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FINAL REPORT

RAMBOLL

STUDY ON THE COST EFFECTIVENESS AND EFFICIENCY OF EMSA'S OIL POLLUTION RESPONSE SERVICES

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EXECUTIVE SUMMARY

History and mandate

Major incidents such as the ERIKA and PRESTIGE disasters have highlighted the need for a common European body that would be able to ensure a timely and efficient response to accidents occurring at sea, as well as help to develop and implement the necessary preventive measures across the Member States.[1] Against this background, EMSA was established by Regulation (EC) 1406/2002[2] (hereafter referred to as the EMSA Regulation) in order to provide the Commission and Member States with the necessary support tools for ensuring a high, uniform and effective level of maritime safety.

Besides its other tasks, the Agency was given the mandate to "*provide Member States and the Commission with technical and scientific assistance in the field of accidental or deliberate pollution by ships and support on request with additional means in a cost-efficient way the pollution response mechanisms of Member States*".[3]

Regulation No 911/2014 of 23 July 2014 established a second Multiannual Funding framework (MAF II) with the purpose of ensuring the implementation of EMSA's tasks in relation to the detection and response to marine pollution caused by ships and oil and gas installations. The financial envelope covering the current financial period was slightly larger than the one established for the previous period, because it needed to take into account "*the expansion of the Agency's remit with regard to pollution response, and also the need for the Agency to increase the efficiency in using the funds allocated to it.*"[4]

Table 1: EMSA's mandate and financial envelopes for activities connected with its response to marine pollution caused by ships and by oil and gas installations

	MAF I –Regulation 2891/2006	MAF II – Regulation 911/2014
Period:	1 January 2007- 31 December 2013	1 January 2014 – 31 December 2020
Financial Envelope:	€ 154,000,000.	€ 160,500,000
Mandate:	(1) Operational assistance and supporting, on request, with additional means, such as stand-by anti-pollution ships and equipment, Member States' pollution response actions in the event of accidental or deliberate pollution caused by Ships (2) Developing a centralised satellite imagery service for surveillance. (3) Other ancillary tasks[5]	(1) EMSA Oil Pollution Response assistance was expanded to cover: Third Countries sharing a regional sea basin with the Union; States applying for accession to the Union and to the European Neighbourhood partner countries Marine pollution caused by oil and gas installations (2) Maintaining and further developing the European Satellite Oil Monitoring Service (CleanSeaNet) for surveillance (3) Other ancillary tasks[6]

[1] http://www.emsa.europa.eu/about/faq/174-general/336-why-does-emsa-exist-what-does-emsa-do-what-benefits-does-the-agency-provide30.html

[2] Regulation (EC) No 1406/2002 of the European Parliament and of the Council of 27 June 2002 establishing a European Maritime Safety Agency (OJ L 208, 5.8.2002, p. 1).

[3] Art. 1 (3) d of Regulation 1406/2002/EC, as amended.

[4] Preamble 17, Regulation No. 911/2014.

[5] E.g. information and the assembling, analysing and disseminating of best practices, techniques and innovations, such as instruments for monitoring tank-emptying, in the field of responding to pollution caused by ships; technical and scientific assistance in the framework of the activities of the relevant Regional Agreements, etc.

[6] Ibid. footnote 36

In order take the above-mentioned context into account, the Agency's anti-pollution response activities are now classified under three main categories, namely:[7]

- Operational assistance and support to coastal States in the event of pollution, by making available on request the following additional response capacity:
  - its network of oil spill response vessels (OSRV);
  - the provision of specialised stand-alone equipment (also referred to as the EAS, or Equipment Assistance Service);
  - dispersant supplies and application systems;
  - technical expertise
- Cooperation, coordination and provision to the Member States and the Commission of technical and scientific assistance;
- Information, analysis and dissemination in relation to best practices, expertise, techniques and innovations.

Methodology

This study contains an evaluation of the cost effectiveness and cost efficiency of the EMSA's Oil Pollution Response Services consisting of:

(i) the network of contracted standby oil spill response vessels (OSRVs)
(ii) the stockpiles of oil pollution response equipment (EAS) and
(iii) stockpiles of dispersants.

This study examines and evaluates whether the oil pollution response services established by the Agency are effective when compared against the objectives outlined in the MAF II[8], and whether they are cost efficient by comparison with existing or potentially equivalent services performed by other governmental agencies and private organisations.

The findings of this study rely on the assessment of evidence based on triangulated data collected from a range of different sources, including:

- Internal and external documentation[9].
- A targeted stakeholder consultation consisting of a survey administered to Member States, plus interviews with key stakeholders.
- Expert assessments provided by oil pollution response experts.
- Industry and cost data provided by shipyards and shipbrokers.

EMSA's service model for providing operational assistance

In order to provide operational assistance through its network of standby oil spill response vessels, the Agency contracts companies that own or charter vessels and will guarantee the availability of the vessel for oil pollution response within a maximum of 24 hours from the time of notification. Under normal circumstances, the contracted vessels are carrying out their usual commercial activities (e.g. oil trading, bunkering, offshore supply). However, in the event of an oil spill, and following a request for assistance from a requesting State, the vessels are expected to interrupt their normal activities and be ready for service within a maximum of 7 to 24[10] hours (the contractual time frame varies).

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[7] Only the first set of activities is examined in this study.

[8] Regulation No 911/2014 of 23 July 2014 established a Multiannual Funding framework (MAF II) with the purpose of ensuring the implementation of EMSA's tasks in relation to the detection of, and response to, marine pollution caused by ships and by oil and gas installations.

[9] Technical documentation on the number, location and endowment of EMSA's oil pollution response assets; Financial data; Inventories of capacities available at national level; national policies relating to the use of dispersants; Regional Risk Assessments; Oil Tanker traffic density maps; Data on historical oil spills, and other relevant documentation such as internal procedures, procurement documentation, etc.

[10] One of the vessel arrangements involves a mobilization time of 28 hours, as its area of operations (in the Atlantic) is larger than for the other arrangements.

Currently, EMSA does not own any standby oil recovery vessels. It pays for the necessary oil pollution response equipment used by each OSRV or stored in the EAS stockpiles, the pre-fitting of the vessels, a yearly vessel availability fee (VAF) which also covers the costs of training the crew and conducting regular drills, plus the cost of insurance, warehousing and equipment maintenance. EMSA covers the cost of participating in exercises separately.

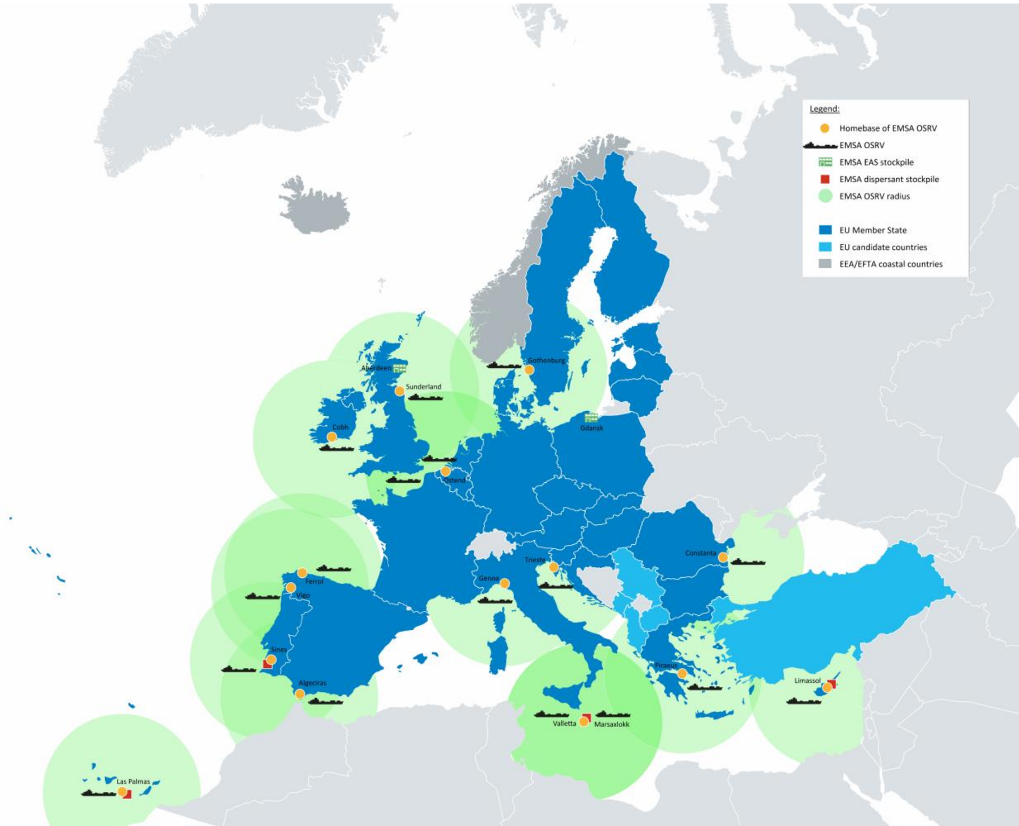
According to EMSA's mandate, the Standby Oil Recovery Vessel Network and the EAS can be activated using the community mechanism set up in the field of civil protection[11] by the following Requesting Parties:

- EU Member States and EU Candidate Countries;
- European Free Trade Association (EFTA)/European Economic Area (EEA) coastal states;
- Third Countries sharing a regional sea basin with the Union;
- Private entities.[12]

Overview of the capacities of EMSA's Oil Pollution Response Services

Over the period of implementation of its task, the range of the Agency's oil pollution response services and capabilities has become more diverse and versatile. The number of vessels has also increased, and the overall geographical coverage of the network continues to evolve on a year-to-year basis as contracts are amended or expire, as threat and risk landscapes evolve. The current contracts allow 17 vessels to be mobilised simultaneously in the Mediterranean, the Black Sea, the Atlantic Ocean, the North Sea and the Baltic Sea[13].

Figure 1: Estimated coverage of EMSA OSRVs within 24 hours from the end of mobilization time, 2017.[14]



Source: Ramboll (2017) presentation, based on data from EMSA's Operational Oil Pollution Response Services

[11] Common Emergency Communication and Information System – CECIS, operated by DG ECHO

[12] "Private Entity" means the ship owner or oil and gas installation operator controlling the activity that has caused the marine pollution or posing an imminent threat of it.

[13] The situation in the Baltic Sea is temporary; in 2017, a the procurement of an additional vessel is underway

[14] Note that the 24-hour radii on this map are indicative and present some limitations, as ships cannot take direct paths across land. Similarly, for the sake of simplicity the calculations of the 24-hour radii take as their initial reference point the *home base* of each individual vessel; however, some vessels may be mobilised without needing to return to their home bases.

Assessment of EMSA's capacities for Oil Pollution Response

We consider whether EMSA's mandate in the field of Oil Pollution Preparedness and Response as outlined in the MAF II[15] (including the EC Communication),[16] the Action Plan for Oil Pollution Preparedness and Response[17], EMSA's Founding Regulation and EMSA's 5-year strategy[18] has been adequately implemented.

Table 2 presents a brief concluding assessment regarding the minimum requirements imposed on EMSA by its mandate.

Table 2: Assessment matrix for EMSA's oil pollution response activities

Minimum requirements	Assessment
Ship-sourced oil pollution operational assistance	
Sufficient speed and power to arrive on-site as rapidly as possible	The average maximum speed of the vessels is 12.4 knots. At this speed, the EMSA vessels can cover a radius of 286 nautical miles from their home base within 24 hours from the end of their mobilisation time.
Large oil storage capacity (preferably between 1500-3000 m^3)	With an average storage capacity of 3,437 m^3 and a median value of 2,976 m^3, the current EMSA vessels fall into this specification range. No vessels[19] currently active[20] have a storage capacity less than 1,500 m^3. In our assessment, the EMSA OSRVs' large on-board storage capacity for recovered oil would contribute substantial added value to any major oil spill operation, as the OSRVs would be able to maintain their recovery operation for a long time without needing to call at a port to discharge recovered oil or requiring the offshore transfer of their recovered oil to a temporary-storage oil tanker.
Suitable equipment on board	In our assessment, the storage capacity and the quantity and type of equipment on board the vessels are appropriate for handling the tasks allotted to the vessels, i.e. EMSA's OSRVs are equipped with modern, up-to-date oil spill response equipment that will ensure they can contribute an effective, high-capacity response to supplement any nationally-initiated response operation.
Available within a short period of time	Our assessment is that the maximum mobilization time of 24 hours from the signature of the Incident Response Contract is appropriate and is in compliance with the "second response capacity" of multiple MS national response-time requirements for larger national response vessels. A shorter contractual mobilization time would probably make it impossible to use EMSA's OSRVs for their usual commercial activities during the "standby time" (24 hours), which would consequently generate a significant increase in the Yearly Availability Fee.
Sufficient manoeuvrability	The OSRVs possess greater manoeuvrability than ships of similar size and propulsion capabilities, which enhances their performance potential as oil spill response vessels.
Vessel is compliant with all relevant international and EU legislation	EMSA has taken comprehensive and adequate steps to ensure that its contracted vessels comply with all relevant international and EU legislation.
Priority given to at-sea recovery	The endowment of the vessels and equipment stockpiles with sweeping arms, heavy-duty booms, high-capacity skimmers and oil-slick detection systems is a clear indication that EMSA has prioritised building capacity for the mechanical recovery of oil at sea over other types of oil pollution response.

[15] Regulation No 911/2014 of the European Parliament and of the Council of 23 July 2014 on multiannual funding for the action of the European Maritime Safety Agency in the field of response to marine pollution caused by ships and oil and gas installations.

[16] European Commission, Communication on the programming of human and financial resources for decentralised agencies 2014-2020 (COM (2013)519).

[17] Action Plan for Oil Pollution Preparedness and Response 2004, complemented by the 2013 Action Plan for Response to Marine Pollution from Oil and Gas Installations.

[18] http://www.emsa.europa.eu/emsa-homepage/77-publications/2050-emsa-s-5-year-strategy-2014-2019.html

[19] Aegis I has a capacity of 990 m^3. However, it is only a back-up vessel to the larger Piraeus-based Aktea.

[20] The contract for the Varna-based vessel Enterprise, which had a capacity of 1,374 m^3, expired in September 2016 and was not renewed.

Minimum requirements	Assessment
Topping up the Member States' capacities	In our assessment, it appears that on the whole, EMSA is topping up the Member States' own response capability by providing a Tier III capability which is characterised by ships possessing a large storage capacity that would be difficult and costly for the Member States to create independently. The base locations of EMSA's oil spill response capability are *generally complementary* to those of the MS; however, considerable differences exist from one coastal region to another.
Priority areas are set in accordance with EMSA's Annual Work Programme	The choice of location for these assets is somewhat consistent with the priority areas set in the Action Plans. Decisions to establish, extend or discontinue OSRV contracts are normally accompanied by the justification for such a decision that takes account of the perceived risks and established capacity available in the region. At the time of drafting this report, the Baltic Sea, which was originally considered a priority area, is only partially covered by a vessel based in Gothenburg and by the EAS stockpile placed in Gdansk, Poland. As Gothenburg lies far away from much of the area of the Baltic Sea, including the Gulf of Finland and the Bay of Bothnia, with the approval of its Administrative Board EMSA has initiated a procurement process to conclude a contract for an additional vessel in the Baltic Sea in the near future.
Participation in regular quarterly drills	In 2014, 2015 and 2016 all vessels successfully took part in 100% of the required quarterly drills (approximately 61, 62 and 70 drills respectively).
Participation in oil pollution response exercises	In 2014, 2015 and 2016 respectively, 12, 11 and 12 EMSA vessels took part in operational exercises. The ability of the EMSA vessels' crews to deploy and manoeuvre the spill response equipment is reported as having been generally satisfactory. This assessment has been confirmed by interviews and survey data from the Member States' Maritime Authorities which participated in these exercises with EMSA.
Operational assistance in the event of marine pollution caused by oil and gas installations	
Provisions of limited stocks of dispersants	The use of dispersants is not limited to those countries where the stockpiles are located. The stockpiles are located in those countries where a suitable vessel is in service and where the national authorities have incorporated the possibility of a response that involves the use of dispersants into their contingency planning. Vessels based in the same location as the dispersant stockpiles have been adapted to give them dispersant-spraying capabilities. Some of those Member States which share a regional basin that contains a stockpile location maintain their own dispersant stockpiles and spraying capabilities. Nevertheless, the presence of EMSA's dispersants in their current locations is relevant for those EU countries which allow their use (e.g. Croatia, Cyprus, Malta, Greece, France, Spain and Portugal), as well as for Third Countries along the Mediterranean shores (e.g. Morocco, Libya, Tunisia, Egypt, Syria, Lebanon, Israel, Turkey, Albania and Montenegro).
Adaptation to respond to spills from offshore installations	In order to adapt its service offering to the revised mandate's requirement to establish the capability to respond to spills from offshore installations, EMSA has taken the following steps: • The adaptation of 12 EMSA OSRVs to deal with substances having a flashpoint below 60°C, thus making them suitable for the recovery and storage of volatile substances; • The provision of dispersant stockpiles, as discussed in the section above; • The equipment stored[21] in the newly established EAS is intended to be capable of dealing with spills originating from offshore installations. In particular, the availability of fire booms facilitates a response in which in-situ burning may be desirable.
Provision of specialised equipment (EAS)	Since 2016, EMSA has offered stand-alone OPR equipment in two locations (Aberdeen, UK, and Gdansk, Poland) under its Equipment Assistance Service (EAS). This new approach aims to support the Member States' operations by providing OPR equipment for the use on vessels of opportunity. These stockpiles are primarily intended to provide support in the event of spills in the North Sea

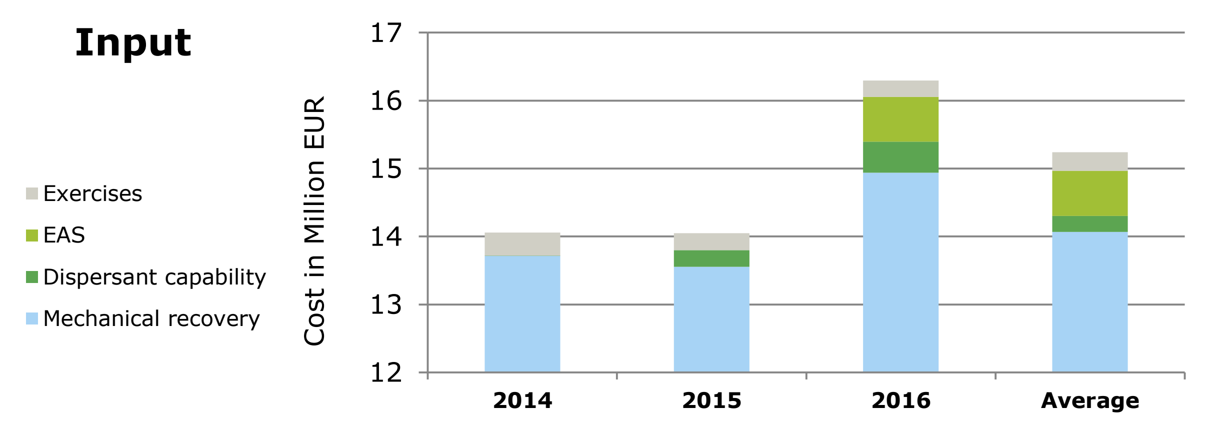
[21] E.g. Fire Boom; Speed Sweep; Current Buster; Roboom-Roskim Integrated System; Trawl Net System.

Minimum requirements	Assessment
	and in the central Baltic, but could also be mobilised for spill incidents elsewhere. In our expert assessment, the presence of rapidly deployable EAS equipment is a tool for extending EMSA's response capacity in the event of a serious incident in the areas adjacent to it. It is noted that the equipment can, if necessary, be relatively quickly transported by road or air to other locations and installed on board an EMSA OSRV or other convenient vessel.

Cost effectiveness and cost efficiency of EMSA's services

The cost[22] of maintaining the oil spill response capability set up by EMSA averages approximately € 14.8 million per year.

Figure 2: Total annual cost of the Oil Pollution Response Services for each main component.[23]



Output	2014	2015	2016	Average
Number of vessels[24]	16.1	15.1	17	16.1
Capacity in m^3	52,090	54,746	60,908	55,915
Number of EAS equipment items				
Fire Boom	-	-	8	
Speed Sweep	-	-	4	
Current Buster	-	-	2	
Roboom-Roskim Integrated System	-	-	1	
Trawl Net System	-	-	4	
Dispersant quantity in stock (in tonnes)	200	400	800	

The average annual cost per oil-pollution response-vessel arrangement[25] is € 865,000 across all regions. The average cost of vessel arrangements relative to the on-board storage capacity for recovered oil is € 252 per cubic metre, ranging between € 116 and € 910 per cubic metre, depending on the characteristics of the individual vessel.

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[22] Actual costs of the service (adjusted for inflation) per unit of output.

[23] The costs shown are adjusted to take account of the availability of the services, and are amortised according to the definition of each type of cost.

[24] The number of vessels and Capacity in m^3 is adjusted to the partial availability of each vessel during the year.

[25] OSRV and associated oil pollution response equipment.

Theoretical models indicate that EMSA's oil pollution response activities would be cost-effective when compared to the fallout resulting from an absence of the capacity to adequately recover oil before it reaches the shoreline.

Comparative analysis with other service models

An in-depth analysis of a wide range of potential alternative models that EMSA could have used to implement its mandate shows that it is highly unlikely that it would be able to provide a similar or higher level of service with superior cost efficiency, whether in relation to the costs incurred by EMSA or to the costs borne by the requesting parties.

EMSA's current service model has the main advantage of allowing the vessel owners to continue with their usual commercial activities while keeping their vessels ready and available for an oil pollution response whenever it is called on. Compared with any other service model analysed, this significantly reduces the cost of maintaining operational capacity when the vessels are not carrying out OPR duties. Any significant additional reduction of costs is likely to imply a reduction in the level of service.

On the other hand, some alternative models appear more feasible and cost efficient than others. In particular, the option for EMSA to charter multi-purpose vessels (MPVs), offers some interesting advantages that arise from the additional capabilities of the MPVs, as well as with regard to its own costs if these are split with other EU Agencies.

Oil pollution preparedness and the Member States' response capacities

The existence of EMSA's oil pollution response services as a supplement to national and private resources does not seem to have had a negative impact on the level of preparedness of the EU Member States and EFTA countries, which has remained stable over the period analysed and looks set to follow the same trend looking ahead towards 2020.

Recommendations

On the basis of the work undertaken in this study, the following actions are recommended:

Table 3: Recommendations for EMSA

Recommendations
Pursue opportunities to reduce total contract costs: EMSA should undertake a variety of actions to optimise its contract costs. Primarily, changes to the established procurement procedures could be enacted in pursuit of the following goals: (a) Expanding the pool of eligible candidates bidding for a given procurement contract, and (b) encouraging greater price competition among preselected candidates.
Engage in a collaborative process with the Member States to ensure that the contents of the EAS stockpiles fill acknowledged gaps, top up the Member States' capacities in the regions they are placed in, and are suitable for responding to the specific risks identified in each region.
Perform an oil spill risk assessment to analyse the need for oil pollution response services: EMSA should work with all the regional agreements and coastal Member States to determine the environmental risk of oil spills and their potential impacts, in order to provide input for the decisions that must be made regarding what comprises an efficient level and response options.
EMSA should **continue its policy of taking part in the operational exercises** organised by the Member States, and should actively seek to be invited to participate in such exercises in order to highlight its capabilities, to improve the operational readiness of the OSRVs' crews, and to improve the joint coordination of the participating vessels and the organising authority
Assess the availability of multi-purpose vessels with an oil pollution response capability for shared use among EMSA and other competent authorities: EMSA and co-financers should assess the market availability of MPVs capable of carrying out coast guard, fisheries control and oil pollution response functions.

