for emergency response measures should be ensured during ship movements and/or oil loading/unloading activities for both confined port areas, semi-enclosed port areas, and open sea terminals. During winter and icy conditions, special arrangements are recommended in addition to those described above.

PROCEDURES OF ASSESSMENT FOR ADEQUACY IN OIL SPILL PREPAREDNESS Proposed by IMO (IMO.2006)

It is recommended to use the following table:

Activity	Tier 1 (terminal, port)	Tier 2 (regional)	Tier 3 National < International
1. Carry out risk assessment and determine: * size of oil spill * areas of high risk of oil spills			
1. Create sensitivity maps (SM) of appropriate scale ● Chose more voluble ecosystem components (VEC) of considered area			
2. Carry out [mathematical] modeling of oil spill behavior on the surface of water and determine: ● size of oil slick ● evaporation ● dispersion ● time of reaching shore ● length of polluted shorelines			
3. Analyze SM and results of modeling, and choose an polluted areas that are to be protected first.			
5. Calculate the length of booms need to protect this areas.			
6. Established requirements for standing by, at terminals and ports.			
7. Based on item 3 results, determine the size of oil slick.			
8. Calculate the quantity of booms needed for containment of the slick, taking into account the time needed for boom deployment			
9. Estimate how many and what types oil skimmers and storage facilities are needed to recover the slick.			
10. Assess the number of ships required for operation of OSR equipment.			
11. Estimate the needed manpower.			

Note: Depending on the area being considered, the result can multiply on 2 or 3

- Time shall be established on national level.

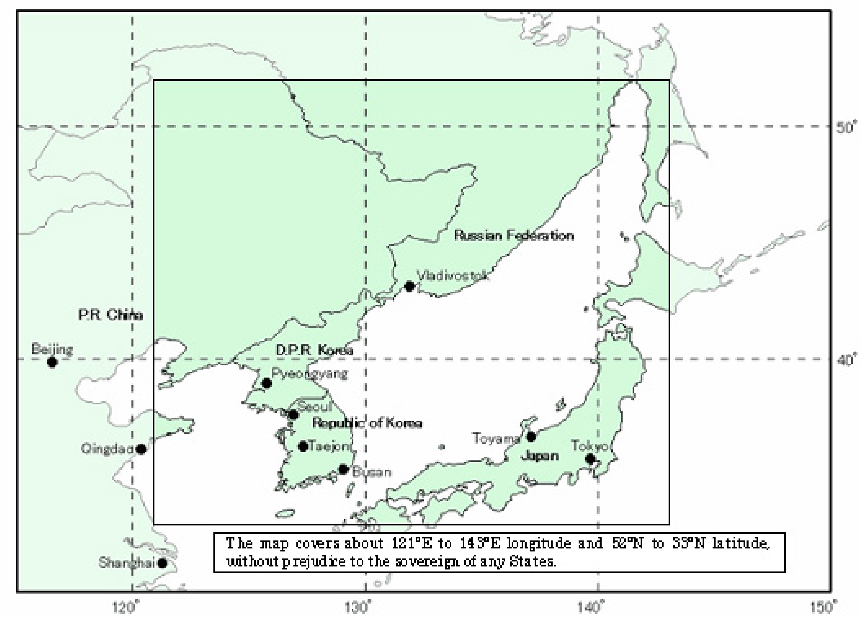
Annex C. Self Assessment Questionnaires

Introduction

The objective of this document is to help member countries carry out a simple 'Self Assessment' on their response plans and identify any gap areas in their response preparedness, particularly in respect of the interface between the member countries and the operationalisation of the regional contingency plan that covers a significant area.

This quick and easy method of completing 'Self assessment' will provide an indication of particular areas that should be addressed to ensure that the member countries gets the best available operational interface and enhanced response readiness.

Member countries can also use the document as a reference to gauge levels of response preparedness and readiness within their jurisdictional areas.



Geographical coverage of NOWPAP

(Source: CEARAC NOWPAP)

Guidelines for completion

The ‘Self Assessment’ is divided into four sections that deals with each aspect of response preparedness. The sections include:

Management Organization & Training • Planning • Notification and Mobilization • Response

Process for completion

A number of questions are asked to gauge the levels of preparedness, particularly in the context of interface with the member countries. The aim is to conduct a quick and simple gap analysis of the relationship and identify any actions that should be completed to ensure that member country’s resources could be effectively integrated into the response.

