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Operational requirements matrix

D5.4

WP5: Strategic Net Environmental Benefit Analysis (sNEBA)

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Executive Summary

Work package 5 will develop and launch a strategic Net Environmental Benefit Analysis (sNEBA) tool for decision-making, to design an appropriate and fast national oil spill response strategy combining the right mix of interventions (e.g., mechanical recovery, in situ burning, chemical dispersants and/or bioremediation). The matrices outlined and presented in this deliverable D5.4 shall serve as a compliment to the sNEBA tool to answer the question "Can we?" when evaluating different oil spill response methods.

The operational requirements included for assessment are categorized as operational window (time window, weather window and ice conditions) and resource logistics (equipment, personnel and transport).

Matrix Z1 is a generic compilation of basic operational requirements for each response method.
The operational probability, i.e. the probability that the specific method can be used for a specific oil spill scenario, is assessed in Matrix Z2.

The operational probability is expected to give guidance in selection of response method, where an OSR method with high operational probability is more likely to be efficient for a specific oil spill scenario. The time window will affect the possibilities for a successful operation. If the needed resources cannot be made available at the site within the time window, the specific OCR can be disregarded.

1 Introduction

The operational requirements matrix outlined in this report constitutes deliverable D5.4 and is a part of work package 5 of the GRACE project; Strategic Net Environmental Benefit Analysis.

1.1 GRACE

The project focuses on developing, comparing and evaluating the effectiveness and environmental effects of different oil spill response methods in a cold climate. In addition to this, a system for the real-time observation of underwater oil spills and a strategic tool for choosing oil spill response methods is developed.
The results of the project will be made available for use to international organizations that plan and carry out cross-border oil spill response cooperation in Arctic sea areas. The full name of the project is ”Integrated oil spill response actions and environmental effects – GRACE"

1.2 Background to the operational requirements matrix

Work package 5 will develop and launch a strategic Net Environmental Benefit Analysis (sNEBA) tool for decision-making, to design an appropriate and fast national oil spill response strategy combining the right mix of interventions (e.g., mechanical recovery, in situ burning, chemical dispersants and/or bioremediation).