1. INTRODUCTION

This study contains an evaluation of the cost-effectiveness and cost efficiency of the EMSA's Oil Pollution Response Services consisting of:

(i) the network of contracted standby oil spill response vessels, (OSRV)
(ii) the stockpiles of oil pollution response equipment (EAS) and
(iii) stockpiles of dispersants.

The study examines and evaluates whether the oil pollution response services established by the Agency are effective when compared to the objectives outlined in the MAF II[26], and cost efficient in comparison with existing or potentially equivalent services performed by other governmental agencies and private organisations.

The results are intended to support the development of the Mid-term Report of the MAF II which is to be prepared by the European Commission in 2017 in accordance with Regulation (EC) 911/2014.

1.1 Structure of the report

This document contains the results of the study

Following this introduction chapter, the report is divided in the following parts:

- Part 1: *Utility, relevance and added value of EMSA's services* presents the pollution response services established by the Agency, and assess them against the above mentioned criteria.

- Part 2: *Cost-effectiveness and cost efficiency of EMSA's services* assesses the extent to which EMSA services provide value for money by analysing the costs incurred by the Agency per unit of service and in comparison with the cost of shoreline clean-up for a given amount of oil spilled. This part of the study also examines potential improvements to the service model configuration in terms of cost efficiency.

- Part 3: *Comparative analysis with other service models* contains a multi-criteria comparative analysis between EMSA's current service arrangements and other potential service formats and models.

- Part 4: *EU Member States' trends in the level of oil pollution preparedness and response* analyses the trend of oil pollution response capacity in terms of ships and at sea response capacity at national and regional level. This section contains both a forward as well as a backward looking perspective.

- Conclusions and recommendations: *Key conclusions* and *Recommendations* stemming from the findings of the study.

[26] Regulation No 911/2014 of 23 July 2014 established a Multiannual Funding framework (MAF II) with the purpose of securing the implementation of EMSA's tasks in the field of marine pollution detection and response caused by ships and oil and gas installations

1.2 Glossary

Table 4: Glossary of terms

Term	Definition
Bow Thrusters	Propulsion device built into the bow of a vessel to make it more manoeuvrable.
Deep Water Installations	Offshore projects located in water depths between 500 and 2,000 metres.
Equipment Assistance Service (EAS)	Stand-alone oil pollution response equipment stockpiles made available by EMSA to potential Requesting Parties (defined further down).
(Fire) Booms	Floating, physical barriers to oil to slow the spread of oil and keep it contained. Fire booms are made of fire-resistant material and can contain the oil long enough that it can be burned.
Flashpoint	Lowest temperature at which the vapours of a volatile material will ignite if exposed to an ignition source.
High Pressure Wells	High-pressure wells contain oil and gas under intense pressure, creating a greater risk of large spills which are difficult to control in case of a blowout during exploration and extraction activities.
Horizontal Assessment Procedure	Assessment across several departments.
In-situ Burning	Ignition of the oil at sea, contained in fire booms.
Notification Exercises	"The aim of [Notification Exercises] is to test and implement agreed procedures and lines of communication for reporting incidents and for requesting and providing assistance."[27]
Oil Dispersant	An oil dispersant is composed of emulsifiers and solvents breaking down spilled oil and facilitating diffusion into the water column.
Operational Exercises	Exercises simulating the recuperation of oil at sea.
Requesting State	The entity requesting the use of EMSA vessels and assistance. It can be an EU member state, a candidate country for EU accession, European Free Trade Association (EFTA) or European Economic Area (EEA) coastal Member States, or third countries sharing a regional sea basin with the Union.
(Oil) Storage capacity	Volume available to store oil on a vessel measured in cubic metres.
Tier III Response Vessel	Response vessels for the large oil slicks.
Vessel Pre-fitting	Modification to a vessel in order to install oil recovery systems. These modifications include foundations on the deck and, if necessary, modifications to the vessel pumping and piping systems as well as storage tanks.

[27] According to EMSA. (2016). Drills and Exercises Annual Report 2015.

1.3 Table of abbreviations

Table 5: Table of abbreviations

Abbreviation	Definition
CECIS	Common Emergency Communication and Information System
CILPAN	Centro Internacional de Luta contra a Poluicao do Atlantico Nordeste (Lisbon Agreement)
EAS	Equipment Assistance Service
EBCGA	European Border and Coast Guard Agency
ECT	Equipment Condition Test
EET	Equipment Evaluation Tool
EFCA	European Fisheries Control Agency
EMSA	European Maritime Safety Agency
HNS	Hazardous and Noxious Substances
IBC	Intermediate bulk containers
IOPC funds	International Oil Pollution Compensation Funds
IOPP	International Oil Pollution Prevention
IRC	Incident Response Contract
IRC-V	Incident Response Contract Vessel
ISM	International Safety Management
ISPS	International Ship and Port Facility Security Code
HELCOM	Baltic Marine Environment Protection Commission (Helsinki Commission)
MAF	Multi-Annual Funding
MPV	Multi-purpose vessel
MRCC	Maritime Rescue Coordination Centre
OPR	Oil pollution response
OSRV	Oil spill response vessel
REMPEC	Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea
SMC	Safety Management Certificate
TLE	Total Life Expectancy
VAC	Vessel Availability Contract
VAF	(yearly) Vessel Availability Fee

2. PART 1: UTILITY, RELEVANCE AND ADDED VALUE OF EMSA'S SERVICES

The aim of this part is to present the pollution response services established by the Agency, comprising of mechanical recovery of oil and oil dispersant application capabilities, and assess their utility, relevance and added value to EMSA's stakeholders, mainly the competent authorities in in charge of maritime affairs in the EU Member States (MS).

This assessment is done by comparing the established services to the requirements and objectives set in the establishing documents, namely:

- Regulation (EU) No 911/2014[28] – containing the Agency's multi-annual funding framework (MAF II)
- The 2004 Action Plan for Oil Pollution Preparedness and Response
- The Action Plan for Response to Marine Pollution from Oil and Gas Installations (2013)
- The EMSA mandate set in Regulation (EC) No 1406/2002 as amended
- Annual Work Programmes of the Agency

2.1 Methodology

The conclusions reached in this part of the study rely on the assessment of evidence based on triangulated data collected from a range of different sources:

- A thorough assessment of internal and external documentation including:
    - Technical documentation on the number, location and endowment of EMSA's network of oil spill response vessels, equipment assistance stockpiles and dispersant stockpiles
    - Financial data related to the costs of the above services
    - Inventories of capacities available to oil pollution response at national level and national policies related to the use of dispersants
    - Regional risk assessments prepared in the context of the Regional Agreements
    - Oil tanker traffic density maps
    - Data on historical oil spills
    - Other relevant documentation such as internal procedures, procurement documentation, etc.
- A targeted stakeholder consultation which consisted in a survey to Member States and interviews with key stakeholders (see section below)
- Expert assessments provided by oil pollution response experts.

2.1.1 Desk Research

A full list of documents analysed in the context of this study is given in appendix 9 of this report.

2.1.2 Stakeholder consultation approach

In order to complement the assessment of EMSA's oil pollution response services, two stakeholder consultation activities were undertaken, these consisted in:

- An online survey of Maritime Authorities, organised by EMSA
- In-depth interviews with a sample of stakeholders

In order to provide a balanced assessment, answers provided by stakeholders are weighted against the total number of views expressed and placed into the context of all data collected within each topic of assessment.

[28] Regulation (EU) No 911/2014 of the European Parliament and of the Council of 23 July 2014 on multiannual funding for the action of the European Maritime Safety Agency in the field of response to marine pollution caused by ships and oil and gas installations Text with EEA relevance, OJ L 257, 28.8.2014, p. 115–120

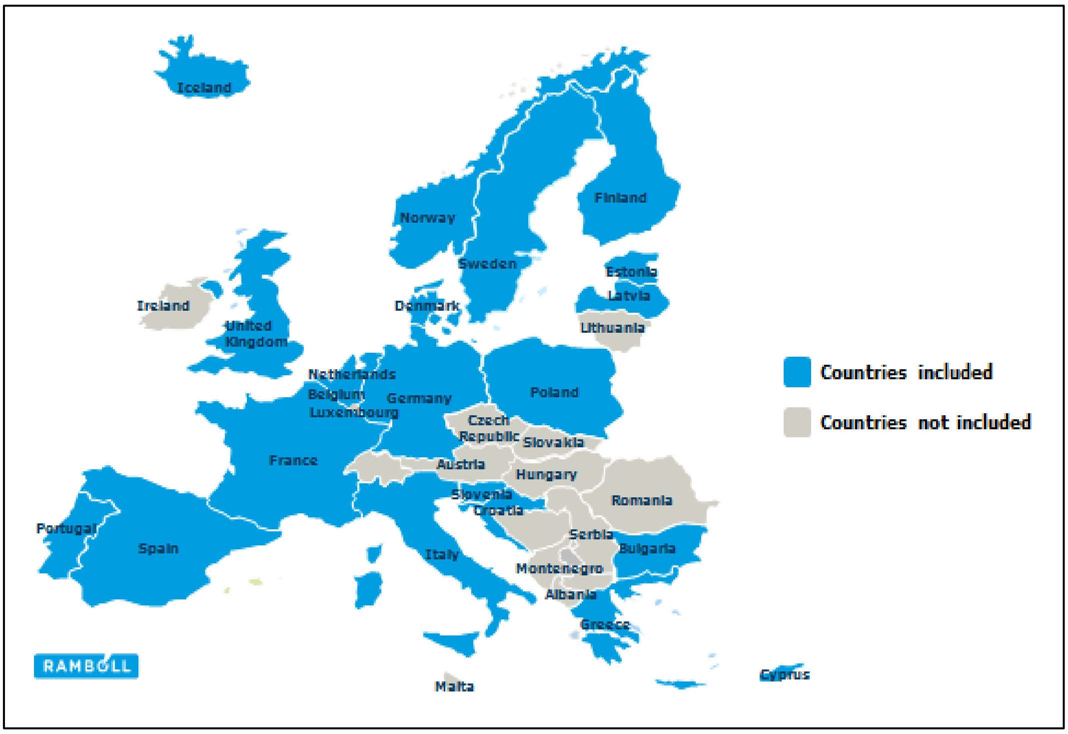
Stakeholder consultation followed defined sets of questions, with some questions allowing stakeholders to openly express views and discuss the topics which they considered relevant. In that sense, the set of questions contained both 'closed' and 'open' questions. The report brings in answers from the consultations where relevant statements were made by the respondents. Statements were systematically balanced against each other to provide the nuance encountered in the interview and survey data.

Online survey of Member States

The online survey has been conducted directly by EMSA between mid-June to mid-July 2016. The purpose of this survey was to collect views of the Member States on EMSA's oil pollution response (OPR) services.[29] The results from topics of the survey relevant to the study are analysed in relevant sections of the report.

A total of 23 individual sets of answers were received from 19 out of 28 EU MS and EFTA countries Iceland and Norway. Two MS (Croatia and Italy) provided two sets of answers to the questionnaire.[30] The figure below shows the coverage of the online survey:

Figure 3: Coverage of responses of online stakeholder survey



Source: Ramboll Management based on responses to EMSA survey (June-July 2016)

In-depth interviews with relevant stakeholders

Semi-structured telephone interviews with stakeholders were conducted for the study over a period of three months. The purpose of the interviews was to analyse stakeholder's views on:

- The relevance, utility, effectiveness, and added value of EMSA's OPR services;
- The appropriateness of EMSA's choices with respect to the type of services funded, the size and capacity of the vessels, location of the assets and service model chosen;
- The advantages and disadvantages of potential alternative service model;
- The present and future availability of OSRVs and equipment at national and private level.

[29] Such as the oil spill response vessels, the Equipment Assistance Service, the dispersant application service, and other related services beyond the scope of this study, such as CleanSeaNet or the MAR-ICE Service.

[30] When analysing the results of the survey, whenever the two answers of respondents from the same MS coincided, they were counted as one. In case they differed, they were treated separately.

Stakeholders acting across the field of marine pollution were contacted to obtain perspectives from competent authorities, market actors of the maritime and oil pollution services sector (ship owners, ship brokers, spill response equipment and services providers), and policy makers, including:

- EU/EFTA costal Member States and Third Country authorities with responsibilities in oil pollution response at a national level (coast guard authorities, Maritime Rescue Coordination Centres)
- Oil pollution research centres;
- Regional Agreements;
- Representatives of EU Commission Directorates;
- Other relevant stakeholders.

The list of stakeholders interviewed and the interview questions are attached to this report in Appendix 7 and Appendix 8 respectively.

2.1.3 Expert input

Judgements regarding technical aspects of EMSA's oil pollution response (OPR) services, and the analysis of the cost-effectiveness of EMSA's oil spill response vessels (OSRVs) were provided by oil spill preparedness and response consultants. Their expert consultation also allowed to complement the data sources used for issuing conclusions.

2.2 History and mandate

Major incidents such as the ERIKA and PRESTIGE disasters highlighted the need for a common European body that could ensure the timely and efficient response to accidents as well as help develop and implement the necessary preventive measures across the Member States.[31]

Against this background, EMSA was established by Regulation (EC) 1406/2002[32] (hereinafter the EMSA Regulation) to provide the Commission and Member States with the necessary supportive tools for ensuring a high, uniform and effective level of maritime safety.

Among its tasks, the Agency received the mandate to: "*provide Member States and the Commission with technical and scientific assistance in the field of accidental or deliberate pollution by ships and support on request with additional means in a cost-efficient way the pollution response mechanisms of Member States*".[33].

EMSA's mandate was further expanded in 2013 with Regulation (EU) 100/2013 amending Regulation 1406/2002 to address marine pollution from oil and gas installations. These missions were first operationalised in the Action Plan for Oil Pollution Preparedness and Response (2004) and updated in 2013 with the expansion of the mandate to,[34] as well as in the in the context of the Annual Work Programmes of the Agency.

Regulation No 911/2014 of 23 July 2014 established a Multiannual Funding framework (MAF II) with the purpose of securing the implementation of EMSA's tasks in the field of marine pollution detection and response caused by ships and oil and gas installation.

As indicated in Table 6, the financial envelope covering the current period was slightly larger than the one established for the previous financial period, taking into account *"the expansion of the Agency's remit with regard to pollution response, and also the need for the Agency to increase*

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[31] http://www.emsa.europa.eu/about/faq/174-general/336-why-does-emsa-exist-what-does-emsa-do-what-benefits-does-the-agency-provide30.html

[32] Regulation (EC) No 1406/2002 of the European Parliament and of the Council of 27 June 2002 establishing a European Maritime Safety Agency (OJ L 208, 5.8.2002, p. 1).

[33] Art. 1 (3) d of Regulation 1406/2002/EC, as amended.

[34] See Action Plan for Response to Marine Pollution from Oil and Gas Installations (adopted in November 2013).

the efficiency in using the funds allocated to it."[35] Under the second MAF and the expansion of its mandate (implemented via new services and equipment provided, including a dispersant application capability and an Equipment Assistance Service, but also other services outside of the scope of this study), the Agency thus had to achieve more with similar funding.

Table 6: EMSA's mandate and financial envelopes to deliver actions in the field of response to marine pollution caused by ships and oil and gas installations

	MAF I –Regulation 2891/2006	MAF II – Regulation 911/2014
Period:	1 January 2007- 31 December 2013	1 January 2014 – 31 December 2020
Financial Envelope:	€ 154,000,000.	€ 160,500,000
Mandate:	(1) Operational assistance and supporting, on request, with additional means, such as stand-by anti-pollution ships and equipment, Member States' pollution response actions in the event of accidental or deliberate pollution caused by Ships (2) Developing a centralised satellite imagery service for surveillance. (3) Other ancillary tasks[36]	(1) EMSA Oil Pollution Response assistance was expanded to cover: Third Countries sharing a regional sea basin with the Union; States applying for accession to the Union and to the European Neighbourhood partner countries Marine pollution caused by oil and gas installations (2) Maintaining and further developing the European Satellite Oil Monitoring Service (CleanSeaNet) for surveillance (3) Other ancillary tasks[37]
Action Plan(s):	From the perspective of operational assistance, the original Action Plan for Oil Pollution Preparedness and Response committed to: Provide "additional" oil recovery vessels to deal with large spills of heavy oils Station the response vessels in a number of pre-established high priority areas Participate in joint oil pollution response activities.	In addition to the tasks operationalised in the original Action Plan, which remain applicable, a new Action Plan[38] focused on response to spills caused by offshore installations foresees that EMSA shall fulfil their new mandate by: Adapting the network of Stand-by Oil Spill Response Vessels in terms of geographic distribution of vessels and the inclusion of equipment suited for response to oil spills from offshore installations. Providing limited dispersant supplies and application systems Developing contractual arrangements for the use of existing oil pollution response equipment stockpiles for use on suitable vessels Procuring additional stand-alone equipment stockpiles.

[35] Preamble 17, Regulation No. 911/2014

[36] E.g. information and the assembling, analysing and disseminating of best practices, techniques and innovations, such as instruments for monitoring tank-emptying, in the field of responding to pollution caused by ships; technical and scientific assistance in the framework of the activities of the relevant Regional Agreements, etc.

[37] Ibid. footnote 36

[38] Action Plan for response to Marine Pollution from Oil and Gas Installations (2013), As adopted by EMSA´s Administrative Board at its 37th Meeting held in Lisbon, Portugal, on 13-14 November 2013

Taking into account all developments presented above, the Agency's anti-pollution response activities are now classified in three main categories, namely:[39]

- Operational assistance and support to coastal States in case of pollution, by making available upon request the following additional response capacity:
  - the network of oil spill response vessels (OSRV);
  - the provision of specialised stand-alone equipment (EAS);
  - dispersant supplies and application systems;
  - technical expertise.
- Cooperation, coordination and provision to the Member States and the Commission of technical and scientific assistance;
- Information, analysis and dissemination of best practices, expertise, techniques and innovations.

2.3 EMSA's service model for providing operational assistance

To provide operational assistance through the network of stand-by oil spill response vessels, the Agency has the following service model: it contracts companies that own or charter vessels and which guarantee the availability of the vessel for OPR within maximum 24 hours from notification. Under normal circumstances, contracted vessels carry out commercial activities, mainly oil trading, bunkering, or offshore supply. However, in the event of an oil spill, and following a request for assistance from a requesting State, vessels are expected to interrupt their normal activities and be ready for service in a maximum time frame of 7 to 24[40] hours (varying between contracts). This is intended to give sufficient time to the crew to discharge any cargo and load specialised OPR equipment.

Currently EMSA does not own any stand-by oil recovery vessels. It pays for the pre-fitting of the vessels, a yearly vessel availability fee (VAF) which also covers the costs of training of the crew and the costs for regular drills, in addition to insurance costs, warehousing and maintenance of equipment. The cost of participation in exercises is covered separately by EMSA.

Additionally, EMSA pays for the purchase of the necessary oil pollution response equipment used by each OSRV or stored in the EAS stockpiles. The equipment is either purchased directly by EMSA or purchased by the contractor, EMSA retaining the option to take ownership of the assets at the end of the contractual period.

The purchase,[41] overhaul,[42] replacement[43] and disposal[44] of equipment are managed in accordance with an established oil spill response equipment management policy. The theoretical life expectancy of equipment purchased by EMSA depends on the nature and type of the equipment and is generally between eight and sixteen years.

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[39] Only the first set of activities is the subject of this study.

[40] One of the vessel arrangements has a mobilization time of 28 hours, as it's area of operations (in the Western Atlantic) is relatively larger than those of other arrangements.

[41] The oil pollution response equipment on-board the stand-by anti-pollution vessels as well as those stored in separate warehouses as part of the EAS is either purchased directly by EMSA, or purchased by the vessel contractors in line with EMSA's requirements, or transferred from a previous contracted vessel to a new arrangement when a service contract expires.

[42] Subject to a case by case analysis.

[43] Using a specifically developed Equipment Evaluation Tool (EET) which suggests the optimal replacement periods for the equipment, based on its condition (following periodic inspections) correlated with the theoretical life expectancy, purchase date, accounting depreciation period and contract renewal date. EMSA replacement policy foresees a theoretical life expectancy of 16 years for the majority of the OPR equipment, 12 years of single point inflation booms made from PVC and 8 years for slick detection systems, sensitive electronic equipment and other assets (hoses, wires, lines, ropes, etc.).

[44] (i) Donation (preferred option); (ii) Public Sale, (iii) Scrapping and (iv) retention by contractor (when a public sale procedure fails and the scrapping involves more costs than revenue).

Based on EMSA's mandate, the Vessel Network and the EAS can be activated using the community mechanism in the field of civil protection (Common Emergency Communication and Information System – CECIS, operated by DG ECHO) by the following Requesting Parties:

- EU Member States;
- EU Candidate Countries;
- European Free Trade Association (EFTA)/ European Economic Area (EEA) coastal States;
- Third Countries sharing a regional sea basin with the Union;
- Private entities.[45]

When activating the network of OSRVs, Requesting Parties would be responsible for the payment of operational / stand-by rates, fuel consumption and vessel cleaning costs associated with the intervention.

2.4 Overview of the capacities of EMSA's Oil Pollution Response Services

This section provides a descriptive overview followed by an assessment of EMSA's Oil Pollution Response services available currently and during the MAF period under scope (2014-2016).[46] Given the absence of actual spill response activities during the period, only operational outputs of the network are assessed. Operational outputs include characteristics of the vessels network namely contract and vessel specifications, the inventory of stand-alone oil pollution response equipment under the EAS, quantities of dispersants in stockpiles, and testing and maintenance of the quality of OPR services and equipment under EMSA's Drills and Exercises programme.

2.4.1 Overview of EMSA's Network of Oil Spill Response Vessels

Since the inception of EMSA in 2002 and of the network of OSRVs, the number of vessels has increased and the overall geographical coverage of the network has continued to evolve on a near year-to-year basis as contracts expire or change, and new vessels enter into service. The Agency's oil pollution response services and capabilities have diversified in recent years with the addition of a dispersant spraying capability and dispersant stockpiles in 2014 and the launch of an Equipment Assistance Service (EAS) in 2016.

As of February 2017, EMSA had Vessel Availability Contracts (VAC) for 21 vessels[47] with 15 contractors.[48]

Current contracts allow 17 vessels[49] to be mobilised simultaneously in the Mediterranean, Black Sea, Atlantic Ocean, North Sea and Baltic Sea. However it should be noted that the vessels are also available to respond to spills outside their stand-by area, anywhere else on the European and EFTA coast and the coast of Third Countries sharing a regional sea basin with EU Member States. Three other vessels are secondary or back-up options in case the main vessel cannot be mobilised. Information about the network and per vessel is presented in Figure 4 in this chapter and Table 76 in Appendix 1.

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[45] "Private Entity" means the ship owner or oil and gas installation operator controlling the activity causing the marine pollution or the imminent threat of it.

[46] Covering the first three years of the full (seven years) MAF period.

[47] Three of the vessels included in this count are secondary or back-up vessels, which cannot be mobilised simultaneously, as they share the OPR equipment with another vessel associated with the same contract.

[48] Between 1st January 2014 and January 2017 several vessel availability contracts have expired and have not been renewed, these include contracts for the Kontio, OW Copenhagen, Enterprise, GSP Orion. On December 16th 2016, a contract for a vessel was signed to be based in Varna, Bulgaria. This vessel is expected to enter into stand-by phase to replace the Enterprise as of mid-2017.