Responses to the questions are recorded on a numerical matrix that indicates whether the issue was considered to be adequately addressed. Certain aspects are considered critical success factors, and failure in these areas would be detrimental to the ability of the member country to assist other member countries, or more importantly, for the member country to be able to provide an effective response.

The responses used should be dependent upon the context of the question.

Response	Status
Yes / Satisfactory / This year	1
In need of action / Review / Last year	2
No / Unsatisfactory/ Before last year	3

Section 1. Management Organization & Training

It is essential that there is a robust management structure to lead the response for any incident. The responsible agencies in member countries should be aware of their individual roles and responsibilities, and be trained in oil spill response. The responsible agency should be aware of how the supporting agency from member countries fits with their management organization. The organization should be regularly tested.

Reference document – Regional OSCP / National OSCP

	1	2	3
M 1 Is there a management structure for dealing with an oil spill incident?			
M 2 Are all member countries aware of their individual Roles and Responsibilities?			
M 3 Is there a Response Management System in place?			
M 4 Have all of the team members been trained in oil spill response?			
M 5 Have members of the Management team been briefed on how Regional plan operates, and the respective responsibilities of the lead country and the supporting country?			
M 6 When was the management team last tested?			

Section 2. Planning

There should be a contingency plan in place to co-ordinate a response to an oil spill. The plan brings together the various elements of the response, and it should be kept up to date and tested on regular basis. The national plan should interface with other adjacent plans. The national plan should have an appropriate and relevant risk assessment, and identify where resources to support Tier 1, 2 and 3 response can be accessed.

Reference document – Regional Oil Spill Contingency Plan (RCP) / National Oil Spill Contingency Plan (NCP)

	1	2	3
P 1 Is there a national contingency plan in place?			
P 2 When was the NCP last reviewed / updated?			
P 3 When was the NCP last tested?			
P 4 Does the NCP integrate with NOWPAP RCP?			
P 5 Does the NCP interface with other National OSCP of member countries?			
P 6 Does the risk assessment plan reflect the scope of the operation and anticipate credible level of NOWPAP member countries' involvement?			
P 7 Is the Risk Assessment conducted based on the methodology identified in the report ?			

Section 3. Notification and Mobilization

An effective response is dependent upon an effective notification and mobilization system to alert the supporting country to the nature and the scope of the emergency. This section deals with the system used for alerting the supporting country to an emergency and ensures that both parties are aware of the information required and the authorities needed to mobilize support. Critical information is required by the supporting country to evaluate the best response options for the lead responding country, which will ultimately be translated into an agreed plan of action.

Reference document – RCP / NCP

	1	2	3
N 1 Is there a procedure in place to notify NOWPAP member countries of an incident?			
N 2 Is there an agreed upon process to update notification and mobilization procedure?			
N 3 When was the procedure last tested?			
N 4 Is there a procedure in place to mobilize NOWPAP member countries in the event of an incident?			
N 5 When was it last reviewed / updated?			
N 6 When was the system last tested?			
N 7 Can you obtain advice and information support from NOWPAP member countries?			
N 8 Are you aware of the response time, likely to be achieved in the event of a mobilization?			

Section 4. Response

In order for the supporting country to be able to respond effectively at the request of the leading country, there needs to infrastructure items to support the response. This section deals with these elements.

Reference document – RCP / NCP

	1	2	3
R 1 Is there a safety management plan in place for response operations?			
R 2 Has response personnel been trained in the safety aspects of oil spill response?			
R 3 Is there an effective communication system to enable the co-ordination of response?			
R 4 Have secure equipment stockpile areas been identified for imported equipments?			
R 5 Have the logistical and custom's arrangements been identified for equipment importation?			
R 6 Is there a capability to deploy additional equipments delivered by a NOWPAP member?			
R 7 Is there a common standard on oil spill response strategies? ● Monitoring and evaluate ● In-situ burning ● Dispersant usage ● Offshore containment and recovery ● Shoreline protection ● Shoreline cleanup			
R 8 Has a waste management plan been developed for the response operation?			
R 9 When was the system last tested?			

Annex D. List of National Experts of Expert Group on Minimum Level of Preparedness to Respond on Oil Spills in the NOWPAP Region Report

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