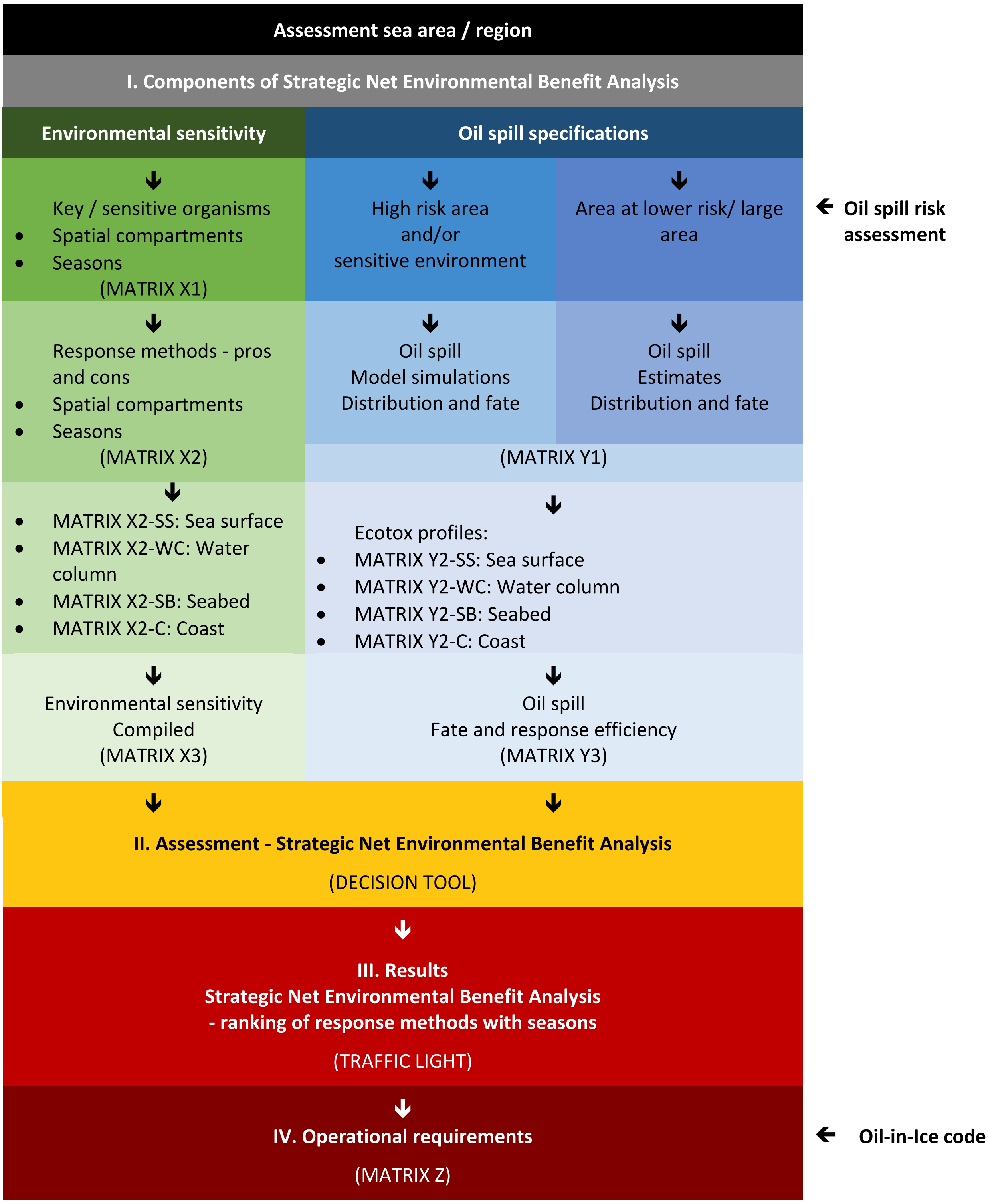
The work package also includes development of matrices for knowledge/data collection to serve as input to the strategic analysis. Environmental matrices are outlined in deliverable D5.5 and are supposed to answer the question “Shall we?” with regard to usage of different response techniques. The operational requirements matrices are supposed to answer the question “Can we?”.

1.3 Objectives

The matrices shall serve as a compliment to the sNEBA tool to answer the question “Can we?” when evaluating different oil spill response methods.

2 The sNEBA structure and the operational requirements matrices

The operational matrix described in this deliverable describes tool components to be conducted after the initial sNEBA to find out if the preferred spill response methods, can be practically applied in terms of operational efficiency. The role and context of the Z matrices may be illustrated by the flow chart in the figure below.



Given a **specific area** and **specific design oil spill** (Quantity and type), the sNEBA matrices will give traffic light indications for each of the 4 oil spill response methods; mechanical recovery, dispersion, in-situ burning (ISB) and do nothing. The one or the ones with green light means yes "we will" apply the indicated response method, e.g. Mechanical recovery.

Then the next question “can we” takes the decision maker to **Matrix Z1 and Z2** where the operational requirements are assessed.

Matrix Z1 is a generic compilation of basic operational requirements for each response method. The information given in the table may have to be refined to correspond to local conditions.

The **operational probability**, i.e. the probability that the specific method can be used for a specific oil spill scenario, is assessed in Matrix Z2.

3 Operational requirements

The response methods are all associated with constraints in operability. The methods require different resources to be available. The actual conditions, in terms of ice and weather, also influences the possibilities and the effectiveness of each method strongly. The operational requirements included for assessment are categorized as operational window and resource logistics.

3.1 Operational window

3.1.1 Time window of opportunity

The operational *Time window* (duration, from the moment of spill when the method is applicable/operational/efficient) is primarily governed by the type of oil but also influenced by the weather and ice conditions. The time window is given in hours, days or weeks. Data on the operational time window for different oil types are to be compiled from established guidance manual and IOGP compilation. If required resources cannot be made available at the site within the time window, the response method will not be efficient.

3.1.2 Weather window of opportunity

The weather window defines weather conditions when the response method will be efficient. Wind, sea state and current will influence the effectiveness and the applicability of the response methods. High wind speed will for instance obstruct the possibilities of using booms and will increase the risks associated with in-situ burning.