[49] Ibid 47

EMSA Oil Spill Response Vessels' (OSRVs) equipment specifications

EMSA's OSRVs are meant to intervene primarily on spills beyond national response capacity of Member States with state-of-the-art at-sea oil recovery technology. Vessels are selected for their capacity to be certified equipped and manned as OSRV, as per EMSA's 2004 Action Plan.[50] Vessels may however require modifications in order to be on par with EMSA's expectations. All vessels thus undergo a 'pre-fitting' phase and are equipped by the contractor according to contract specifications before they enter into service.

EMSA vessels have similar characteristics which make them apt to respond to spills. This includes a system to decant oil from water to optimize storage, as well as heated storage and high capacity pumps to facilitate the discharging of heavy viscous oil mixtures to shore side facilities. Their main oil recovery mechanism is the 'sweeping arm' (two per vessel) with an alternate 'ocean-going boom and skimmer' system (one or two skimmers and up to two sections of booms per vessel), the use of which depends on what is requested by the Member State based on known characteristics of the incident (extent of the spill, type of oil, weather and sea conditions, etc.). Vessels also possess radar technology to allow the detection of oil slicks and night-time operations. Table 76 (in Appendix 1) summarises vessels' technical specifications.

2.4.2 Overview of EMSA's stand-alone oil pollution response equipment

In addition to vessels, EMSA offers stand-alone OPR equipment in two locations (Aberdeen, UK and Gdansk, Poland) since 2016 under its Equipment Assistance Service (EAS) (see Figure 4). This new service aims to support Member States' operations by providing OPR equipment to be deployed from vessels of opportunity. Equipment stockpiles should provide support in case of spills primarily in the North Sea, and in the Southern Baltic Sea but could also be mobilised for spill incidents elsewhere. The storage of fire booms in these locations facilitates the possibility to utilise in-situ burning, should this response option be appropriate. Table 78 in Appendix 1 presents the equipment available in the two locations.

2.4.3 Dispersant stockpiles and application capability

Although mechanical recovery of oil is intended to be the primary response method to a spill, the application of dispersants may in some cases be the safest and most effective solution to quickly prevent oil slicks from reaching coasts. Dispersants are most effective to treat lighter types of oil which can more easily disperse into the water column. The use of dispersants as oil spill response option is also related to the quantity of pollutant released, making them relevant to respond to spills caused by offshore installations which may involve higher quantities of lighter oil released or incidents involving crude oil tankers carrying lighter crude oil. Because large spills of such kind are more likely to occur following incidents related to offshore oil and gas extraction operations, the use of dispersants by EMSA vessels and provision of material to Member States was decided when the Agency's mandate was expanded in 2013 to response to marine pollution from oil and gas installations.[51]

Consequently, EMSA dispersant capabilities are, in 2017, available in four ports: in the Atlantic (Sines, Portugal and Las Palmas in the Spanish Canary Islands) and the Mediterranean (Valletta, Malta and Limassol, Cyprus). Four EMSA vessels attached to these ports possess dispersant spraying systems (see the map in Figure 4 below). The home base of each of these vessels houses about 200 tonnes of dispersant for a total of 800 tonnes. The dispersant in stockpiles is Radiagreen OSD, which was selected through a public procurement procedure.

In 2015, the planned establishment of an aerial dispersant spraying service could not be completed due to the delay in the EU certification process of the equipment.

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[50] EMSA. (2004). Action Plan For Oil Pollution Preparedness and Response.

[51] EMSA. (2013). Action Plan for Response to Marine Pollution from Oil and Gas Installations.

2.4.4 Drills and exercises

Different types of drills and exercises are conducted under Vessel Availability Contracts (VAC). Section 2.5.11 specifically reviews EMSA Drills and Exercises activities over the period 2014-2016.

2.5 Assessment of EMSA's capacities for Oil Pollution Response

This section evaluates EMSA's capacities on the basis of the minimum criteria outlined in the MAF II[52] (including the EC Communication),[53] the Action Plan for Oil Pollution Preparedness and Response of 2004, complemented by the 2013 Action Plan for Response to Marine Pollution from Oil and Gas Installations, as well as Regulation (EC) No 1406/2002 as amended establishing EMSA and in the 5-year EMSA strategy.[54]

2.5.1 Maximum speed of the vessels

The 2004 Action Plan set a target for EMSA vessels to have "*sufficient speed and power to arrive "on-site" as rapidly as possible"*.[55]

With an average maximum speed of 12.4 knots, all vessels in the current EMSA inventory fulfil this criterion. Most vessels are able to reach maximum speeds between 12 and 13 knots, while two vessels[56] can reach speeds slightly above 14 knots. Only one vessel has a maximum speed below 12 knots.[57]

Assuming a service speed similar to the average maximum speed of the vessels, within 24 hours from the end of the mobilisation period, the EMSA vessels can cover a radius of 286 Nautical miles (529 Km) from their home base.[58]

Areas theoretically not covered within 24 hours from the end of mobilization time by the network of OSRVs include parts of the West coast of France[59] parts of the Mediterranean coast of Spain, the waters around the Balearic Islands,[60] small parts of the South-East Italian coastline and the Eastern and Northern Baltic Sea.

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[52] Regulation No 911/2014 of the European Parliament and of the Council of 23 July 2014 on multiannual funding for the action of the European Maritime Safety Agency in the field of response to marine pollution caused by ships and oil and gas installations.

[53] European Commission Communication on Programming of human and financial resources for decentralised agencies 2014-2020 (COM (2013)519).

[54] http://www.emsa.europa.eu/emsa-homepage/77-publications/2050-emsa-s-5-year-strategy-2014-2019.html

[55] Action Plan For Oil Pollution Preparedness and Response (2004) - "General Criteria", page 60

[56] Ria de Vigo stationed in Vigo and Santa Maria stationed in Marsaxlokk

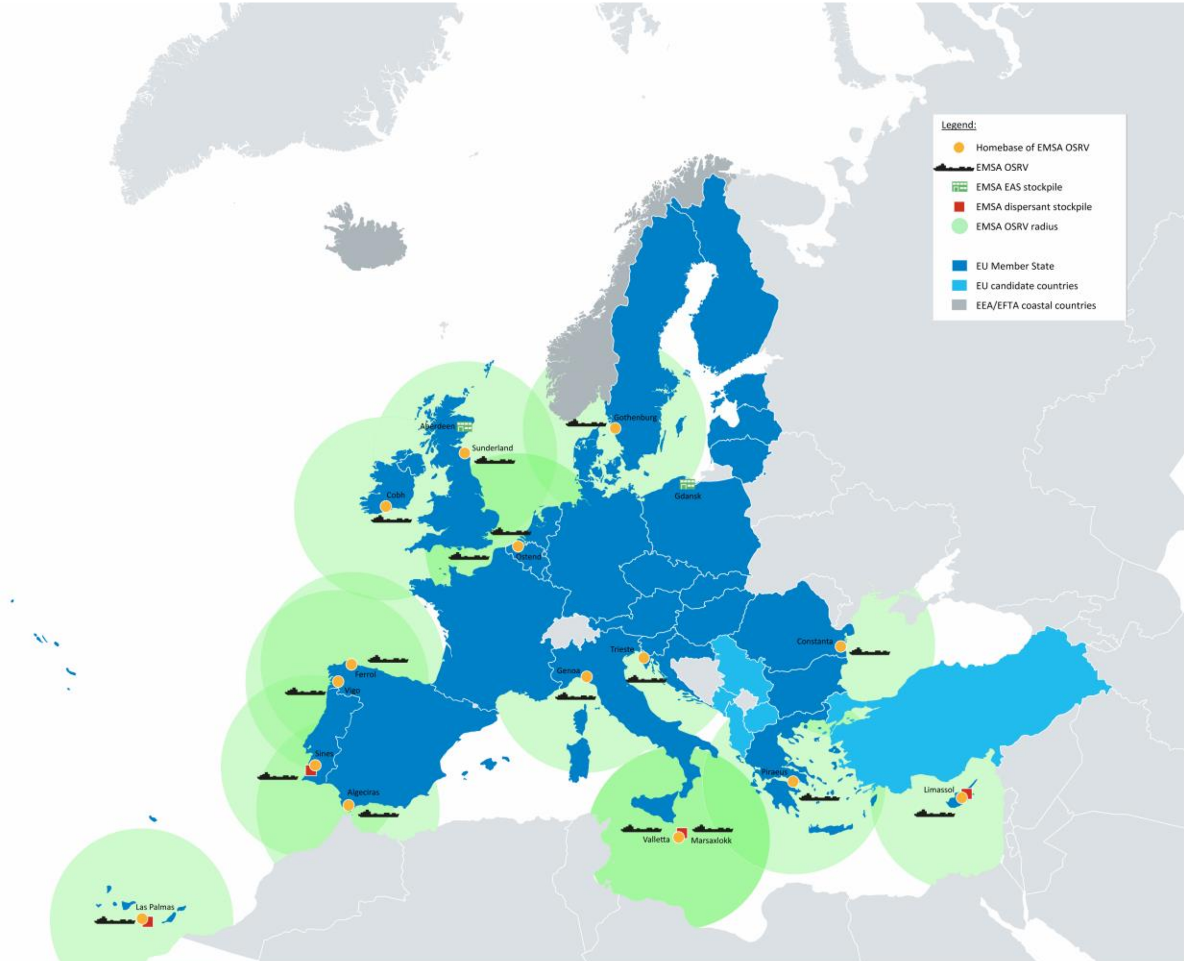
[57] Monte Arucas, stationed in Ferrol has a maximum speed of 10 knots

[58] The homebase of the vessel is the most relevant indicator of where a vessel may become available for OPR, however, depending on whether OPR equipment is permanently stored on board and whether the vessel may discharge it's commercial cargo at a different port, it may become available for OPR at any point in the area of activity.

[59] From the South-Western end of Britany down to approximately the same latitude as Bordeaux.

[60] The apparent gap on the Mediterranean cost of Spain and the waters around the Balearic islands results from the fact that the procedure for securing a vessel whose area of economic activity covers this precise area has resulted in a vessel based in Algericas.

Figure 4: Estimated coverage of EMSA OSRVs within 24h from the end of mobilization time, 2016.[61]



Source: Ramboll, based on EMSA (2016): EMSA's Operational Oil Pollution Response Services (November 2016)[62]

2.5.2 Storage capacity

According to the targets set, all EMSA vessels should: "*Have a large storage capacity (preferably within the 1,500 – 3,000* m^3 *range) to effectively supplement existing capacity of coastal states in the event of a large scale incident*."[63]

With an average of 3,437 m^3 and a median value of 2,976 m^3, the current EMSA vessels comply with the above criterion. No vessels[64] currently active[65] have a storage capacity below 1,500 m^3.

As shown in Table 7 below, looking at only the main vessels[66] contracted by EMSA, EMSA can mobilise 17 vessels with a total capacity of 62,458 m^3. This capacity is mostly located in the

[61] This figure includes vessels Norden and Mencey, Note that the 24 hour radii on this map are indicative and present some limitations, as ships cannot take direct paths across land. For example, the radius for the vessel located in Gothenburg cannot realistically reach the South East of the Baltic Sea in 24 hours as it must cross the Danish-Swedish strait.

[62] Retrieved from: http://www.emsa.europa.eu/operations/pollution-response-services.html. Note that the 24 hour radii on this map are indicative and present some limitations, as ships cannot take direct paths across land. For example, the radius for the vessel located in Gothenburg cannot realistically reach the South East of the Baltic Sea in 24 hours as it must cross the Danish-Swedish strait.

[63] Action Plan For Oil Pollution Preparedness and Response (2004) - "General Criteria", page 60

[64] Aegis I has a capacity on 990 m^3, however it is only a back-up vessel to the larger vessel Aktea OSRV based in the port of Piraeus.

[65] The contract for the vessel Enterprise, based in Varna which had a capacity of 1,374 m^3 has expired in September 2016 and has not been renewed.

[66] This table excludes secondary and back-up vessels which are not mobilised at the same time as the main vessel.

Mediterranean, Atlantic and the North Sea. Relatively smaller capacity is based the Black Sea and the Baltic regions.

While the Atlantic and Black Sea regions are characterised by larger vessels, the average capacity in the other regions is close to the median value of 2,976 m^3.

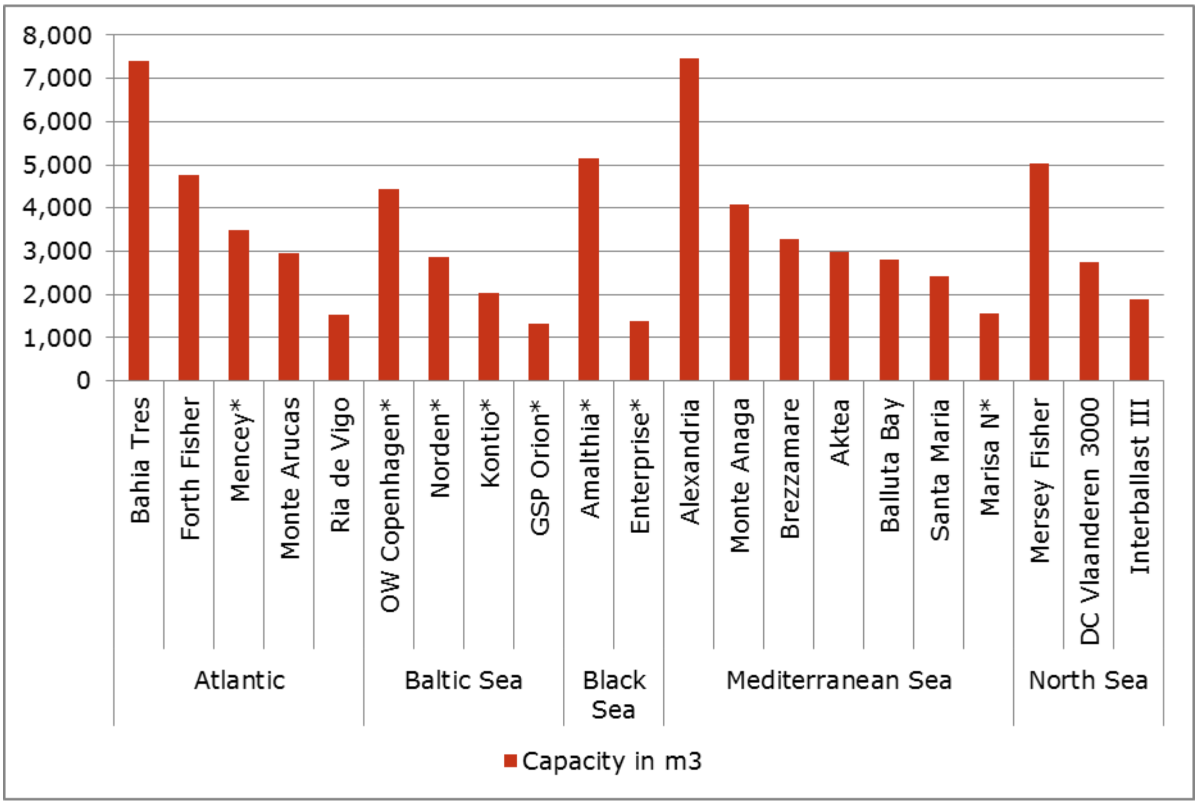
Table 7: Total and average capacity of EMSA's contracted vessels per regional basin, 2016[67]

Region	No. of Vessels	Capacity in m^3	Average capacity in m^3
Atlantic	5	20,141	4,028
Baltic Sea	1	2,880	2,880
Black Sea	1	5,154	5,154
Mediterranean Sea	7	24,625	3,518
North Sea	3	9,658	3,219
Total	**17**	**62,458**	**3,437***

* Average calculated based on individual vessels' capacity.

Figure 5, below, provides an overview of the capacity of all vessels contracted by EMSA during the period 2014-2016. This shows that a number of vessels have a much higher storage capacity than the recommended minimum range of 1,500 to 3,000 m^3. While EMSA has contracted vessels in previous years which had a capacity of lower than 1,500 m^3, these vessels' contracts have not been renewed to prioritise contracting larger vessels.

Figure 5: Storage capacity of EMSA's contracted vessels, 2014-2016.



Note: Vessels marked with an asterisk have not been available throughout the entire period, as contracts ran out or only began during the period. This figure does not include secondary or back-up vessels.

[67] This table includes all vessels whose contracts were on-going at the time of drafting (including Norden and Mencey)

Stakeholders strongly recognise that the main added value of EMSA OPR services is a result of EMSA's coverage of Tier III incidents, which in turn allows Member States to focus on first- and second-tier response capacity.

The EMSA OSRVs' large onboard storage capacity for recovered oil provides a substantial added value to any major oil spill operation, mainly allowing EMSA OSRVs to pursue recovery operation for a long time without need for returning to port or transferring recovered oil at sea into a temporary storage oil tanker or barge.

Although this has been suggested in interviews by some Member States' maritime authorities, the use of EMSA OSRVs as temporary storage vessels is not considered within EMSA's objectives as the vessels would not be able to maintain their primary function as OSRVs and carry out OPR operations themselves.

2.5.3 Suitable equipment on board

EMSA's mandate inscribed in the Action Plans requires that all vessels should "*be equipped with all necessary means for mechanical oil recovery at sea particularly during adverse weather conditions. This includes, sweeping arms, pumps able to handle heavy oil, skimmers, oil/water separation installation, cargo heating installations, safety and cleaning facilities.*"[68]

An analysis of the technical capacities of EMSA vessels[69] shows that:

- All vessels have two containment and mechanical recovery systems available for response operations depending on the type and chemical composition of the spilled oil and to a certain degree also the weather conditions:
  - Each vessel is equipped with two **sweeping arms** (15 metres (m)) with either weir or weir/brush skimmers[70]. The pumping capacity of the sweeping arms is at least 360 m^3/h of water/oil emulsion.
  - Most vessels[71] are equipped with **ocean-type booms** totalling 500 m (2x250).
  - Each vessel is equipped with at least one **offshore capacity skimming system** (on certain vessels there is more than one skimming system available: such additional systems include also high-capacity skimmers and weir booms). The pumping capacity of the additional skimmers is between 111 and 360 m^3/h
- All vessels have the ability to **heat the holding tanks for recovered oil** in order to facilitate the discharging of heavy viscous oil mixtures to shore facilities and reduce the time the vessel spends in port during oil spill operations.
  - The average heating capacity is 2,306 kW which is generally adapted to the total storage capacity of the vessel in question.
- All vessels utilize **high capacity pumps** in order to facilitate the discharging of recovered oil to shore side facilities. The pumps can be used with both heavy and light oils.
  - With an average pumping capacity of 1,542 m^3/h, the OSRV's vessels are able to discharge their full storage capacity within maximum 5 hours.[72] Considering individually the storage and pumping capacity of each vessel, the average theoretical discharge time, if vessel full with water, is 2h30 minutes.
- All EMSA vessels possess radar technology to allow the **detection of oil slicks** during low visibility conditions and night-time operations.

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[68] Action Plan For Oil Pollution Preparedness and Response (2004) - "General Criteria", page 60.

[69] For the purpose of this analysis, the back-up vessel, Aegis I, located in Piraeus has not been included, as its role is only to serve as back-up in case the main ship located in the same home base, the Aktea is not available.

[70] The capacity of the recovery equipment associated with each vessel, according to the technical specifications of the manufacturers ranges from 360 ^{m3}/h to 720 ^{m3}/h. Source: EMSA. (2014). Network of Stand-by Oil Spill response Vessels and Equipment – Handbook 2014.

[71] One vessel, the Ria De Vigo stationed in Vigo has an additional Weir Boom and one vessel (Balluta Bay stationed in Valetta) has 1 reel with 300 m of boom.

[72] This maximum relates to the vessel Amalthia located in Constanta.

- In order to respond efficiently to the broadened pollution response task under its revised Founding Regulation, the Agency has reviewed and modified its strategy to take into account the Action Plan for marine pollution from oil and gas installations. This includes the technical adaptation of the vessels and equipment in order to optimise the capabilities for the recovery of products with a **flashpoint below 60°C.**[73]
    - Twelve of the current EMSA vessels[74] are now certified to recover products with a flashpoint below 60°C. Vessels equipped for this purpose are located: in the Atlantic (3 of 6 vessels with flashpoint below 60°C available in the region); North Sea (2 of 4), the Mediterranean (6 of 8 ships) and the Black Sea (1 of 1 Vessel). No vessel in the Baltic Sea is equipped to deal with products with a flashpoint below 60°C.
- **Seaborne dispersant application** capability:
    - Alternatively to the mechanical oil recovery options, seaborne dispersant application systems and dispersant stockpiles are available on four[75] of the network's vessel arrangements. Dispersants may be used in connection with response to lighter oil types.

A full list of technical equipment with which the current EMSA contracted vessels are endowed can be found in Table 76 in Appendix 1.

EMSA's choices with respect the size and endowment of the vessels were generally viewed positively by stakeholders, both in the context of the survey as well as in the context of the in-depth interviews.

In our assessment, the EMSA OSRVs are equipped with modern and up-to-date oil spill response equipment that will ensure the OSRVs as an effective, high capacity response contribution to any national initiated response operation.

2.5.4 Mobilisation time

Taking into account the need to unload a vessel of its cargo, crew the vessel and/or install the equipment required to convert a vessel into an oil recovery vessel, the Action Plan required that the network of vessels should "*be available within a short period of time*".[76] Under current contracts, vessels may be requested to intervene in an oil spill. In the event of a request, vessels must stop any on-going activity, discharge their cargo, load OPR equipment (in case it is not permanently stored on board) and become available (or 'mobilised') as an OSRV to a requesting State within a contractually agreed mobilisation time.

The majority of EMSA contracted vessels (11 vessels) have a maximum mobilisation time of 24 hours from signature of the Incident Response Contract (IRC), as per the requirements recalled in the 2013 Action Plan.[77] Several vessels over-perform against this criterion, having committed to be ready to respond to a pollution incident within 3,[78] 7,[79] 12,[80] 16[81] and 22[82] hours from the signature of the IRC respectively. One arrangement has a mobilisation of 28 hours in the case of one contract involving two vessels.[83]

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[73] These include lighter types of oil with a high content of volatile organic compounds (VOC), mainly found in spills from oil and gas installations.

[74] This includes secondary and back-up vessels.

[75] Bahia Tres, located in Sines, Portugal, Mencey located in Las Palmas, Spain, Balluta Bay located in Valletta, Malta and Alexandria located in Limassol, Cyprus,

[76] Action Plan For Oil Pollution Preparedness and Response (2004) - "General Criteria", page 60.

[77] Action Plan For Response to Marine Pollution from Oil and Gas Installations. (2004). Page 57.

[78] Aegis I, back-up vessel in Piraeus.

[79] Marisa N in Trieste.

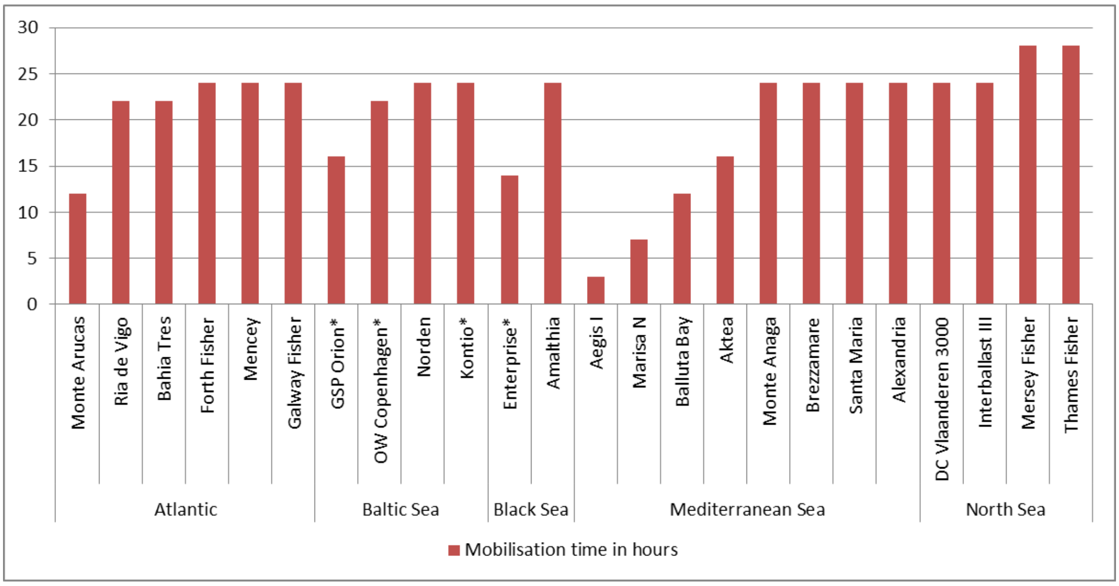
[80] Balluta Bay in Valletta and Monte Arucas in Ferrol.

[81] Aktea in Piraeus.

[82] Bahia Tres in Sines and Ria de Vigo in Vigo.

[83] The two vessels with a mobilisation time of 28 hours are the Mersey and Thames Fisher (main and secondary vessels in the VAC, respectively). These vessels have a relatively larger geographical area of operations, requiring a longer time for mobilisation

Figure 6: Mobilisation times of EMSA vessels active during 2014-2016[84]

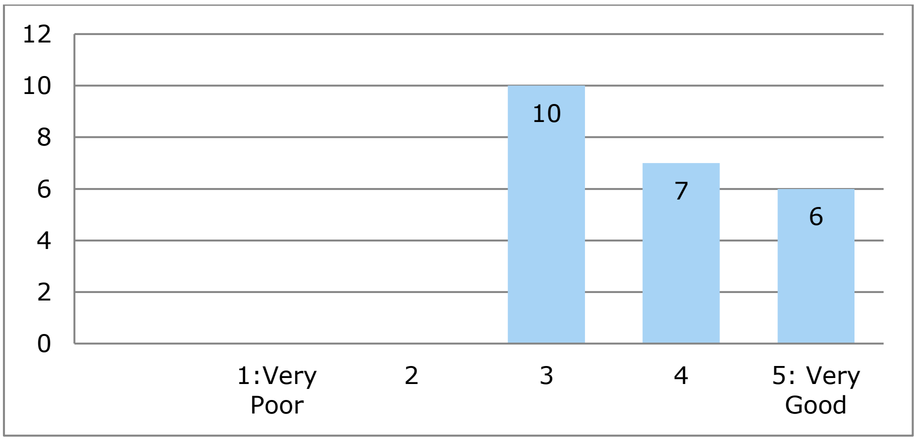


Source: Ramboll, based on data provided by EMSA

Note: Vessels marked with an asterisk (*) have not been available over the entire period, either expiring during the period or commencing their activities within the period in scope.

In the course of the stakeholder consultation activities, Member States were also asked to rate the 24 hour target mobilisation time. The results indicate an overall positive assessment by survey respondents, as shown in Figure 7.

Figure 7: Survey respondents' rating of the 24-hour target mobilization time for vessel and equipment services



Source: Survey to Member States, 2016

However, some Member States consider that EMSA vessels would be more useful if the mobilisation time was shorter, for example in comparison to neighbouring States' mobilisation time (2 respondents in the survey). Other Member States in both the survey and interviews noted that 24 hours was an appropriate time for the mandate of 'topping up' Member States' OPR capacities.

In our assessment, the maximum mobilization time of 24 hours from the signature of the IRC is relevant and in compliance with the "second response capacity" of several MS national response time requirements for larger national response vessels. A shorter contractual mobilisation time

[84] This Graph includes all vessels which were active during the period under scope

would probably make it impossible for the EMSA OSRVs to conduct their usual commercial activities during the "stand-by time" (24 hours) and, by this, lead to an increase of the yearly availability fee. In addition, this would render EMSA a first-on-site service, potentially in breach of EMSA's mandate which stipulates that EMSA's OPR services should not relieve Member States of their primary responsibility to set up appropriate response means.

2.5.5 Manoeuvrability

Requiring that vessels should "*have a certain degree of manoeuvrability in order to position it efficiently with respect to the nature of the oil slicks during the at-sea oil recovery operations"*,[85] the Action Plans and regulatory documents did not operationalise the criteria of manoeuvrability, delegating this aspect to EMSA.

In order to ensure their appropriateness for oil pollution recovery operations, special requirements in terms of low speed capacity and manoeuvrability were put in place by EMSA.

Within procurement procedures, EMSA has required bidders to prove vessels' ability to operate at **low speed** and maintain **manoeuvrability**. Consequently, EMSA has evaluated the ships' propulsion and manoeuvring systems, including propellers and thrusters.

Propulsion on EMSA contracted vessels is assured, in most cases, by one or two controllable pitch propellers, azimuthal propellers, or multiple fixed pitch propellers. All current EMSA contracted vessels are also equipped with bow thrusters for enhanced manoeuvrability.

Given the size of ships and their propulsion capabilities, the OSRV's have a higher manoeuvrability than other ships of similar size, which has improved the vessels' capabilities for OPR.

2.5.6 Compliance with all relevant international and EU legislation

The 2004 Action Plan required that EMSA vessels "*have to comply with all relevant international and EU legislation regarding construction (if applicable: double hull), manning and procedures (ISPS, ISM)*".[86]

Comprehensive checks for compliance with relevant international and EU legislation are conducted in the context of the procurement procedure for each vessel.

In order to comply with this criterion, EMSA verifies the existence and adequacy of the following certificates during the procurement procedure for each ship:

- Vessel's Safety Management Certificate (SMC) for the International Safety Management (ISM) Code
- Certificate of Flag Registry
- Certificate of Class
- International Oil Pollution Prevention (IOPP) Certificate
- Minimum Manning Certificate
- Cargo Ship Safety Radio Certificate
- Continuous Synopsis Record
- Cargo Ship Safety Construction Certificate
- Cargo Ship Safety Equipment Certificate
- International Load Line Certificate

[85] Action Plan For Oil Pollution Preparedness and Response (2004) - "General Criteria", page 60
[86] *Ibid.*

In addition to the above, during procurement, EMSA checks whether the vessels are:

- Not subject to the single hull phase-out requirements;
- Registered with either an EU Member State or an EFTA country or a non-EU "white listed" register as defined by the Paris MoU;
- Classified by a Recognised Organisation in accordance with Regulation (EC) No 391/2009.

The contracted vessels systematically are subject to Flag State as well as Port State Control and inspections. Overall, we consider that EMSA has taken comprehensive and adequate steps to ensure that their contracted vessels comply with all relevant international requirements and EU legislation.

2.5.7 Priority to at-sea recovery

EMSA's mandate in oil pollution response services requires it to give priority to at-sea mechanical recovery. EMSA has operationalised this mandate in two distinct ways:

- Firstly, as a minimum criterion, EMSA verifies that **all its vessels are classed for unrestricted sea-going service** and have all the certificates required for international voyages without any limitation.
- Secondly, this criterion is operationalised through the **type of recovery equipment** with which its vessels and stockpiles are endowed.

The type of equipment made available under the EAS and the equipment on board EMSA OSRV shows that EMSA has prioritised the at-sea mechanical oil recovery aspects of its services over other types of oil pollution response options.

Interviewees generally agreed that EMSA's focus on mechanical offshore containment and recovery was appropriate. Only one respondent pointed out that there might be an over-reliance on this option, pointing out that large oil spills can hardly be contained and prevented from reaching coastlines with the sole use of mechanical recovery response options.

In our assessment, the size of the EMSA OSRVs, their classification for unrestricted sea-going service and their equipment consisting of heavy duty ocean type oil spill recovery equipment are clear indications that EMSA has complied with its mandate of building up a substantial capacity for mechanical recovery of oil at sea over other types of oil pollution response options.

2.5.8 Top-up Member States capacity

The mandate given to EMSA requires that the established capabilities should "top-up" and not replicate or replace the Member States capacities.

This section analyses the manner in which EMSA has dealt with the task of providing services which top up Member States' capacities. It is based primarily on an overview of the national capacities available at Member State level and is complemented with an assessment of whether EMSA's capacities correspond to the priority areas set by the Action plan and Annual work programmes of the Agency.[87]

In our assessment, it appears that EMSA is, at a general level, topping up Member States response capacities by providing a Tier III response capacity characterised by large storage capacity ships, a capacity which is difficult and costly to establish by the Member States on their own.

The figures below present a summarised overview of EMSA's capacities alongside those established by Member States in each regional area. A detailed comparison between EMSA's capacities and those available at national level can be found in Part 4.

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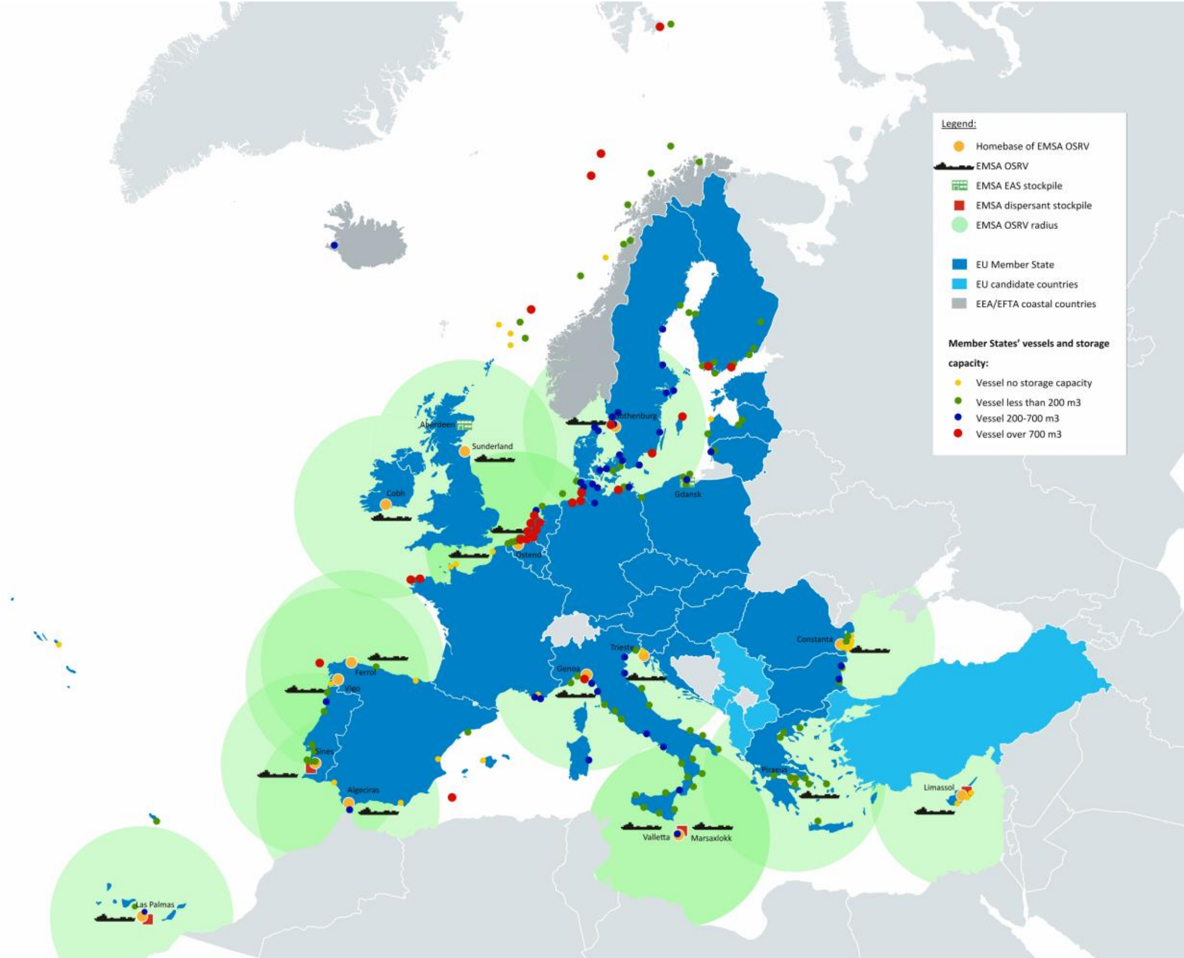
[87] See section 2.5.9

The analysis in this report regularly refers to the location of EMSA' but also Member States' vessels for OPR. In the map below, EMSA and Member States' vessels are represented on a map of Europe. The map allows to see locate Member States' vessels on the basis of their recovered oil storage capacity (from no capacity, to over 700 m^3). This allows to identify gaps in Member States' network of vessels which EMSA has aimed to address with its own services.

Figure 8: EMSA's services and Member States' vessels and storage capacity for oil recovery, 2016.[88]



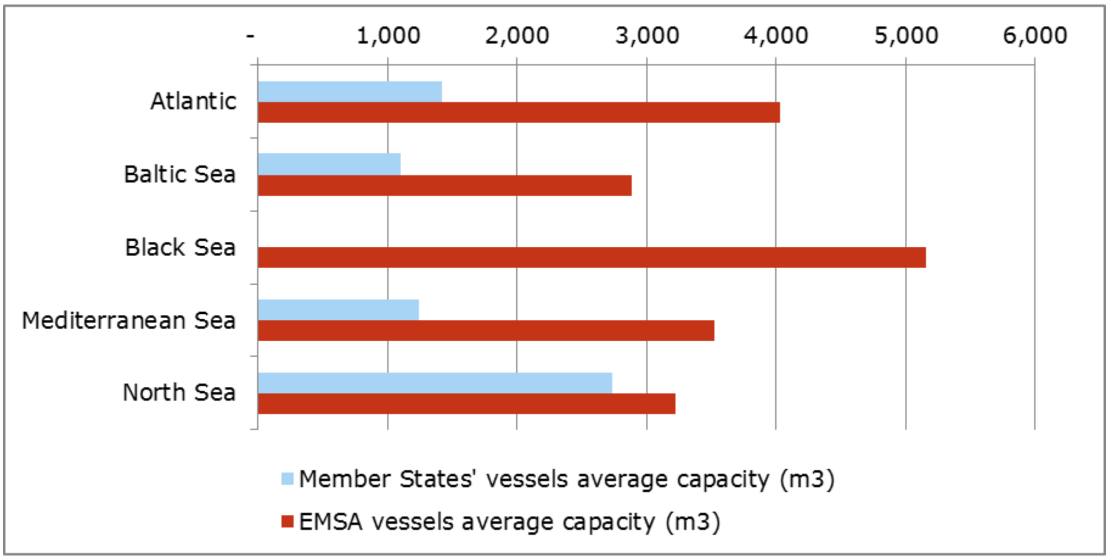
Source: Ramboll, based on EMSA (2016) Inventory of EU Member States Oil Pollution Response Vessels 2016

In order to provide an accurate comparison of EMSA's capacities with those available at Member State level, the analysis conducted below takes into account only the national capacities of Member States in terms of vessels with and oil storage capacity of over 700 m^3.

As can be seen in Figure 9, in line with the objective to provide Tier III response capacities, EMSA's vessels have, on average, **significantly larger on board storage capacity for recovered oil** than Member States' response vessels with over 700 m^3 of recovered oil storage capacity

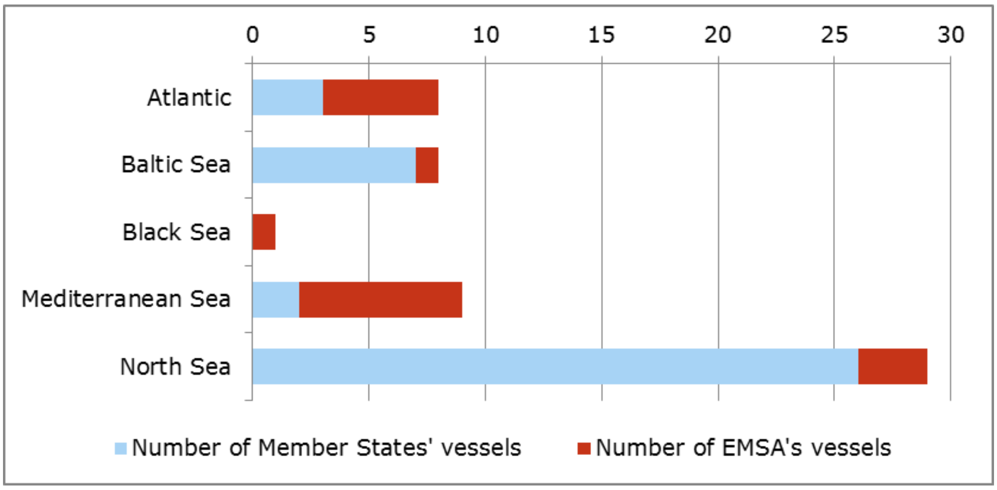
[88] Note that the 24 hour radii on this map are indicative and present some limitations, as ships cannot take direct paths across land. For example, the radius for the vessel located in Gothenburg cannot realistically reach the South East of the Baltic Sea in 24 hours as it must cross the Danish-Swedish strait.

Figure 9: EMSA and Member States - average storage capacity (m^3) of vessels over 700 m^3 of recovered oil storage capacity per region, 2016.[89]



In terms of number of vessels, EMSA's share is particularly important in the Atlantic, the Mediterranean Sea and the Black Sea, whereas the number of Member States' vessels exceeds EMSA's vessels in the Baltic and the North Sea. Overall, this shows that EMSA places Tier III capacity where Member States have low capacity.

Figure 10: EMSA and Member States (MS) – number of vessels with over 700 m^3 of recovered oil storage capacity and region, 2016.[90]



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[89] The calculation of the average storage capacity of Member States is based on the ratio between the total storage capacity of all reported oil storage vessels available in a particular region and the number of vessels in this region. Only vessels of a capacity of more than 700 m^3 have been taken into account. Member States' vessels in the North Sea include the Norwegian Sea.

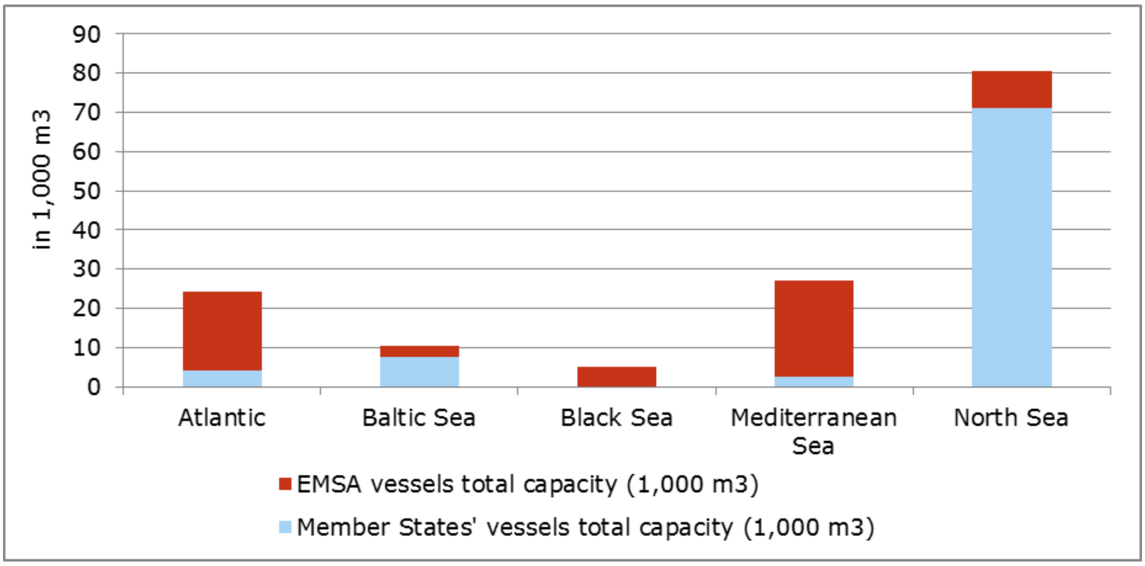
[90] Member States' vessels in the North Sea include vessels in the Norwegian Sea.

When looking at total storage capacity (Figure 11), we can observe that:

- In the North Sea EMSAs OSRVs' recovered oil storage capacity represents of 14% of the oil storage capacity of the vessels available nationally, in the Baltic Sea, this share is 37%.
- In the Atlantic and the Mediterranean, EMSA's storage capacity is significantly larger than the cumulative storage capacity of vessels over 700 m^3 available at national level;
- In the Black Sea, Member States have no vessels with storage capacity of over 700 m^3.

In the Atlantic, Mediterranean and Black Sea, EMSA provides significantly more capacity than what the Member States provide themselves.

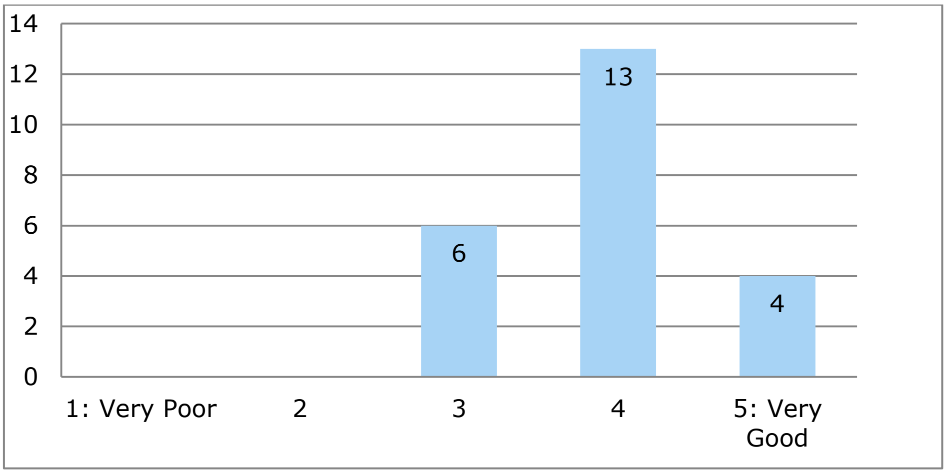
Figure 11: EMSA and Member States – total oil storage capacity of vessels in 1,000 m^3 per region, 2016.



All stakeholders interviewed in the context of this study, and, in particular, representatives of relevant authorities within coastal Member States considered EMSA's OPR activities to be highly relevant and appropriate in terms of providing tier III response capacity across the EU.

In the context of the survey, when asked whether the Agency adequately "tops-up" Member States resources in responding to large scale incidents, respondents answered positively, as indicated by Figure 12.

Figure 12: Respondents' rating of the Agency's adequacy to "top-up" MS resources in responding to large scale incidents



Source: Survey to Member States, 2016

In our assessment, the geographical location and characteristics of EMSA's network of OSRVs provides a substantial increase in the storage capacity of recovered oil and, by this, also an increased capacity for offshore oil spill recovery operations. As a result, EMSA OSRVs have provided a Tier III response capacity available to all MS in case of a major spill incident.

2.5.9 Priority areas set in accordance with EMSA's Annual Work Programme

Two main criteria are used by EMSA when deciding on the location of the new assets or the continuation of existing contracts: (i) risk factors and (ii) existing capabilities.

The first criterion entails the reliance on general risk assessments which focus primarily on ship and tanker traffic, location of offshore oil and gas exploration, location of past oil spills, and other relevant factors. The second criterion takes into account the existent capabilities for oil pollution response available at national level.

When identifying the initial priority areas listed in the 2004 Action plan,[91] EMSA relied to a high extent on the risk assessment undertaken by ITOPF (International Tanker Owners Pollution Federation) at the request of the Commission, supplemented with additional information from a range of sources including input from Member States.