Weather statistics on wind speed and direction are available as “windroses” or tables for most Arctic areas, and can be utilised to derive a probability figure (percentage) that operational weather (wind) conditions can be expected at the specific area during the specified season.

3.1.3 Ice conditions

Ice coverage and ice thickness governs both the possibilities of operate in the area as well as the actual efficiency of each method.

Ice statistics, in terms of ice thickness, coverage and ice type, are available for most Arctic areas, and can utilised to derive a probability figure (percentage) for operational ice conditions for specific area during the specified season.

3.2 Resources - Logistics

3.2.1 Equipment

The equipment required for each method is included in matrix Z1. The actual spill scenario defines the quantities needed. The operational probability for a specific response method will be reduced if the needed equipment exceeds what is available.

3.2.2 Personnel

Different types of personnel may be required; trained responders, volunteers and administrators. Doing nothing does not require any personnel within the time window, although this method may cause intensive personnel demand in the long term if extensive beach clean-up will be necessary later on.
The operational probability for a specific response method will be reduced if the needed personnel exceeds what is available.

3.2.3 Transport

Transport includes both required vehicles for land as well as for sea and air transportation. Transport of both equipment from stockpile to spill site and transport of personnel and provisions shall be considered. In addition, also temporary storages and transport of recovered oil needs to be considered.

The operational probability for a specific response method will be reduced if the needed transport exceeds what is available.

4 Matrix Z1

For each of the 4 OSR methods, MATRIX Z1 defines **general operational requirements** in terms of time, weather windows and ice conditions and identifies **needs for specific resource logistics** in terms of equipment, personnel and vehicles. In addition, the operational requirements vary depending on oil type. Matrix Z1 primarily refers to conditions in spatial compartments Sea surface 1 and Coast 4.

Oil spill response method	Operational window			Resource logistics		
	Time window	Weather window	Ice conditions	Equipment	Personnel	Transport
Mechanical recovery	Medium 8-72 h	Moderate 0-9 m/s	<1/10	Booms, skimmers, storage	Intense,	Dedicated vessels
Dispersion	Very short 2-8 h	Wide for airborne application	< 5/10	Dispersants, spraying equipment	Non intensive	Aircraft, boats
ISB	Short 6-24 h	Calm stable	0 – 8/10	Fire boom, herders, igniters	Non intensive	Boats
Do nothing	Long 0 - years	Only option for severe weather	0-10/10	monitoring	No urgent needs, but may call for intensive beach cleaning	Only for monitoring

5 Matrix Z2

The variables defining weather and ice conditions cannot be accurately specified in absolute figures for a specific area and season, but may rather be described in terms of probability figures. Therefore, Matrix Z2 is outlined to calculate the **operational probability** for each OSR method and each season for a **specific oil spill scenario**.

Oil spill response method	Season	Operational window			Resource logistics						
		Oil specific time window	Probability weather window	Probability suitable ice conditions	Equipment		Personnel		Transport		Operational probability
		hours	p_{WW}	p_{Ic}	Available E_{av}	Needed E_{ne}	Available P_{av}	Needed P_{ne}	Available T_{av}	Needed T_{ne}	$P(op) = p_{WW} \times p_{Ic} \times \frac{E_{av}}{E_{ne}} \times \frac{P_{av}}{P_{ne}} \times \frac{T_{av}}{T_{ne}}$
Mechanical recovery	Spring										
	Summer										
	Autumn										
	Winter										
Dispersion	Spring										
	Summer										
	Autumn										
	Winter										
ISB	Spring										
	Summer										
	Autumn										
	Winter										
Do nothing	Spring										
	Summer										
	Autumn										
	Winter										

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6 Discussion and conclusion

The operational probability is expected to give guidance in selection of response method, where an OSR method with high operational probability is more likely to be efficient for a specific oil spill scenario. The time window will affect the possibilities for a successful operation. If the needed resources cannot be made available at the site within the time window, the specific OCR can be disregarded.

The matrices presented are tentative and subject to revision and modifications during the sNEBA tool development and trial application. Tabulated figures on efficiency and operational limitations are indicative and will be further specified during subsequent project tasks.