The 2004 Action Plan for Oil Pollution Preparedness and Response identified a number of assumptions regarding oil spill risk factors around European waters. Four priority areas were identified in European waters which required additional action:

- The Baltic Sea;
- The Western approaches to the Channel;
- The Atlantic coast;
- The Mediterranean Sea, particularly the area along the tanker trade route from the Black Sea.

Subsequent updates to the risk profiles conducted in the context of annual programmes as well as resulting from the regional risk assessments[92] conducted by the different Regional Agreements serve to adapt the Agency's choices of location of vessels and content of the EAS. Generally, however, the initial analysis remains valid with certain exceptions.[93]

In subsequent revisions to the original setting of priority areas, additional issues considered included the following:

- The potential threat posed by the relatively high concentration of single hull tankers trading in the East Mediterranean and Black Sea areas;
- The development of shipping and oil/gas exploration activities in general and in the Arctic in particular;
- Particularly in the wake of the Deepwater Horizon incident, the potential threat posed by offshore oil facilities.

The 2013 Action Plan, which is being operationalised yearly through annual Work Programmes adopted by the Administrative Board, focused on the particular threats posed by offshore oil facilities. In order to determine the geographical areas of priority for operational assistance, a number of factors were taken into consideration:

- The location of offshore oil facilities present in European waters.
- The Member States' preparedness and response arrangements.

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[91] The 2004 Action Plan described the existing structures and activities in Europe for pollution response at Member State level and in the context of co-operation by means of the Regional Agreements. In addition, it outlined the marine pollution risk in European waters by identifying the main tanker routes and the growing density of seaborne traffic.

[92] E.g. BRISK and BEAWARE.

[93] See EMSA's Contribution to the Mid-term Report 2007-2009 regarding Regulation No. 2038/2006/EC on the Multi-annual Funding of the Agency's Marine Pollution Preparedness and Response Activities.

- The specific risk factors linked to offshore operations, characterised by:
    - Potentially very large spills in case of a high pressure well blowout;
    - Oils with a flash point below 60°C due to the presence of gas with the oil and flammable volatile organic components.

Priority for response capacity was set to be given to those areas where offshore exploratory drilling is **continuing or anticipated**, and to a lesser degree driven by the historical presence of offshore installations.

As a result of this assessment, EMSA concluded that, as stand-by vessels contracts expire, "*the Agency will reconsider the distribution of the contracted vessels and will propose adaptations if needed*."[94]

As can be seen in Table 7 above, EMSA's capacity is mostly located in the Mediterranean, Atlantic and the North Sea. Relatively smaller capacity is located in the Black Sea and the Baltic regions. Additional equipment, focused primarily (but not exclusively) on response against oil pollution from offshore oil and gas installations[95] is located in warehouses in Gdansk and Aberdeen.

The choice of location of assets is consistent with the priority areas set in EMSA's Action Plans and updated yearly through the Agency's Annual Work Programmes as well as with the regional risk assessments conducted in the context of Regional Agreements.

The Baltic Sea, which has originally been considered a priority area, is currently only covered by one EMSA vessel. This is only a temporary situation as one of the on-going contracts in the Baltic expired (second term) in April 2016 and a procurement procedure for a replacement is on-going, following a decision taken by EMSA's Administrative Board to stabilise the capacity to two vessels in the Baltic Sea region.

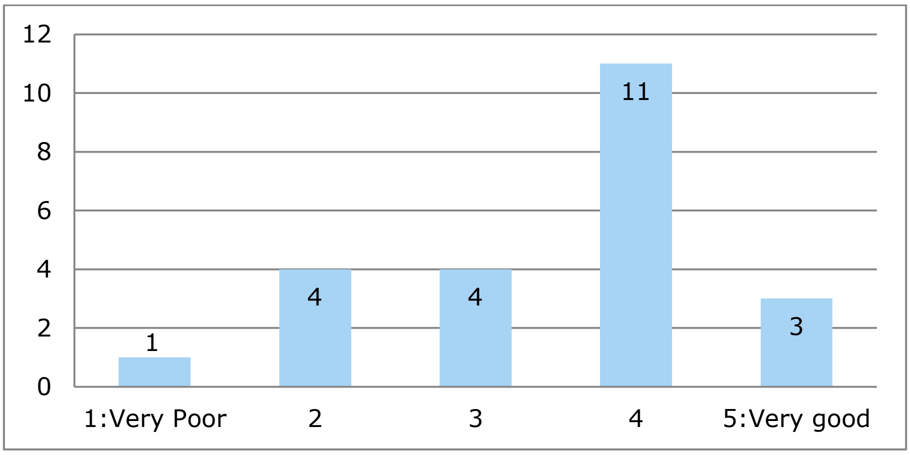
In the course of the stakeholders consultation activities, most respondents considered that the location of assets is appropriate and ensures a good balance between covering the areas of high risk as well as providing capacity where there is little (even though risks may be lower). A minority of interviewees pointed out that the process for selecting locations, and types of equipment to be placed in stockpiles could be improved. They welcomed a more transparent and collaborative process.

In the context of the survey, Member States were asked to rate the geographical coverage of European waters by the EMSA OSRV network. Generally speaking, Member States are rather satisfied with the geographical coverage of EU waters; however, as indicated by Figure 13, some of the countries rated this aspect less favourably. The less favourable assessments are mostly due to the temporary situation in the Baltic Sea and the understandable geographical distance of EMSA OSRVs to Iceland. One country, rated this aspect poorly due to a perceived disconnect between the location of assets and national capacities and identified risks. This view is analysed in depth in sections 2.5.8 and 2.6.

[94] Action Plan for response to Marine Pollution from Oil and Gas Installations, As adopted by EMSA´s Administrative Board at its 37th Meeting held in Lisbon, Portugal, on 13-14 November 2013, page 57.

[95] In-situ burning equipment (fire booms).

Figure 13: Member States rating of geographical coverage of EU waters by EMSA's Stand-by Oil Recovery vessel Network



Source: Survey to Member States, 2016

In our assessment the geographical coverage of EU Waters by the EMSA OSRVs Network is adequate taking into account ealier comments on the need for better coverage of the Northern Baltic Sea (soon to be addressed by a new vessel) and the Western Mediterranean Sea.

2.5.10 Contractual allocation per region

The 2004 Action Plan established that EMSA *"should be able to restrict the amount per ship needed to conclude a stand-by contract at a reasonable level. Using existing contracts of some Member States as a benchmark, EMSA should be able to conclude [vessel availability] contracts for a maximum of 5 M euro per region"*[96], while acknowledging that *"In the context of a multiannual contract, the total amount required will vary (up and downwards) depending on the type of vessel, the set of equipment needed and the required length of the contract to cover investment costs"*.

For the purpose of interpreting this requirement, we understand that the authors of the Action Plan analysed the possibilities available to EMSA at the time of drafting and estimated that EMSA should be able to establish multi-annual stand-by contracts within the envelope of € 5 M per region.

Based on the text of the requirement, we understand that the financial requirement refers to the total contractual costs associated with each individual vessel arrangement over a multi-annual contract and, in our interpretation, should include, over the multi-annual period of the contract:

- Availability fees;
- Pre-fitting costs; and
- Equipment costs associated to the period considered.

In order to calculate the average yearly contractual allocation and provide an accurate and comparable estimation, our methodology has considered the full cost of costs running between 2014-2016, taking account of the average annual availability fees, the yearly average pre-fitting costs over the same period, as they have been spread over the entire duration of the contract and the average yearly equipment costs, as they have been spread over the total life expectancy (TLE) of each individual piece of equipment.

[96] Action Plan For Oil Pollution Preparedness and Response (2004) - "General Requirements", page 58

Taking this into consideration, over a multi annual period of four years, it is observed, that the average contractual allocation per vessel is approximately € 3.6 M, (well below the € 5 M limit) and only one contract is above the threshold.[97]

Table 8: Average yearly contractual allocation for each contract active during the period 2014-2016

Current contractor	Vessel	Type of vessel	Average	Total over 4 years
Atlantic			**1,042,810**	**4,171,238**
James Fisher Everard	Mersey; Galway and Forth Fisher*	Oil Tanker	1,511,455	6,045,821
James Fisher Everard	Forth or Galway Fisher	Oil Tanker	868,449	3,473,797
Remolcanosa	Ria de Vigo	Offshore supply	1,385,092	5,540,367
Mureloil	Bahia Tres	Oil Tanker	862,304	3,449,214
Ibaizabal	Monte Arucas	Oil Tanker	857,872	3,431,488
Petrogas	Mencey	Oil Tanker	771,686	3,086,744
Baltic Sea			**861,480**	**3,445,922**
Arctia Icebreaking	Kontio	Ice-breaker	1,088,013	4,352,051
OW Tankers	OW Copenhagen	Oil Tanker	531,497	2,125,987
Stena	Norden	Oil Tanker	964,932	3,859,728
Black Sea			**783,540**	**3,134,159**
Bon Marina	Enterprise	Offshore supply	774,017	3,096,070
Grup Servicii Petroliere	GSP Orion	Offshore supply	877,056	3,508,225
Petronav	Amalthia	Oil Tanker	699,545	2,798,181
Mediterranean Sea			**885,056**	**3,540,225**
Petronav	Alexandria	Oil Tanker	1,066,700	4,266,800
EPE	Aktea (back-up Aegis I)	Oil Tanker	884,586	3,538,343
Tankship	Balluta Bay	Oil Tanker	747,006	2,988,025
Ciane	Brezzamare	Oil Tanker	868,824	3,475,294
Castalia	Marisa N	Oil Tanker	1,046,925	4,187,701
Naviera	Monte Anaga	Oil Tanker	895,140	3,580,561
Falzon	Santa Maria	Oil Tanker	867,857	3,471,428
North Sea			**678,831**	**2,715,324**
DC Industrial	Interballast III	Hopper Dredger	468,570	1,874,278
DC Industrial	DC Vlaanderen 3000	Hopper Dredger	517,825	2,071,300
James Fisher Everard	Thames or Mersey	Oil Tanker	1,050,098	4,200,393
Average			**877,966**	**3,564,627**

Source: Ramboll, based on financial data provided by EMSA.

* Contract for the Mersey; Galway and Forth Fisher covered the possible use of two vessels simultaneously.

2.5.11 Participation in regular quarterly drills and exercises

To maintain the quality of the at-sea oil recovery service, all vessels and crews undergo regular drills under the supervision of the Agency. Furthermore, EMSA aims to participate in operational exercises[98] organised by Member States and actively promotes the undertaking of notification exercises.[99] These exercises enhance the communication with Member States and the integration of EMSA's assets in the command and control structures to prepare for the scenario of a major spill. Drills and exercises train personnel and test equipment and relevant contingency plans.

Different types of drills and exercises are conducted under Vessel Availability Contracts (VAC). Table 9 summarises the total number of drills and exercises conducted during the current MAF period.

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[97] The Ria de Vigo, stationed in Vigo. The contract for the Mersey; Galway and Forth Fisher also exceeds € 5 M, however this contract offered the possible use of two vessels simultaneously (with two sets of OPR equipment), thus explaining the higher cost. If excluded from the table, the average cost per arrangement over the duration of the 4 year contracts decreases to less than € 3.45 M.

[98] Operational exercises at sea are organised by the Member States within the framework of national or regional contingency plans. EMSA, as a guest to these exercises, usually has only a limited influence on their content.

[99] Notification exercises are usually conducted in conjunction with operational exercises. In addition, 'standalone' notification exercises are occasionally carried out. The aim of these exercises is to test and implement agreed procedures and lines of communication for reporting incidents and for requesting and providing assistance.

Table 9: Number of Drills and Exercises per year (2014-2016)[100]

Year	Quarterly drills	Operational exercises (and number of vessels involved)	Notification exercises (and number of contractors involved)	Total
2014	61	10 (12)	11 (14)	92
2015	62*	9 (11)	10 (14)	89
2016	79**	10 (12)	10 (14***)	99

** Includes 2 repeated drills.*
*** Includes 7 equipment condition tests for the EAS and 3 acceptance drills.*
**** Includes 12 vessel contractors and, for the first time, 2 EAS contractors.*

Quarterly drills, EAS Equipment Condition Tests, notification exercises and operational exercises are described below. We also provide an assessment of EMSA's performance in terms of response time during notification exercises and ability of the crew to work with the equipment. The assessment uses the data provided by EMSA in Drills and Exercises Reports for the period under scope (2014, 2015 and 2016).[101] In addition, a view from Maritime Authorities interviewed and surveyed is provided at the end of this section.

Quarterly drills

Quarterly drills are conducted four times a year subject to the vessel's period of service. They aim to verify that the capability of the vessel and specialised equipment and the skill of the crew are at an appropriate level to carry out OPR services efficiently. The acceptance of the contractor's quarterly drill report by the Agency is a condition for the payment of the VAF by the Agency.

Table 10, below, shows that in the period under scope all vessels successfully took part in 100% of required quarterly drills.

Table 10: List of Drills and Exercises and contract information per vessel contracted between 2014, 2015 and 2016.

<table>
<tr><th>Vessel</th><th>Quarterly drills conducted and accepted in 2014</th><th>Operational exercises 2014</th><th>Notification exercises 2014</th><th>Quarterly drills conducted and accepted in 2015</th><th>Operational exercises 2015</th><th>Notification exercises 2015</th><th>Quarterly drills conducted and accepted in 2016</th><th>Operational exercises 2016</th><th>Notification exercises 2016</th></tr>
<tr><td>Monte Arucas</td><td>4 out of 4</td><td>1</td><td>1</td><td>4 out of 4</td><td>2</td><td>2</td><td>4 out of 4</td><td>1</td><td></td></tr>
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<tr><td>Galway Fisher</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Bahia Tres</td><td>4 out of 4</td><td></td><td></td><td>4 out of 4</td><td></td><td></td><td>4 out of 4</td><td>1</td><td>1</td></tr>
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<tr><td>Enterprise*</td><td>4 out of 4</td><td></td><td>1</td><td>4 out of 4</td><td></td><td></td><td>3 out of 3</td><td>1</td><td>1</td></tr>
<tr><td>Amalthia*</td><td>N/A</td><td>N/A</td><td>N/A</td><td>1 out of 1</td><td></td><td></td><td>4 out of 4</td><td>1</td><td>1</td></tr>
<tr><td>Marisa N*</td><td>N/A</td><td></td><td></td><td>4 out of 4</td><td></td><td></td><td>4 out of 4</td><td></td><td></td></tr>
<tr><td>Brezzamare</td><td>4 out of 4</td><td>1</td><td>1</td><td>4 out of 4</td><td>1</td><td>1</td><td>4 out of 4</td><td>1</td><td>1</td></tr>
<tr><td>Aktea OSRV</td><td>6 out of 6</td><td></td><td></td><td>4 out of 4</td><td>1</td><td>1</td><td>4 out of 4</td><td></td><td></td></tr>
<tr><td>Aegis I</td><td>4 out of 4</td><td></td><td></td><td>2 out of 2</td><td>1</td><td></td><td>2 out of 2</td><td></td><td></td></tr>
<tr><td>Santa Maria</td><td>4 out of 4</td><td>1</td><td>1</td><td>4 out of 4</td><td>1</td><td>1</td><td>4 out of 4</td><td>1</td><td></td></tr>
<tr><td>Monte Anaga</td><td>4 out of 4</td><td>1</td><td>1</td><td>4 out of 4</td><td></td><td></td><td>4 out of 4</td><td>2</td><td>2</td></tr>
<tr><td>Alexandria</td><td>4 out of 4</td><td>1</td><td>1</td><td>3 out of 3</td><td>1</td><td>1</td><td>4 out of 4</td><td>1</td><td>1</td></tr>
<tr><td>Balluta Bay</td><td>4 out of 4</td><td>1</td><td>1</td><td>4 out of 4</td><td>1</td><td>1</td><td>3 out of 3</td><td>1</td><td></td></tr>
<tr><td>Interballast III</td><td rowspan="2">4 out of 4</td><td>1</td><td>1</td><td>3 out of 3</td><td></td><td>1</td><td>4 out of 4</td><td>1</td><td>1</td></tr>
<tr><td>DC Vlaanderen 3000</td><td>1</td><td>1</td><td>3 out of 3</td><td></td><td>1</td><td>4 out of 4</td><td></td><td>1</td></tr>
<tr><td>Mersey Fisher</td><td>3 out of 3</td><td></td><td></td><td rowspan="2">4 out of 4</td><td>1</td><td></td><td rowspan="2">4 out of 4</td><td></td><td>1</td></tr>
<tr><td>Thames Fisher</td><td>2 out of 2</td><td>1</td><td>1</td><td></td><td>2</td><td></td><td></td></tr>
</table>

[100] Sources: EMSA (direct communication) and EMSA's 2014, 2015 and 2016 Drills and Exercises Annual Reports. Retrieved from: http://www.emsa.europa.eu/

[101] Sources: EMSA's 2014, 2015 and 2016 Drills and Exercises Annual Reports. Retrieved from: http://www.emsa.europa.eu/

Kontio	4 out of 4	1	1	4 out of 4	1	4	N/A	N/A	N/A
OW Copenhagen*	4 out of 4	1	3	*N/A*	*N/A*	*N/A*	N/A	N/A	N/A
GSP Orion*	4 out of 4			*N/A*	*N/A*	*N/A*	N/A	N/A	N/A
Mencey*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	3 out of 3		
Norden*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	3 out of 3	1	2

** Vessels marked with an asterisk (*) have not been available for the entire period possibly accounting for less than 4 quarterly drills conducted, as contracts started or ended during the period.*

EAS Equipment Condition Tests

Since the inception of the Equipment Assistance Service, EMSA carries out equipment condition tests, ECTs, in order to ensure availability and overall quality of machinery and equipment. At most, six ECTs are to be carried out per EAS arrangement per year. Guidelines for ensuring continued good condition are an integral part of the Service Availability Contract.

ECTs for the two EAS arrangements were carried out in 2016 two in the EAS North Sea and five in the EAS Baltic. All showed a satisfactory level of equipment condition.

In order to improve Member States' knowledge of EMSA's EAS and drill programme, representatives from 18 different EU/EFTA Member States were invited to two seminars held by EMSA in Aberdeen (UK) and Gdansk (Poland)

Notification exercises

Notification exercises are either carried out at the same time as operational exercises or on their own.[102] These exercises test the procedure for requesting assistance from EMSA vessels, thus typically involving a requesting State and a vessel contractor. In 2014, the Common Emergency Communication and Information System (CECIS) operated by DG ECHO became the common tool for conducting the notification exercises in the field of response to marine pollution.

The main criterion for the evaluation of the notification exercise is the time needed for the Incident Response Contract-Vessel (IRC-V)[103] to be signed by both the EMSA contractor and the Member State requesting assistance.

Outcomes of notification exercises in 2014, 2015 and 2016 are reviewed in Table 11 below. In 2014, 7 out of 11 procedures were successful, meaning that the IRC-V was signed. In 2015, 6 out of 10 procedures were successful, and in 2016, 7 out of 10 were successful. Vessel contractors generally responded in time to requests for assistance, with one exception in 2015 (MALTEX 2015 exercise). EMSA has mostly responded to requests on time. Delays in signature of the IRC-V were met particularly in 2015 due to miscommunication, technical issues, and issues in Member States in identifying the person competent to sign the IRC-V. In 2016, delays were due in one instance to unavailability of personnel with the authority to sign on the part of EMSA's contractor or for the requesting State, as well as miscommunication and technical issues with the requesting State.

[102] For the sake of clarity, the outcome of operational exercises is assessed separately in the following section.

[103] "Incident Response Contract": This contract is to be concluded between the ship operator and the affected State. Following a request for assistance, EMSA will activate or even pre-mobilise the vessel to facilitate the operation. The command and control during an incident rests with the coastal State using the vessel.

Table 11: Analysis of the time for signature of the IRC-V during notification exercises in 2014 and 2015.[104]

Notification exercises in 2014		Notification exercises in 2015		Notification exercises in 2016	
Name of the notification exercise	Approximate time for signature of the IRC-V (hours)*	Name of the notification exercise	Approximate time for signature of the IRC-V (hours)*	Name of the notification exercise	Approximate time for signature of the IRC-V (hours)*
BALEX DELTA	4	**BALEX DELTA 2015**	Not signed	**BALEX DELTA 2016**	23***
NEMESIS 2014	3	**NEMESIS 2015**	5	**NEMESIS 2016**	2
MALTEX 2014	2	**MALTEX 2015**	8	**-**	-
RAMOGEPOL 2014	Not signed	**-**	-	**RAMOGEPOL 2016**	Not signed
ORSEC	4	**POLMAR MER 2015**	4	**ANEDPOLMAR 2016**	Not signed
Oil Spill Ria De Arousa	3.5	**ANEMONA 2015**	16**	**ATLANTIC POLEX.PT 2016**	28***
Collision in Bourgas Bay - BULGARIA 2014	1.25	**ROCHES DOUVRES 2015**	Not signed	**BREEZE 2016**	4
MASTIA 2014	2	**KEMI - ARCTIC 2015**	4	**VALENCIA 2016**	Not signed
BALEX BRAVO	Not signed	**TRITON 2015**	4	**BULGARIA**	2.75
STOROVELSEN	Not signed	**VEITIKKA**	Not signed	**GREY SEAL 2016**	0.75
MANCHEX 2014	Not signed	**NotEx DENMARK 2015**	Not signed	**COPENHAGEN AGREEMENT**	4.5
Average time 2014	2.8	**Average time 2015**	6.8	**Average time 2016**	9.3

** EMSA considers 6 hours to be an acceptable target for parties to sign the IRC-V.*
*** Procedure for this exercise was met with major delays due to issues of the requesting State in using CECIS; on the part of the contractor to return the IRC to the requesting State; and suspension of the exercise by the requesting State. See the 2015 Drills and Exercises Annual Report for details.*
**** Prolonged response time was due to technical problems and/or unavailability of the person with authority to sign.*

Operational exercises

At-sea operational exercises usually involve the release of simulated oil, the deployment of pollution response vessels from the participants, and the establishment of a unified command structure and lines of communication. These exercises are generally initiated by EU Member States and/or Regional Agreements inviting EMSA to participate and attributing a specific role for EMSA vessels and equipment. In addition, two exercises were organised by EMSA in 2015.

10, 11, and 11 EMSA vessels in 2014, 2015 and 2016 respectively participated in operational exercises upon invitation from Member States. For each of these exercises, the performance of EMSA equipment used is assessed systematically. The assessment provided below is based on conclusions provided in EMSA's Drills and Exercises Annual Reports for 2014,2015 and 2016.

In Table 12, an overview of these exercises conducted in 2014 is provided. It shows satisfactory levels of performance of EMSA equipment used during the exercise.

[104] Sources: EMSA's 2014 and 2015 Drills and Exercises Annual Reports. Retrieved from: http://www.emsa.europa.eu/

Table 12: Assessment of 2014 operational exercises involving EMSA and the Member States[105]

Region	Name of the exercise	Participating countries	EMSA equipment	Performance of EMSA equipment and crew
Baltic Sea	**Oil in Ice**	Finland, EMSA	Arctic skimmer (from Kontio)	Satisfactory
	Balex Delta 2014	Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Sweden and EMSA	OW Copenhagen	Satisfactory
North Sea	**Pollex 2014**	The Netherlands, Belgium, EMSA	DC Vlaanderen 3000, Interballast 3	Satisfactory
	Manchex 2014	France, EMSA	Thames Fisher	Satisfactory
Atlantic Ocean	**Galicia 2014**	Spain, EMSA	Ria de Vigo	Satisfactory
	Orsec Biscaye	France, EMSA	Monte Arucas	Satisfactory
Mediterranean Sea	**Nemesis 2014**	Cyprus, Israel, Greece, USA, EMSA	Alexandria	Satisfactory
	Maltex 2014	Malta, EMSA	Santa Maria, Balluta Bay	Satisfactory*
	Ramogepol 2014	Italy, Fance, Spain, Monaco, EMSA	Brezzamare	Satisfactory
	Mastia 2014	Spain, EMSA	Monte Anaga	Satisfactory**

** Difficult weather conditions only allowed the deployment of one sweeping arm on each vessel.*
*** One boom presented signs of damage and had to be brought back on board for inspection.*

In Table 13 below we provide an overview of the exercises conducted in 2015. It shows satisfactory levels of performance of EMSA equipment used during the exercise.

Table 13: Assessment of 2015 operational exercises involving EMSA and the Member States[106]

Region	Name of the exercise	Participating countries	EMSA equipment	Performance of EMSA equipment and crew
Baltic Sea	**Kontio Open Ship**	Finland, EMSA (organiser)	Kontio	Satisfactory
North Sea	**Polex 2015**	Belgium, The Netherlands, EMSA	Mersey Fisher	Satisfactory
Atlantic Ocean	**Roches Douvres 2015**	France, EMSA	Forth Fisher	Satisfactory
	Safemed III	EMSA (organiser), Observers from SAFEMED III beneficiary countries	Monte Arucas	Satisfactory
	Anemona 2015	Portugal, Spain, EMSA	Monte Arucas	Satisfactory
Mediterranean Sea	**Polmar Mer 2015**	France, EMSA	Brezzamare	Satisfactory
	Maltex 2015	Malta, EMSA	Balluta Bay, Santa Maria	Satisfactory
	Triton 2015	Greece, EMSA	Aktea OSRV, Aegis I	Satisfactory
	Nemesis 2015	Cyprus, Greece, EMSA	Alexandria	Satisfactory

In table 9 below we provide an overview of the exercises conducted in 2016. All exercises showed a satisfactory level of performance of the EMSA equipment utilised.

[105] EMSA. (2014). Drills and Exercises. Annual Report 2014. ANNEX 1 OPERATIONAL EXERCISES 2014.
[106] EMSA. (2015). Drills and Exercises. Annual Report 2015.

Table 14: Assessment of 2016 operational exercises involving EMSA and the Member States[107]

Region	Name of the exercise	Participating countries	EMSA equipment	Performance of EMSA equipment and crew
Baltic Sea	**COPENHAGEN AGREEMENT 2016**	Sweden, Denmark, Norway, EMSA	*Norden*	Satisfactory
Black Sea	**TRACECA II**	Romania, EMSA	*Amalthia*	Satisfactory
	BREEZE	Bulgaria, U.S., Romania, Turkey, and other NATO participants. EMSA*	*Enterprise*	Satisfactory
North Sea	**ANED-POLMAR 2016**	France, EMSA	*Interballast III*	Satisfactory
Atlantic Ocean	**RAMOGEPOL 2016**	France, Italy, Monaco, EMSA	*Brezzamare*	Satisfactory
	GASCOGNE 2016	France, Spain, EMSA	*Monte Arucas*	Satisfactory
	ATLANTIC POLEX.PT 2016	Portugal, Spain, EMSA	*Bahia Tres Monte Anaga*	Satisfactory
Mediterranean Sea	**SIMULEX 2016**	Morocco, EMSA	*Monte Anaga*	Satisfactory
	MALTA OPEN SHIP 2016	EMSA, participants to the Malta Maritime Summit 2016	*Balluta Bay*	Satisfactory
	NEMESIS	Republic of Cyprus, France, Greece, USA, UK, Arab Republic of Egypt, EMSA, EDT offshore company	*Alexandria*	Satisfactory

In 2014 the Agency concluded that more evaluation should follow operational exercises by the organising Member States to produce feedback and improve practices. The following year (2015), EMSA started to develop its own a horizontal assessment procedure that analyses and incorporates all data collected from the drill reports. Equipment wear and tear, technical problems and effectiveness of equipment deployment and use are examined by EMSA.

Conclusions on the assessment of EMSA's Drills and Exercises Programme and views from the Member States

The results of the drills and exercises show that EMSA has a well-structured system in place for the maintenance of the service, with regular drills conducted (quarterly) for each vessel and a 100% rate of these required drills conducted. The ability of EMSA vessels' crews to deploy and manoeuvre the spill response equipment is overall reported as satisfactory. This assessment is generally confirmed by interviews and survey data from the Member States' Maritime Authorities having participated in exercises with EMSA (3 survey respondents and 2 interviewees, all from different Member States).[108] An overview of ratings from the survey is provided below in Figure 14 below.[109]

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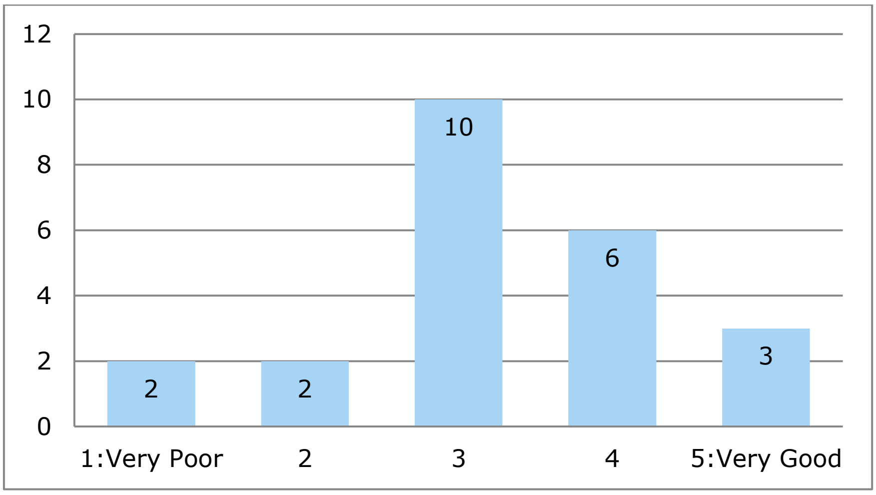
[107] EMSA. (2015). Drills and Exercises. Annual Report 2015.

[108] More Member States have collaborated with EMSA in the conduct of these exercises, however the answers to the questionnaire and during interviews did not systematically allow to find out the extent of knowledge with the Drills and Exercises Programme and levels of training of EMSA's contracted vessels' crews.

[109] Respondents' rating of the programme does not fully reflect actual rating. Although it is difficult to assess as not all respondents provided additional comments to their rating, it seems that none of the Maritime Authorities having organised or participated in exercises have actually rated the programme negatively.

Figure 14: Member States' rating of EMSA's Drills and Exercises Programme.



Source: Survey to Member States, 2016

On the one hand, several survey respondents reported not having any direct experience with EMSA's Drills and Exercises Programme (one third of the 21 respondent countries[110] in the survey), and a few others suggested more exercises should be organised.[111] On the other hand, one interviewee noted that they would welcome participation in EMSA's drills to observe EMSA vessels in action, and two interviewees (from a Member State and the Commission) pointed out that EMSA does invite Member States to attend training drills as observers and requests the participation of its contracted vessels to Regional Agreement' and Member States' exercises. Although there remains a contradiction in these results, it is expected that with time and continued communication efforts from EMSA, Member States should become more aware of EMSA's Drills and Exercises programme.

2.5.12 Provisions of limited stocks of dispersants

EMSA dispersant capabilities are, as of February 2017, available in four ports: in the Atlantic (Sines, Portugal and Las Palmas in the Spanish Canary Islands) and the Mediterranean (Valletta, Malta and Limassol, Cyprus).

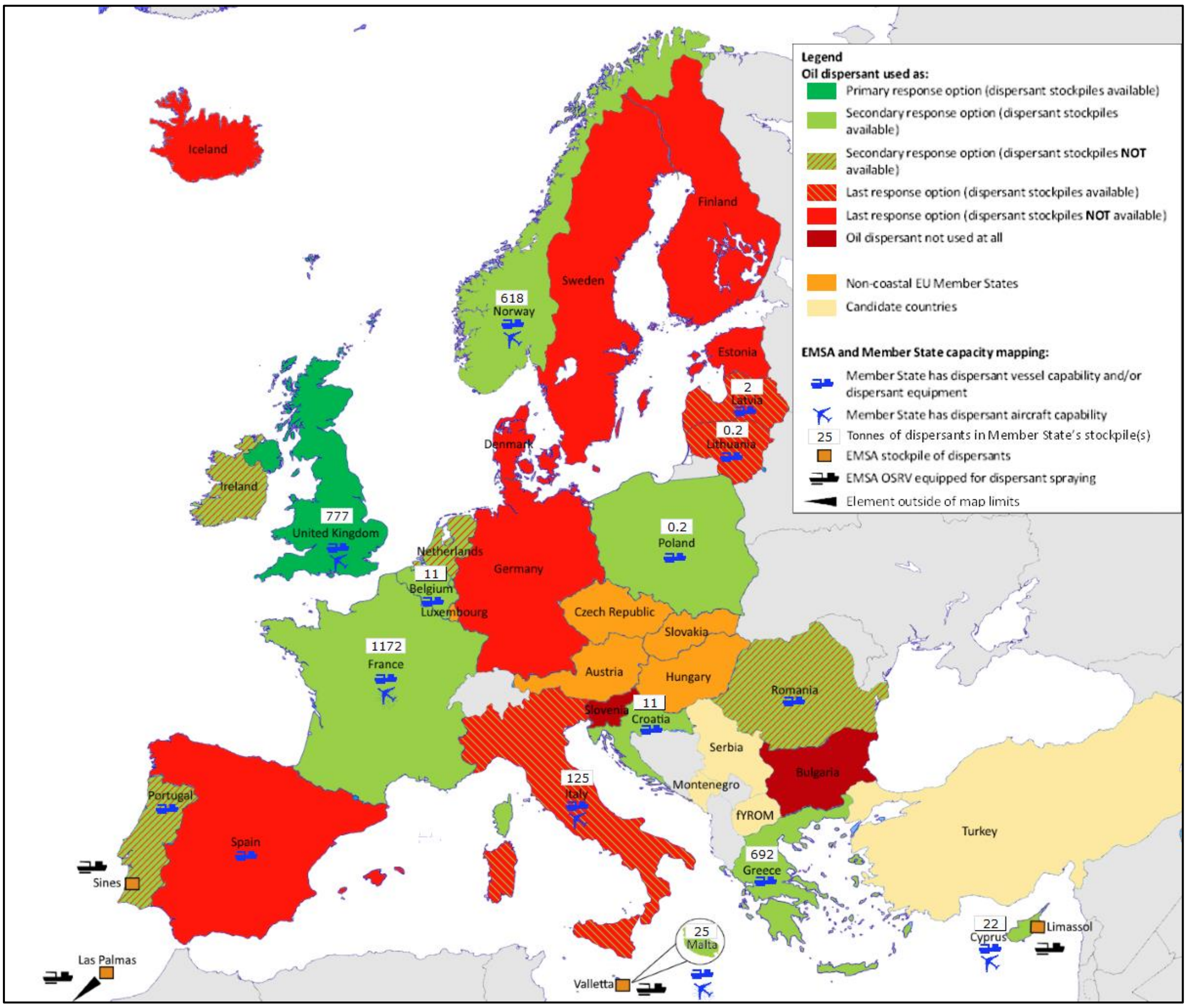
Four EMSA vessels attached to these ports possess dispersant spraying systems. The home base of each of these vessels houses about 200 tonnes of dispersant for a total of 800 tonnes. The dispersant in stockpiles is Radiagreen OSD.

Figure 15, below, places the locations of EMSA's stockpiles of dispersants in the context of the national policies on the use of dispersants.

[110] Including EU Member States and EEA/EFTA countries.

[111] Note that the survey and interviews did contain a specific question on whether respondents were familiar with EMSA's Drills and Exercises Programme.

Figure 15: EMSA and Member States' national policies and capacities for the use of oil spill dispersants.



Source: Ramboll, based on EMSA's 2014 Inventory of national policies on the use of dispersants and EMSA's 2016 Inventory of Member States' Oil Pollution Response Vessels

Areas where EMSA offers no dispersant application capability or stockpiles are generally areas where this response option is not preferred or disfavoured among parties of the Regional Agreement, or where Member States already have relatively high capability. Dispersants are discouraged in the Baltic and Black Seas, which also explains the low level of capacity available nationally in those regions.[112] On the contrary, Member States around the North Sea (Norway and UK) and parts of the Atlantic (France and UK) and Mediterranean (France and Greece) have high national capacity in terms of dispersants.

As can be seen from Figure 15, dispersant stockpiles are placed in proximity to Member States which authorise their use and which foresee their use within their contingency plan (Croatia, Cyprus, Malta, Italy,[113] Greece, France, Spain[114] and Portugal[115]) as well as Third Countries along

[112] Although Poland and Latvia have indicated using dispersants as a secondary response option, these Member States have limited stockpiles and are contracting parties of the Helsinki Convention under which its members disfavour the use of dispersants.

[113] Italian policy is to discourage the use of dispersants, only as last solution, and in a case by case evaluation of the oil spill by a group of experts

[114] Spain only authorises the use of dispersants as a measure of last resort and, at the moment of drafting this report, the national regulations authorising the use of the type of dispersant in EMSA stockpiles was not yet in force, meaning that the use of Radiagreen could not be suitable for Spain if the future regulation does not cover its use.

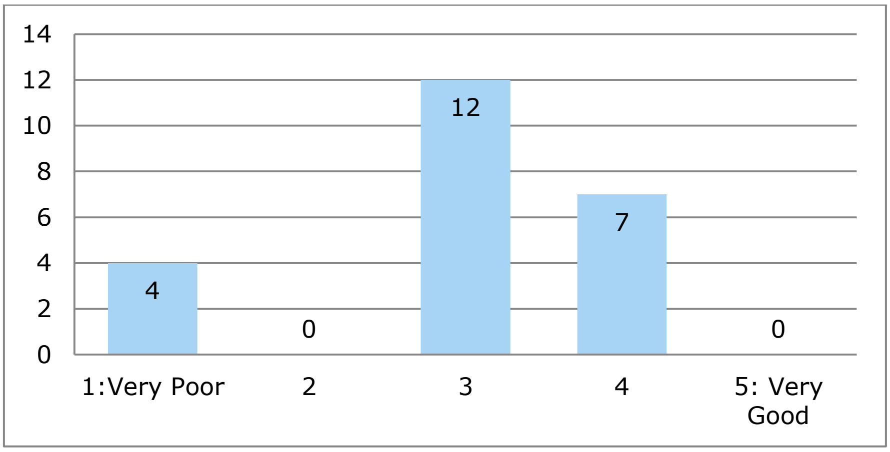
[115] Portugal does not foresee the use of dispersants as part of their contingency planning

the Mediterranean shores (e.g. Morocco, Libya, Tunisia, Egypt, Syria, Lebanon, Israel, Turkey, Albania and Montenegro). Further details are provided in Table 81 in Appendix 3.

Given the limited window of opportunity for the use of dispersants in most oil spill situations, as well as the national policies applicable (see explanations above) the dispersants stockpiles provided by EMSA would be of limited use to Member States other than the ones mentioned above.

It is important to mention however that, as seen in Figure 15, some of the above countries maintain their own stockpiles of dispersants as well as spraying capacities, thus reducing the relevance of establishing additional EMSA dispersant stockpiles and application capability for those countries. This is particularly the case of France and Greece.

Figure 16: Member States' responses regarding the type (Radiagreen OSD) and quantity (200 t per location) of dispersant that EMSA has purchased to top-up Member States' capacities



Source: Survey to Member States, 2016

The answers of Member States to EMSA's survey, when prompted to rate the type (Radiagreen OSD) and quantity (200 tonnes per location) of dispersant reflected their respective experiences and national policies with dispersants and more generally their lack of familiarity with, and common negative approach to, the use of dispersants.[116] Answers to interviews and from Member States allowing the use of dispersants showed interest in the service. These same respondents thought that an aerial dispersant spraying service would also provide significant added value to EMSA's services due to much quicker response capability.

In our assessment, given all above considerations, we consider the location of EMSA's stockpiles of dispersants to be adequate. The presence of EMSA dispersants in their current locations remains highly or moderately relevant for those Member States which allow their use and which maintain a limited national dispersant spraying capacity as well as for Third Countries which would be capable of requesting assistance from EMSA in case of need.

2.5.13 Provision of specialised equipment (EAS)

In addition to OSRVs, EMSA offers, since 2016, stand-alone OPR equipment in two locations (Aberdeen, UK, and Gdansk, Poland) under its Equipment Assistance Service (EAS). The equipment stored as part of this service is presented below.

[116] This preference is generally motivated by the potential environmental impact of dispersants and incidentally their economic impact, such as upon fisheries.

Table 15: Number and type of stand-alone equipment sets per location with associated pumping capacity[117]

OPR Equipment	Fire Boom (150 m)	Speed Sweep	Current Buster	Roboom-Roskim Integrated System	Trawl Net System
No. of sets in EAS Baltic Sea	4	2	1	1	2
No. of sets in EAS North Sea	4	2	1	0	2
(Maximum) pumping capacity per set of equipment	N/A	100 m^3/hour	100-125 m^3/hour	100 m^3/hour	N/A

This new approach aims to support Member States' operations by providing OPR equipment for equipping vessels of opportunity. These stockpiles should provide support in case of spills primarily in the North Sea and in the central Baltic Sea but could also be mobilised for spill incidents elsewhere.

Over the course of the stakeholder consultation process, Member States expressed satisfaction with the type of equipment that has been purchased in the context of the EAS, especially considering that some equipment (e.g. fire booms) were not available at national level. However, some Member States generally noticed that the purchase of new equipment should be based on an enhanced communication with the concerned Member State.

In the context of the survey to Member States, the views expressed related to the location of the EAS stockpiles where mixed: 7 Member States rate the locations positively and 5 Member States negatively with the other expressing neutral views. The reasons for a negative assessment included: "*insufficient information*"; "*existence of sufficient national capacity*"; "*distance to the concerned Member State*"; "*lack of a stockpile in the south of Europe*". The improvement of communication between EMSA and the Member States on the subject of development and set-up of EAS stockpiles may be necessary but also sufficient to improve the level of satisfaction of Member States.

In our assessment, the EAS equipment provides an important and fast opportunity for extending the EMSA response capacity in case of a serious incident in the northern regions of the EU sea area and in the vicinity of this area. Furthermore, given their flexibility and relatively lower set-up costs, such system provides an adequate opportunity to top-up Member States capacities where particular gaps are identified.

2.5.14 Adaptation to respond to spills from offshore installations

Offshore oil spills can differ from other types of spills in that they can be amongst the largest due to the continuous flow of oil, especially in cases where a well blowout from a high pressure well cannot be controlled due to depth at which the incident can occur (e.g. such as the Deepwater Horizon incident, 780,000 tonnes spilled). In addition, the oil tends to be lighter and mixed with gas, creating a more flammable mixture with a low flash point (below 60°C).

In order to adapt its service offering to the risk spills from offshore installations, EMSA has proceeded with the adaptation of EMSA OSRVs to deal with substances with a flashpoint below 60°C, meaning that all installations on board the OSRVs need to be explosion-proof. Hence, at the moment 12 EMSA OSRVs are prepared to recover oil with a flashpoint below 60°C.

[117] Source: EMSA. (2016). Key aspects of the Equipment Assistance Service. Retrieved from: http://www.emsa.europa.eu/oil-spill-response/vessel-inventory/key-aspects-of-the-eas.html

Secondly, EMSA has developed a seaborne dispersant application service by equipping 4 of its OSRVs, combined with the provision of dispersant stockpiles. The use of dispersant is an appropriate option for responding to an offshore oil spill, in particular during severe weather conditions. As offshore platforms are under the jurisdiction of a particular Member State, the use of dispersant in connection with an offshore oil spill will have to follow the dispersant policy of the Member States in question, for this reason, EMSA's stockpiles of dispersants have been located in proximity of Member States that authorise their use, prioritising areas where offshore activity is expected to take place. This can be observed in Figure 19 of section 2.6.

Finally, EMSA has proceeded with the establishment of stand-alone equipment (EAS stockpiles) which can be used in cases of oil spills originating from offshore installations (e.g. fire booms) and which have been presented in the section above. The equipment stored in the newly established EAS is, to a certain extent, adapted to deal with spills originating from offshore installations. In particular, the provision of fire booms facilitates the possibility to utilise in-situ burning, should this response option be appropriate. However, considering that most offshore installations in the North Sea (albeit not all) are not exploiting high pressure wells, a continuous release of oil following an incident involving an offshore installation (as was the case during the Deepwater Horizon disaster) may be unlikely.

2.5.15 Donations

Very few assets have come to the end of their technical life. To date, two public sales and one donation have been carried out. The results of these activities are presented in Table 16.

Public sales have allowed EMSA to recover of € 240,100[118] while the initial purchase price of the equipment donated was € 498,306. Relevant to the latter is that the equipment in question was donated to a Third Country on the southern Mediterranean shore as part of the SafeMed III project[119], meaning that it will continue to be available to oil pollution response activities of Third Countries in the Mediterranean.

Table 16: Summary of public sales and donations carried out to date

Public Sale of two side collector sweeping arm systems (EMSA/SALE/01/2011)				
Year	2011			
Type of equipment	2x Side collector Sweeping Arm system			
Purchase cost	2x € 361,600			
Sale price	€ 225,100			
Public Sale of OPR equipment (EMSA/SALE/02/2014)				
Year	2014/2015			
Type of equipment	SOFREBA Rigid sweeping arm set (two arms)	HELIA Crane	SEADARQ slick detection system	
Purchase cost	€ 337,853	€ 139,000	€ 91,085	
Sale price	€ 15,000			
SafeMed III project – Donation of OPR equipment				
Year	2015/2016			
Type of equipment	Skimmer Set	Boom Set	Power Pack (110 KW)	Discharging power pack (58 KW)
Purchase cost	€ 52,759	€ 228,835	€ 156,750	€ 59,962

2.5.16 Conclusions

We consider the EMSA mandate in the field of Oil Pollution Preparedness and Response as given in 2004 and expanded in 2013 has been adequately met.

As specific conclusions we consider the following:

[118] The total purchase price of equipment sold to date was 1,291,138
[119] See details of the project here: http://www.emsa.europa.eu/implementation-tasks/training-a-cooperation/safemed-iii.html

1. The EMSA OSRVs Network and additional stockpiles of equipment and dispersant are considered relevant and appreciated in general by the relevant MS authorities.
2. The EMSA OSRVs Network and additional stockpiles of equipment and dispersants cover within the resources available all major shipping traffic lines and most offshore oil and gas operations in the EU and adjacent waters. (for a detailed analysis of this, please see section 2.6)
3. The EMSA OSRVs mobilization time of 24 hours is considered appropriate and in compliance with what internationally is expected as the mobilization time for a Tier III contingency.
4. The size and manoeuvrability of the vessels and the oil spill response equipment on board is considered adequate for the tasks allocated to the vessels.
5. The oil spill response capacity of the OSRVs provides a substantial Tier- III support to the national oil spill response capacity of the MS.

Table 17 presents offers a brief concluding assessment to each of the minimum requirements imposed on EMSA by the mandate given.

Unless otherwise stated, the assessment of EMSA's oil pollution response activities is done on the basis of the capacities active at the time of drafting of this report (January 2017). Where relevant, however, consideration is given to the capacities which were available over the course of the period under scope whose contracts have expired.

Table 17: Assessment matrix for EMSA's oil pollution response activities

Minimum requirements	Assessment
Ship sourced oil pollution operational assistance	
Sufficient speed and power to arrive on-site as rapidly as possible	The average maximum speed of the vessels is 12.4 knots. At this speed EMSA vessels can cover a radius of 286 nautical miles from their home base within 24 hours from the end of the mobilisation time.
Large oil storage capacity (preferably between 1500-3000 m^3)	With an average of 3,437 m^3 and a median value of 2,976 m^3, the current EMSA vessels comply with this criterion. No vessels[120] currently active[121] have a storage capacity below 1,500 m^3. In our assessment, the EMSA OSRVs large onboard storage capacity for recovered oil provides a substantial added value to any major oil spill operation as the storage capacity will allow the EMSA OSRVs to maintain their recovery operation for a long time without need for calling a port for the discharge of recovered oil or offshore transfer of recovered oil to a temporary storage oil tanker.
Suitable equipment on board	In our assessment the storage capacity and the quantity and type of equipment on board the vessels are relevant to meet the tasks designated to the vessels, i.e. EMSA OSRV's are equipped with modern and up-to-date oil spill response equipment that will ensure the OSRVs as an effective, high capacity response contribution to any national initiated response operation.
Available within a short period of time	In our assessment the maximum mobilization time of 24 hours from the signature of the Incident Response Contract is considered relevant and in compliance with the "second response capacity" of several MS national response time requirements for lager national response vessels. A shorter contractual mobilization time would probably make it impossible for using the EMSA OSRVs for their usual commercial activities during the "stand-by time" (24 hours) and, by this, lead to a significant increase of the Yearly Availability Fee.
Certain degree of manoeuvrability	Given the size of ships and their propulsion capabilities, the OSRV's have a higher manoeuvrability than other ships of similar size, which, in a positive way, has improved the OSRV's capabilities as oil spill response vessels.

[120] Aegis I has a capacity on 990 m^3, however it is only a back-up vessel to the large vessel Aktea based in the port of Piraeus.

[121] The contract for the vessel Enterprise, based in Varna which had a capacity of 1,374 m^3 has expired in September 2016 and has not been renewed.

Minimum requirements	Assessment
Vessel is compliant with all relevant international and EU legislation	EMSA has taken comprehensive and adequate steps to ensure that their contracted vessels comply with all relevant international and EU legislation.
Priority given to at sea recovery	The endowment of the vessels and equipment stockpiles with sweeping arms, heavy duty booms, high capacity skimmers and oil slick detection systems is a clear indication that EMSA has prioritised the building up of capacity for the mechanical recovery of oil at sea over other types of oil pollution response activities.
"Top-up" Member States' capacities	In our assessment, it appears that EMSA is, at a general level, topping up Member States response capacities by providing a Tier III response capacity characterised by large storage capacity ships, a capacity which is difficult and costly to establish by the Member States on their own. The location of EMSA's capacities *is generally* complementary to that of MS; however considerable differences exist between the various coastal regions.
Priority areas are set in accordance with EMSA's Annual Work Programme	The choice location of assets is somewhat consistent with the priority areas set in the Action Plans. Decisions to establish extend or discontinue OSRV contracts are normally accompanied by an argumentation for such a decision. This argumentation covers perceived risks and established capacity available in the region. At the time of drafting this report, The Baltic sea, which has originally been considered a priority area is only partially covered by a vessel based in Gothenburg and by the EAS stockpile established in Gdansk, Poland. As Gothenburg is far away from much of the area of the Baltic Sea, including the Gulf of Finland and Bay of Bothnia, EMSA, with the approval of its Administrative Board, launched a procurement to conclude a contract for an additional vessel in the Baltic Sea in the near future.
Contractual allocation by region	Over a multi annual period of four years, it is observed, that the average contractual allocation per arrangement is approximately € 3 million , (well below the € 5 million requirement) and only one contract is above the threshold.[122]
Participation in regular quarterly drills	In 2014, 2015 and 2016 all vessels successfully took part in 100% of the required quarterly drills (approx. 61/62/70 per year respectively).
Participation in oil pollution response exercises	12, 11 and 12 EMSA vessels respectively participated in operational exercises in 2014, 2015 and 2016 respectively. The ability of EMSA vessels' crews to deploy and manoeuvre the spill response equipment is overall reported as satisfactory. This assessment is confirmed by interviews and survey data from the Member States' Maritime Authorities having participated in exercises with EMSA.
Operational assistance in case of marine pollution caused by oil and gas installations	
Provisions of limited stocks of dispersants	The use of dispersants is not limited to the countries where the stockpile is located. The stockpiles are located in countries where an adequate vessel is in service and where national authorities consider that possible response in their contingency plan. Vessels based in the same location as the stockpiles of dispersants have been adapted with dispersant spraying capabilities. Some of the Member States sharing a regional basin with the location of stockpiles maintain their own stockpiles of dispersants as well as spraying capacities. Nevertheless, the presence of EMSA dispersants in their current locations is relevant for those countries which allow their use (e.g. Croatia, Cyprus, Malta, Italy, Greece, France, Spain and Portugal) as well as Third Countries along the Mediterranean shores (e.g. Morocco, Libya, Tunisia, Egypt, Syria, Lebanon, Israel, Turkey, Albania and Montenegro)

[122] The Ria de Vigo, stationed in Vigo. The contract for the Mersey; Galway and Forth Fisher is also above € 5M, however this arrangement covered the possible use of two vessels simultaneously.

Minimum requirements	Assessment
Adaptation to respond to spills from offshore installations	In order to adapt its service offering to the revised mandate of responding to spills from offshore installations, EMSA has taken the following steps: • The adaptation of some EMSA OSRVs to deal with substances with a flashpoint below 60°C, making them suitable for the recovery of storage of volatile substances; • The provision of dispersant stockpiles, are discussed in the section above; • The establishment of stand-alone equipment which can be used in cases of oil spills originating from offshore installations (as discussed below. • In addition to the dispersant capacity (see above), 12 EMSA vessels are equipped to deal with substances with a flashpoint below 60°C, making them suitable for the recovery and storage of volatile substances. • Equipment stored[123] in the newly established EAS is targeted to deal with spills originating from offshore installations. In particular, fire booms facilitate the possibility to utilise in-situ burning, should this response option be appropriate.
Provision of specialised equipment (EAS)	EMSA offers, since 2016, stand-alone OPR equipment in two locations (Aberdeen, UK, and Gdansk, Poland) under its Equipment Assistance Service (EAS). This new approach aims to support Member States' operations by providing OPR equipment for the use on vessels of opportunity. These stockpiles should provide support in case of spills primarily in the North Sea and in the central Baltic Sea but could also be mobilised for spill incidents elsewhere. In our expert assessment, the EAS equipment provides an important and fast opportunity for extending the EMSA response capacity in case of a serious incident in the northern regions of the EU sea area and in the vicinity of this area. If needed it is considered that the equipment can be relatively quickly moved by road or air transportation to other locations and installed on-board an EMSA OSRV or a vessel of opportunity for transportation to the spill site. Furthermore, given their flexibility and relatively lower set-up costs, such system provides an adequate opportunity to top-up Member States capacities where particular gaps are identified.
Operational assistance to Third Countries	
Extension of services to Third Countries	The list of requesting parties have now been extended to allow Third Countries sharing a regional basin with EU Countries to access the OPR services provided by EMSA. Data has been collected in order to assess the existing capacities of countries in the Mediterranean and understand where gaps may exist which EMSA can potentially fill.
Donations	Very few assets have come to the end of their technical life. To date, two public sales and one donation have been carried out. The results of these activities are presented in 2.5.15. Public sales have allowed EMSA to recover of € 240,100 [124] while the initial purchase price of the equipment donated was € 498,306. Relevant to the activity is that the equipment in question was donated to a Third Country on the Southern Mediterranean shore as part of the SafeMed III project[125], meaning that it will continue to be available to oil pollution response activities of Third Countries in the Mediterranean.

2.6 Assessment of the location of EMSA's Oil Spill Response services on the basis of existing risk assessments

For each region, we describe the risk of oil spill by taking into account historical spills, and the risk of spill from oil tanker traffic on the one hand and oil and gas exploration on the other. This risk is represented in the maps below as well as additional data from the most recent risk assessments conducted under the different Regional Agreements. We compare the conclusions of

[123] Fire Boom; Speed Sweep; Current Buster; Roboom-Roskim Integrated System; Trawl Net System; Table 78 in Appendix 1 presents the equipment available in the two locations.

[124] The total purchase price of equipment sold to date was 1,291,138

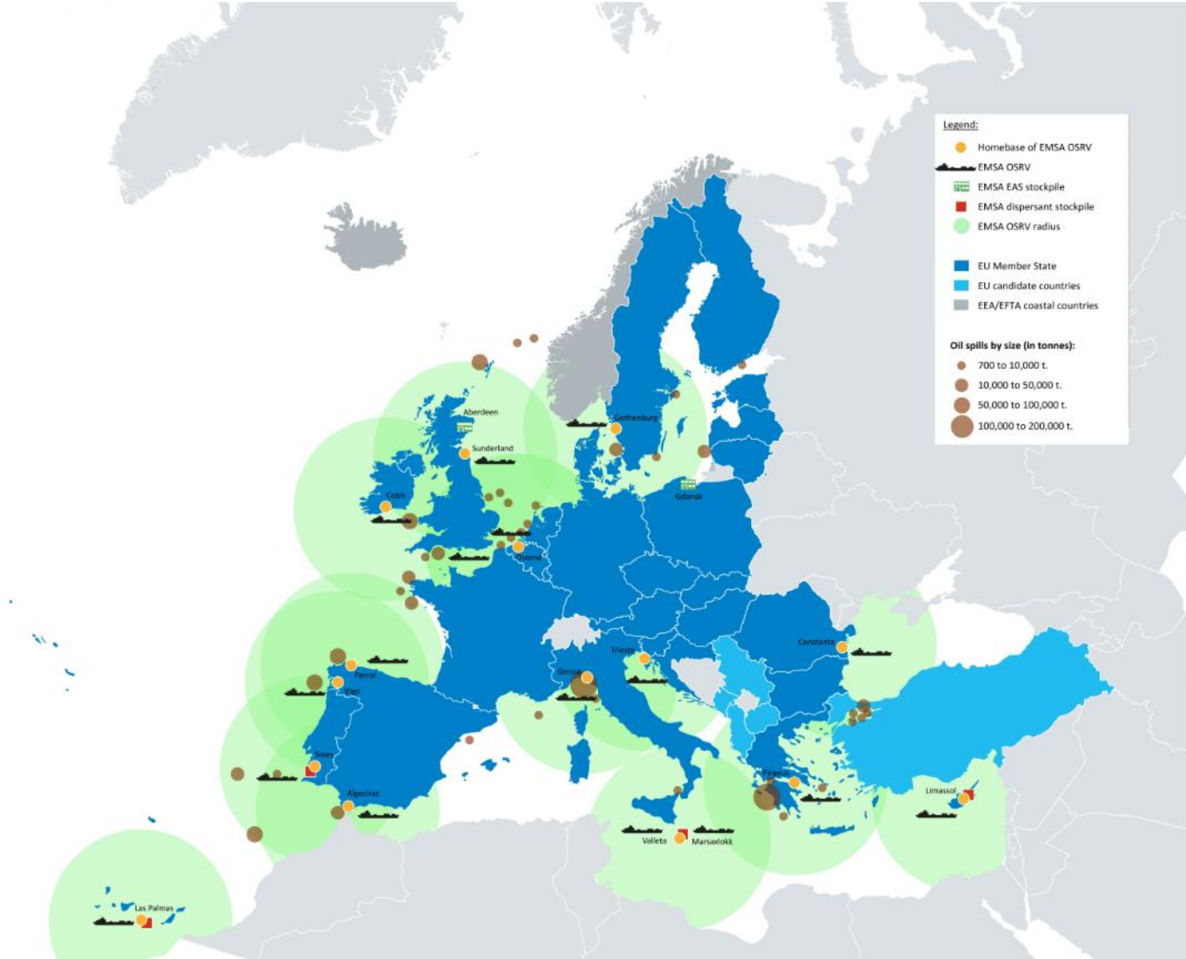
[125] See details of the project here: http://www.emsa.europa.eu/implementation-tasks/training-a-cooperation/safemed-iii.html

these existing assessments with the placement of EMSA services. *Note that in this section we do not discuss EMSA services in relation to Member States' vessel capacities.*

The maps below highlight the different elements of EMSA's services (vessels locations, and the reach of each vessel within 24 hours of movement, the location of dispersant stockpiles, and the location of EAS stockpiles).

Recent and region-specific assessments could not be found in the case of the Atlantic and the Black Sea, therefore the analysis presented is solely based on tanker traffic data, historical spills and oil and gas installations (as mapped below). After each regional review of risks, we assess the relevance of the location of EMSA's oil pollution response (OPR) services including vessels, dispersant capability, and EAS stockpiles.

Figure 17: EMSA's services in 2016 and major oil spills (over 700 tonnes) from ships and oil and gas installations between 1980 and 2015[126]



Source: Ramboll, based on historical spill data sources

The map above takes into account historical data on oil spills between 1980 and 2015 as provided by ITOPF[127] and triangulated with various sources, including CEDRE's oil spills database,[128] REMPEC data for the Mediterranean[129] and other web sources.[130]

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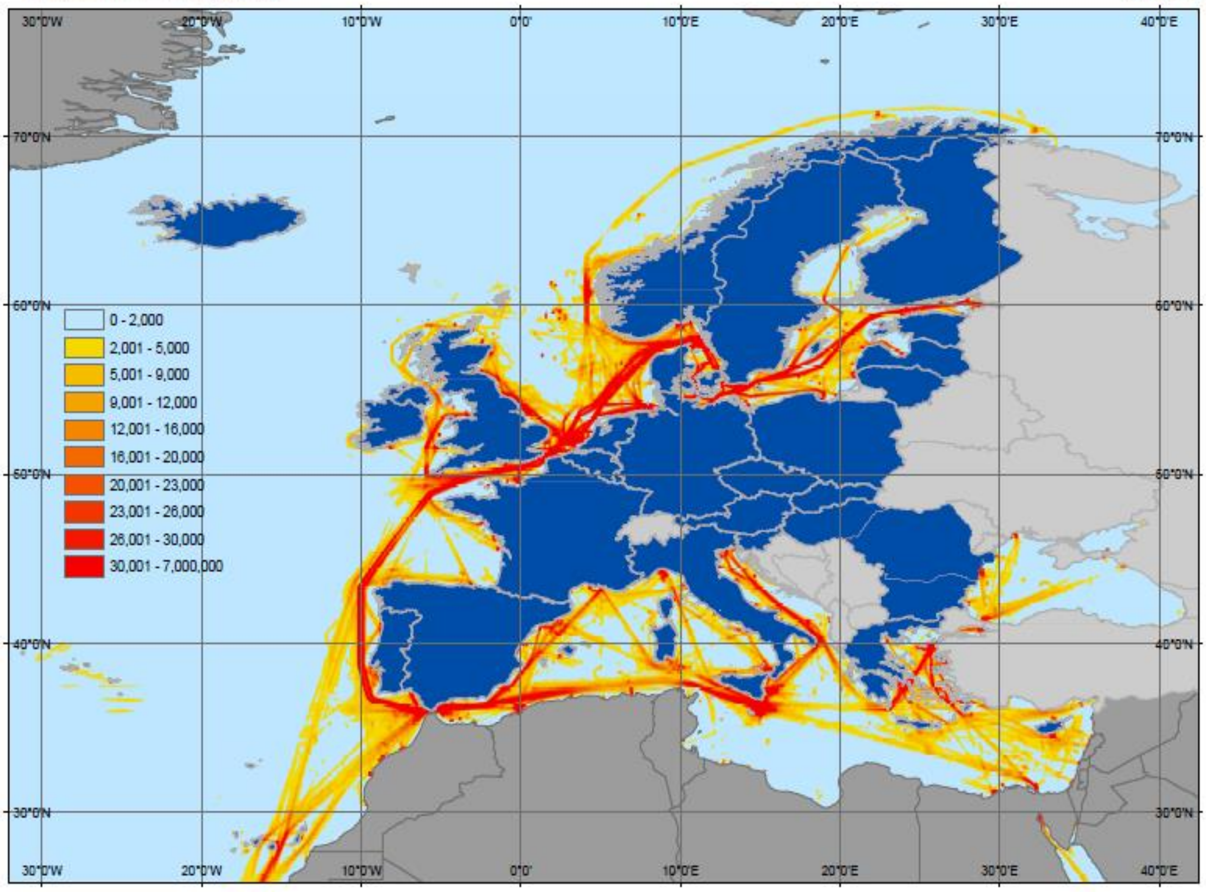
[126] Note that the 24 hour radii on this map are indicative and present some limitations, as ships cannot take direct paths across land.

[127] Historical data for spills from ships in European waters was obtained upon request to ITOPF. (2016).

[128] Cedre. (2016). Spills. Retrieved from http://wwz.cedre.fr/en/Our-resources/Spills.

[129] REMPEC. (2016). Mediterranean Integrated Geographical Information System on Marine Pollution Risk Assessment and Response (MEDGIS). Retrieved from: http://medgismar.rempec.org/

Figure 18: Tankers traffic density, based on SafeSeaNet data (September 2016).

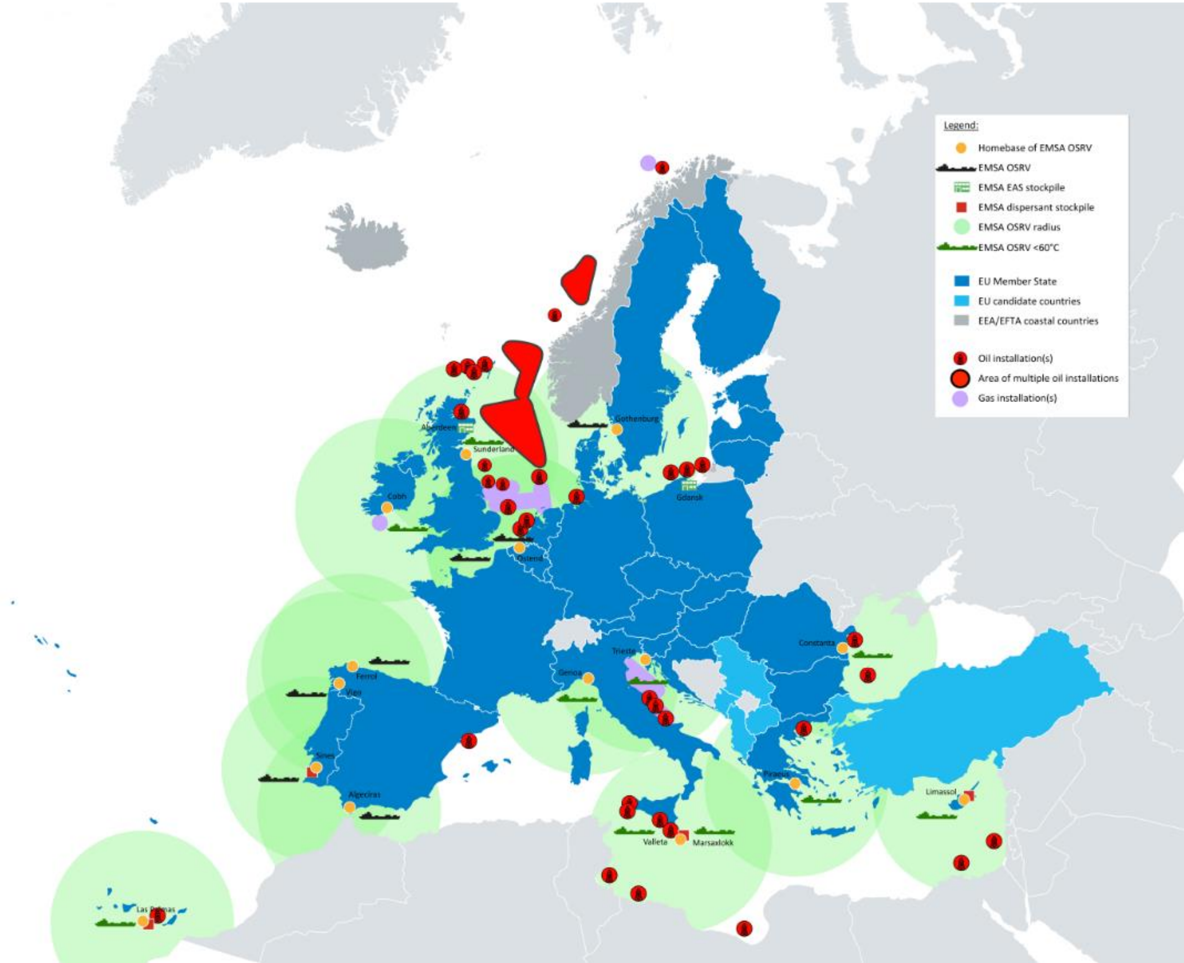


Source: EMSA Maritime Support Services (2016).

The unit of measurement in the map above is the number of tanker Automatic Identification System (AIS) positions in the vicinity of the cell over a period of one month.

[130] Rig Incident List. Retrieved from http://home.versatel.nl/the_sims/rig/losses.htm

Figure 19: EMSA's services (and vessels' radius) and oil and gas installations, 2016.



Source: Ramboll, based on data published by EMSA for EU and EEA/EFTA oil and gas installations[131]

For the approximate location of oil installations in Third Countries, sources are risk assessment studies and online specialised media sources[132] mentioned below.

In addition to the elements of EMSA OPR services mentioned at the beginning of this section and presented in the maps, the map above also shows which EMSA vessels can handle types of oil with a flash point below 60°C (see green OSRV symbols), as these types of oil are more likely to be encountered when dealing with spills from oil and gas installations. Locations of oil and gas installations are indicative and not based on precise geographical data. Some installations may be missing.

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[131] EMSA. (2013). Action Plan for Response to Marine Pollution from Oil and Gas Installations. Figure 1 – Map of offshore installations across ope, p9.

[132] European Commission DG Environment. (2013). Safety of offshore exploration and exploitation activities in the Mediterranean: creating synergies between the forthcoming EU Regulation and the Protocol to the Barcelona Convention. Retrieved from: http://ec.europa.eu/environment/marine/international-cooperation/regional-sea-conventions/barcelona-convention/pdf/Final%20Report%20Offshore%20Safety%20Barcelona%20Protocol%20.pdf

Egypt: European Commission DG Environment. (2013). Safety of offshore exploration and exploitation activities in the Mediterranean.

Israel: http://www.independent.com.mt/articles/2015-02-04/local-news/Maltese-government-signs-new-two-year-oil-exploration-agreement-with-Israeli-company-6736130098

Lybia: http://www.offshore-technology.com/projects/bouri-field-mediterranean-sea/

Tunisia: http://www.offshore-technology.com/projects/hasdrubal-field/

Turkey: http://www.naturalgasworld.com/turkey-tpao-shell-exploration-oil-and-gas-black-sea

2.6.1 Baltic Sea

Input for the assessment of oil spill risk in the Baltic is based on HELCOM's BRISK project, which lasted three years (2009-2012) and presents the most recent and comprehensive risk assessment for the Baltic Region. On the basis of risk modelling of different possible types of accidents,[133] the project assessed potential risks related to oil spills in terms of likely volume of oil spilled in relation to marine traffic and oil and gas installations.[134]

2.6.1.1 Tanker traffic risk assessment

The analysis presented in the BRISK project[135] concludes that spill risk is highest in the South of the Baltic Sea, and that this is due in large part to high marine traffic density. The Northern Baltic faces less marine traffic, yet spills are likely to cause greater damage due to the presence of ice, which makes oil recovery operations more difficult.

Spill risk is increased along the high-traffic routes where collisions can occur (such as the Baltic's deep-water route used by larger vessels and crossed by other routes) but also in shallow waters, where grounding is more likely (mainly near coasts, and in the waters between Denmark, Sweden and Germany).

The BRISK project also modelled expected intervals between spill events, estimating that one large spill (300-5,000 tonnes) is likely to occur every 4 years and one very large spill (over 5,000 tonnes) every 26 years at the scale of the entire region.[136] While the risk of large spills is relatively well distributed across the Baltic, very large spills are more likely along the deep-water route.

2.6.1.2 Risk of oil pollution from oil and gas installations

The low number of offshore oil and gas platforms (4 in total; see Figure 19) tends to minimise the risk of spill from oil and gas offshore activities.[137] In addition, risks of spill from a collision between a ship and the platforms is estimated as relatively low, as are operational spills which tend to involve smaller spills (smaller than 15 tonnes). Possible spills from blow-outs are not included in the model. Overall, the yearly estimated risk is set at 4.82 tonnes, including the risk from the Russian platform.[138]

2.6.1.3 Assessment of the relevance of EMSA's OPR services in the Baltic

Currently, an EAS stockpile in Gdansk provides additional equipment capability to nearby Member States in case of oil spill from both ship incidents and oil installations. However, at the moment, EMSA does not have OSRVs to realistically cover areas of the North Baltic in the minimum 24 hours from the end of mobilisation time, in particular the full length of the deep water route. However this situation is temporary and a new tendering procedure should in 2017 lead to a newly contracted vessel for the area.

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[133] Ship-ship collisions, groundings, fire and explosions, collisions with fixed objects (wind turbines, lighthouses, etc.), foundering and other incidents such as spills during offshore oil transfers.

[134] Nordon. (n.d.). RISKS OF OIL AND CHEMICAL POLLUTION IN THE BALTIC SEA. Results and recommendations from HELCOM's BRISK and BRISK-RU projects. Retrieved from: http://www.helcom.fi/Lists/Publications/BRISK-BRISK-RU_SummaryPublication_spill_of_oil.pdf

[135] Nordon. (n.d.). RISKS OF OIL AND CHEMICAL POLLUTION IN THE BALTIC SEA. Results and recommendations from HELCOM's BRISK and BRISK-RU projects. Retrieved from: http://www.helcom.fi/Lists/Publications/BRISK-BRISK-RU_SummaryPublication_spill_of_oil.pdf

[136] http://www.brisk.helcom.fi/risk_analysis/spills/en_GB/spills/

[137] The report counts 4 offshore oil and gas installations in the Baltic: Russian 'D', Polish 'PG1' and 'Baltic Beta', and the Lithuanian offshore oil loading buoy. Source: Admiral Danish Fleet HQ, National Operation, Maritime Environment. (2012). Project on sub-regional risk of spill of oil and hazardous substances in the Baltic Sea (BRISK). Model report: Part 4 - Frequency and quantity of spill of oil and hazardous substances.

[138] Admiral Danish Fleet HQ, National Operation, Maritime Environment. (2012). Project on sub-regional risk of spill of oil and hazardous substances in the Baltic Sea (BRISK). Model report: Part 4 - Frequency and quantity of spill of oil and hazardous substances.

2.6.2 Mediterranean Sea

The Mediterranean Sea is historically a high marine traffic density area due to the presence of major trading routes and important ports in all States surrounding the basin. It is also a highly exploited region in terms of offshore extraction of oil and gas. The assessment below is based on two sources: REMPEC's risk assessment mapping,[139] and the risk assessment section of a European Commission study on the Safety of offshore exploration and exploitation activities in the Mediterranean.[140]

2.6.2.1 Tanker traffic risk assessment

High traffic density is a particular challenge as oil tankers enter the region through the Strait of Gibraltar coming from the Atlantic between Spain and Morocco, but also the Black Sea through the Bosporus Strait in Turkey, and Middle-Eastern oil entering through the Suez Canal in Egypt (see Figure 18). Historically, there have been several very large spills involving tankers in the Mediterranean (see Figure 17). The area of the Bosporus Strait has particularly been the location of several spills.

2.6.2.2 Risk of oil pollution from oil and gas installations

The Mediterranean Sea faces an increasing risk of spill from oil and gas installations in certain areas where exploration permits are being issued to fossil fuel exploration and extraction firms.

According to the European Commission's 2013 report on the Safety of offshore exploration and exploitation activities in the Mediterranean[140] and some more recent sources (in footnotes), the highest number of active installations can be found around Italy and Malta. However and in addition to exploited fields, the following Member States have been active in issuing permits for exploration: Cyprus, Italy, Malta, Spain[141], Greece,[142] Croatia.[143] On the other hand France[144] and Slovenia[145] do not show intention to explore or exploit offshore hydrocarbon resources. Non-EU countries also have some offshore oil and gas installations, particularly Egypt (near the Nile Delta), Israel, Tunisia and Libya.[146]

2.6.2.3 Assessment of the relevance of EMSA's OPR services in the Mediterranean

EMSA's vessel presence in the Mediterranean covers the main areas of tanker traffic as well as oil and gas installations. Existing and potential new exploitation of offshore oil and gas is also currently covered by EMSA's dispersant application vessels and stockpiles in Malta and Cyprus. Dispersant capability in Malta is relevant with regard to the nearby offshore installations off the

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[139] REMPEC. 2016. Mediterranean Integrated Geographical Information System on Marine Pollution Risk Assessment and Response (MEDGIS).

[140] European Commission DG Environment. (2013). Safety of offshore exploration and exploitation activities in the Mediterranean: creating synergies between the forthcoming EU Regulation and the Protocol to the Barcelona Convention. Retrieved from: http://ec.europa.eu/environment/marine/international-cooperation/regional-sea-conventions/barcelona-convention/pdf/Final%20Report%20Offshore%20Safety%20Barcelona%20Protocol%20.pdf

[141] Spain maintains a map of permits issued or pending (in Spanish). See http://www.minetur.gob.es/energia/petroleo/Exploracion/Mapa/Paginas/mapSondeos.aspx

[142] As indicated during an interview with the Hellenic Coastguards for this study, Greece has recently shown increasing interest for offshore oil and gas activities.

[143] Croatia regularly tenders offshore exploration permits in areas beyond 12 nautical miles of its coasts. Source: http://www.azu.hr/en-us/What-we-need-to-know/Exploration-Activities

[144] No offshore exploration permits issued in France as of July 2015. Source: http://www.developpement-durable.gouv.fr/IMG/pdf/france_tm_07_2015.pdf

[145] Slovenia has negligible oil and gas resources and imports most hydrocarbons it needs. Source: OECD. (2015). SLOVENIA: COUNTRY OVERVIEW. Retrieved from: ftp://ftp.oecd.org/FFS2015/SVN_country%20overview.pdf

[146] European Commission DG Environment. (2013). Safety of offshore exploration and exploitation activities in the Mediterranean: creating synergies between the forthcoming EU Regulation and the Protocol to the Barcelona Convention. Page 22. Retrieved from: http://ec.europa.eu/environment/marine/international-cooperation/regional-sea-conventions/barcelona-convention/pdf/Final%20Report%20Offshore%20Safety%20Barcelona%20Protocol%20.pdf

coast of Sicily and Malta, with a potential to reach Libyan platforms should EMSA's support be requested. Dispersants in Cyprus can cover risks of spill near Greek oil platforms as well as Egypt and Israel.

2.6.3 North Sea

The North Sea is not only one of the most traffic-intensive marine region of Europe, it is also where most offshore oil and gas extraction activities take place in Europe. In 2014, the Bonn Agreement published an analysis (BE AWARE I) of the risk of oil spill with two scenarios, one based on historical data for 2011, and future predictions for 2020.[147] The BE AWARE I risk assessment concludes that the main risk of oil spill will originate from ships and the increase in the number of installations (mainly wind turbines).

2.6.3.1 Tanker traffic risk assessment

Tanker traffic is highest in the Southern and Eastern North Sea thus presenting a higher risk of ship-ship collision.[148] These are areas where large tankers may spill the largest volumes of oil. The development of offshore wind turbines in the area further increases the risk of ship colliding with these objects, and is predicted to increase mainly in the Southern North Sea by 2020.

2.6.3.2 Risk of oil pollution from oil and gas installations

The North Sea presents the highest risk of spills from oil installations due to the very high number of installations, estimated in the BE AWARE ship-to-platform collision risk assessment at over 600 platforms mainly located in the middle and North of the North Sea (excluding decommissioned platforms;[149] see also Figure 19). The risk of large spills from these platforms remains relatively low as high velocity collision of ships with a platform (more likely to cause large spills) are rare (no historical occurrence) and operational spills tend to be small.[149] Smaller oil spills from offshore installations are more common: spill data from the BE AWARE risk assessment of the Bonn Agreement indicates that between 2000 to 2011 alone, there have been 7,166 spills (651 per year on average) averaging 1 tonne for a total of 7,320 tonnes of oil spilt.[150] The OSPAR report on discharges, spills and emissions from offshore oil and gas installations in 2014[151] notes that there has been only one recorded spill from an offshore installation and over 700 tonnes in the North Sea (in 2007; see Figure 17) between 2005-2014.[152]

2.6.3.3 Assessment of the relevance of EMSA's OPR services in the North Sea

The high risk of spill from tanker traffic is well addressed in the entire area of the North Sea with 4 complementary EMSA OSRVs in the East, West and South of the North Sea (see Figure 17 to see the coverage of EMSA vessels in the North Sea and Figure 18 for tanker traffic density). The very high concentration of oil and gas installations is also covered thanks to the vessel in Sunderland (Scotland). This vessel is also able to intervene where oil has a flashpoint below

[147] See http://www.bonnagreement.org/be-aware/. Note that a second analysis (BE AWARE II) was published in 2015 building upon the results of the previous study, which reviews methods and technologies to determine which would be most effective in reducing and responding to oil pollution. The aim of this study does not immediately support the goal of the present analysis, therefore it is excluded here.

[148] Maps apportioning the risk of spill from different types of incidents and in the different parts of the North Sea for future (2020) and historical (2011) scenarios are presented on page 3 and 30 respectively of the following BE AWARE sub-report: BE AWARE – Bonn Agreement. (2014). Technical Sub Report 8 – Maritime Oil Spill Risk Analysis. Retrieved from: http://www.bonnagreement.org/site/assets/files/1129/be-aware_technical_sub_report_8_maritime_oil_spill_risk_analysis.pdf

[149] BE AWARE – Bonn Agreement. (2014). Technical Sub Report 7 – Offshore Installations Oil Spill Risk Analysis. Retrieved from: http://www.bonnagreement.org/site/assets/files/1129/be-aware_technical_sub_report_7_offshore.pdf

[150] COWI, MARIN. (2014). *Technical Sub report 4: Historical accidents and spills.* BE AWARE – Bonn Agreement.

[151] OSPAR. (2016). OSPAR report on discharges, spills and emissions from offshore oil and gas installations in 2014. Retrieved from: http://www.ospar.org/about/publications?q=oil&a=&y=

[152] Research for this study has not been able to uncover similar spills before 2005 and originating from offshore activities. See the List of spills in European waters in Table 80 in Appendix 1.

60°C, an asset for the type of risk presented by offshore installations. Equipment stockpile in Aberdeen further provides additional capacity to nearby Member States' vessel capability.

2.6.4 Atlantic Ocean

The main oil spill risks in the Atlantic are due to tanker traffic, with some spill risk from oil and gas installations in specific locations. The assessment below is mainly based on the mapping of tanker traffic, oil and gas installations and historical oil spills (see figures in the beginning of Section 2.6) and OSPAR's report on spills from offshore oil and gas installations.[153]

2.6.4.1 Tanker traffic risk assessment

Risk of oil spill in the Atlantic Ocean lies mainly in the traffic of tankers along the coasts of the United Kingdom, France, Spain and Portugal. The relatively important number of historically large spills over 10,000 tonnes (see Figure 17) along these coasts highlights this risk.

2.6.4.2 Risk of oil pollution from oil and gas installations

The risk of spill from offshore oil and gas exploitation is limited to Spanish oil installations near the Canary Islands and installations off the coasts of Ireland (near County Cork) (see Figure 19). The 2016 OSPAR report on spills from offshore oil and gas installations shows no recorded large spill (over 700 tonnes) from oil and gas installations in the entire region of the Atlantic (excluding the North Sea, as understood throughout this report).[154]

2.6.4.3 Assessment of the relevance of EMSA's OPR services in the Atlantic

EMSA's OPR services provide good coverage of oil spill risks from both tanker traffic and oil and gas installations with the presence of EMSA vessels all along the coasts of the United Kingdom, Ireland, Portugal and Spain (see Figure 18 and Figure 19). There is no EMSA vessel in France,[155] where several major spills occurred particularly off the coasts of Brittany. OSRVs in Northern Spain and Ireland are able to reach French coasts, however the time required is generally longer than in other areas of the Atlantic. Dispersant equipment and stockpiles are located where oil and gas installations are found (i.e. in the Canary Islands). The risk of spill based on historical spill data is generally addressed under current arrangements.

2.6.5 Black Sea

As there has been no formal risk assessment conducted for the Black Sea, risk analysis data is mainly based on tanker traffic data from EMSA and offshore oil and gas activity reported in the online specialised media and expert knowledge.

2.6.5.1 Tanker traffic risk assessment

Oil tanker traffic in the Black Sea is significant. As can be seen in Figure 18, there are important tanker traffic flows to and from Romania, Bulgaria, Russia and Ukraine. These routes as well as the routes to and from the Bosporus Strait, where vessels converge to cross into the Turkish Marmara Sea and follow into the Mediterranean, are main areas of oil spill risk from ships.

The risk factors in the Black Sea are further increased by the existence of substantial traffic of oil tankers from Novorossiysk area in Southern Russia (Siberian, Russian and Kazakh oil) and from the Supsa and Batumi Oil terminals in Georgia (Azerbaijan and Kazakh oil) which is exported from the Black Sea area via the Turkish Straits resulting in a high concentration of big oil tankers in the South-western part of the Black Sea.

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[153] OSPAR. (2016). OSPAR report on discharges, spills and emissions from offshore oil and gas installations in 2014. Retrieved from: http://www.ospar.org/about/publications?q=oil&a=&y=

[154] OSPAR. (2016). OSPAR report on discharges, spills and emissions from offshore oil and gas installations in 2014. Retrieved from: http://www.ospar.org/about/publications?q=oil&a=&y=

[155] In spite of several attempts, no contracts could be concluded for that area as no offers were made.

2.6.5.2 Risk of oil pollution from oil and gas installations

Offshore oil exploration and drilling activities have been increasing in the past few years in the Western Black Sea. Romania currently is active in extracting oil off of its coast, and in spring 2016 new offshore drilling activities also started off the coast of Bulgaria.[156] In early 2015, Turkey also started exploring for oil and gas in the Western Black Sea.[157] This represents a likely increase in the risk of oil spill from offshore activities in the future.

2.6.5.3 Assessment of the relevance of EMSA's OPR services in the Black Sea

The contract for the EMSA OSRV *Enterprise* located in Bulgaria recently expired (September 2016) and will be replaced in 2017, however the EMSA vessel in Romania currently covers risks from tankers and oil and gas installations in the Western Black Sea.

Taking into consideration the general shipping density in the Black Sea combined with the high volumes of export of crude oil from Georgian, Russian and Ukrainian oil terminals, it is expected that the risk of serious oil pollution incidents will increase in the Black Sea and the Turkish Straits. Consequently, maintaining the current OSRV capacity to two vessels or its potential increase may be considered relevant in the future.

2.6.6 Conclusion on the assessment of the location of EMSA's Oil Spill Response services in relation to existing risks in European waters

Risks of oil spill are likely to increase in European waters in the coming years as tanker traffic and oil and gas exploration and drilling activities are increasing particularly in the Mediterranean and the Black Sea, with significant risks also in the other regions. This assessment has shown that overall, EMSA has developed a service which addresses these risks. The network of EMSA OSRVs generally covers (or is planned to cover) geographical areas where traffic is high, where oil and gas installations are located, and where offshore exploration may lead to further future extraction activities. Areas not covered contain a lower risk, or have been targeted in calls for tenders but could not be covered due to low responses to EMSA's calls.

[156] http://bg.total.com/en/home/media/list-news/total-begins-exploratory-drilling-han-asparuh-block
[157] No specific location could be found for mapping in Figure 19. The following source mentions exploration in the 'Western Black Sea' http://www.naturalgasworld.com/turkey-tpao-shell-exploration-oil-and-gas-black-sea

3. PART 2: COST-EFFECTIVENESS AND COST-EFFICIENCY ANALYSES OF EMSA'S SERVICES

Regulation No 911/2014 of 23 July 2014 established a Multiannual Funding framework (MAF II) with a total financial envelope for EMSA's OPR activities of € 160,500,000 for the period from January 1st 2014 to December 31st 2020. Part 2 of the present study analyses the extent to which the financial outputs of the implementation of this policy are balanced and/or outweighed by the added value that the Agency is offering to its main stakeholders, and primarily the EU Member States as per Part 1.

3.1 Objectives of the cost-effectiveness and cost-efficiency of EMSA's services

In section 3.3 we present a cash flow analysis of the nominal costs incurred in 2014, 2015 and 2016 and compare it with the MAF II envelope as allocated per year. This way we understand the extent to which EMSA has budgeted for the provision of OPR services within the targets of the financial envelope.

In section 3.4 we present a cost-efficiency analysis allocating real costs of the service (adjusted to inflation) per unit of output i.e. per cubic metre (m^3) of storage capacity, per contract arrangement (per region and type of vessel), per type of equipment in EAS stockpiles, per tonne of dispersant, per exercise and per vessel. Appendix 4 indicates the methodology for calculating these costs.[158] As detailed in section 3.2.2 below, this analysis distinguishes the different parts of the service: **OSRV**, **dispersant application capability**, and **EAS**.

In section 3.5 we compare the cost of recovering one tonne of oil at sea with the cost of shoreline-clean-up.

3.2 Scope of the cost-efficiency analysis

The period under scope of analysis is January 1st 2014 to December 31st 2016, however, our economic model has taken into account a reference period from 2007 to 2020 in order to take into account costs incurred under all contract arrangements active at any point in time during the years under scope (2014-2016). All costs are amortised over a number of years, depending on the type of cost they represent: **investment costs**, **fees**, **rates**, and **one-off costs** (see section below).

Costs are expressed in 2015 euros using OECD Harmonised Consumer Price Indices for the EU28.[159] *Note that it means that, on the basis of the yearly indices, the costs reflected in the second section diverge from costs in EMSA's financial sheets.* However by indexing costs we exclude price variations due to inflation and make the costs comparable.

We describe below the general methodology for incurring costs to EMSA for the provision of OPR services and detail the assumptions made to create the model for the analysis. Note that some more specific methodological considerations are also made in the section detailing the results.

3.2.1 Distinction of the different types of costs

Different types of costs are included in the analysis, these are investment costs, fees, rates, and one-off costs.[160] The distinction matters in understanding of how they apply and when, including how should be spread to reflect the cost to EMSA for providing all services for each year under scope.

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[158] Cost elements used in the formulae in Appendix 4 are defined in section 3.2.1.

[159] https://stats.oecd.org/

[160] All costs and calculations can be found in the Excel sheet attached to this report.

- **Investment costs**

Investment costs comprise the price of the equipment on board vessels and in EAS stockpiles. EMSA is able to recover all equipment from expiring contracts at the cost of €1 and transfer this equipment from one vessel to another, meaning that this value is not lost after expiration of a contract. However for each type of equipment, a Total Life Expectancy (TLE) of 8, 12 or 16 years is assumed.[161] Past the TLE, the equipment is assumed to have lost its value.

In addition, investment costs also comprise the cost of pre-fitting vessels. Pre-fitting is an investment made by EMSA to modify the vessel in order to install oil recovery systems including foundations on the deck and, if necessary, modifications to the vessel pumping and piping systems as well as storage tanks. This cost is an added value to the ship which the Agency does not recover unless the contract is terminated before the end of the four years of contract, in which case EMSA is entitled to recover the unamortised cost of pre-fitting in its balance sheet.[162] Pre-fitting costs are amortised over the period from date of purchase until the end of the latest contract.[163]

Lastly, the model accounts for donations (whereby the residual value of the equipment is lost) and the financial inflow from public sales.[164]

- **Payment of fees**

Under each contract arrangement, EMSA pays an annual Vessel Availability Fee for the availability of one vessel from the moment of entry into service until the end of the contract. The VAF includes maintenance costs, warehousing costs (for equipment, dispersant systems and storage of dispersants), equipment condition tests and drills, and insurance costs.

For the EAS, EMSA also pays an availability fee which, similarly to the VAF, includes maintenance, warehousing of equipment, equipment condition tests, and insurance.

In our model, it is assumed that the payment of these fees occurs once each year from the date of entry into service, however we acknowledge that the VAF is normally paid quarterly to the contractors.

- **Payment of rates**

Daily stand-by rates, operational rates and reimbursement of fuel costs are paid to the EMSA vessel contractors by a requesting State during stand-by and operation hire.

- **One-off costs**

One-off costs include the costs for participation of EMSA vessels in operational exercises, for which EMSA compensates the vessel contractors.

3.2.2 Distinction of the parts of EMSA's OPR services

The cost-efficiency analysis of EMSA's OPR services is based on the calculation of indicators reflecting the costs associated with the provision of the different parts of the service, namely the OSRVs (mechanical recovery of oil at sea), dispersant application capability and Equipment

[161] Sweeping arms (16 years), booms (12-16 years), weir booms (16 years), skimmers (16 years), high-capacity skimmers (16 years), dispersant systems (16 years), slick detection systems (8 years), decanting systems (16 years), heating (16 years), discharging (16 years), sampling/testing (8 years), communication (8 years), cleaning (16 years), personal protection equipment (PPE, 8 years), spares (8 years). IBCs with dispersants and spare IBCs (8 years).

[162] Of the vessels under scope, the OW Copenhagen is the only one which contract ended early and led to a reimbursement from the contractor to EMSA of €234,898.

[163] Because it is not possible to predict whether a vessel's contract will be renewed, pre-fitting for vessels currently in their first contract is only spread until the end of that first contract.

[164] As mentioned in Part I, public sales have allowed EMSA to recover €240,100. The total purchase price of equipment sold to date was €1,291,138.

Assistance Service (EAS). The distinction between the three services requires a clear definition of the cost elements under scope for each of these services.

- **OSRV (Mechanical recovery of oil at sea):**
    - Costs of mechanical recovery equipment, i.e. all equipment on board vessels or stored in warehouses waiting to equip new vessels. This includes booms, skimmers, sweeping arms, slick detection systems, systems for decanting, heating and discharging recovered oil, as well as costs related to sampling/testing, communication, cleaning, personal protective equipment and spare equipment/parts.
    - Costs of vessels pre-fitting.
    - Vessel Availability Fee (VAF).

- **Dispersant application capability:**[165]
    - Costs of dispersant equipment (systems) on board vessels, and costs of dispersant stockpiles stored in Intermediate Bulk Containers (IBC).
    - Costs of pre-fitting vessels in order to install dispersant systems.
    - VAF increase following the entry into service of the vessel's dispersant application capability.

- **Equipment Assistance Service:**
    - Costs of stand-alone equipment in stockpiles, i.e. high speed containment and recovery systems (including Speed Sweep, RoBoom-RoSkim and Current Buster), oil trawl-nets and in-situ burning equipment (fire booms) provided under the EAS.
    - EAS annual availability fee.

In addition, we look separately at the cost of EMSA's participation in operational exercises with the Member States.

3.3 Cash flow analysis

This section presents the costs incurred by EMSA for all parts of the service over the 3 years under scope. The prices are shown in 2015-euros and are thus adjusted for inflation which allows for comparisons between years. The higher cost in 2016 can mainly be explained by the introduction of EAS and Dispersants.

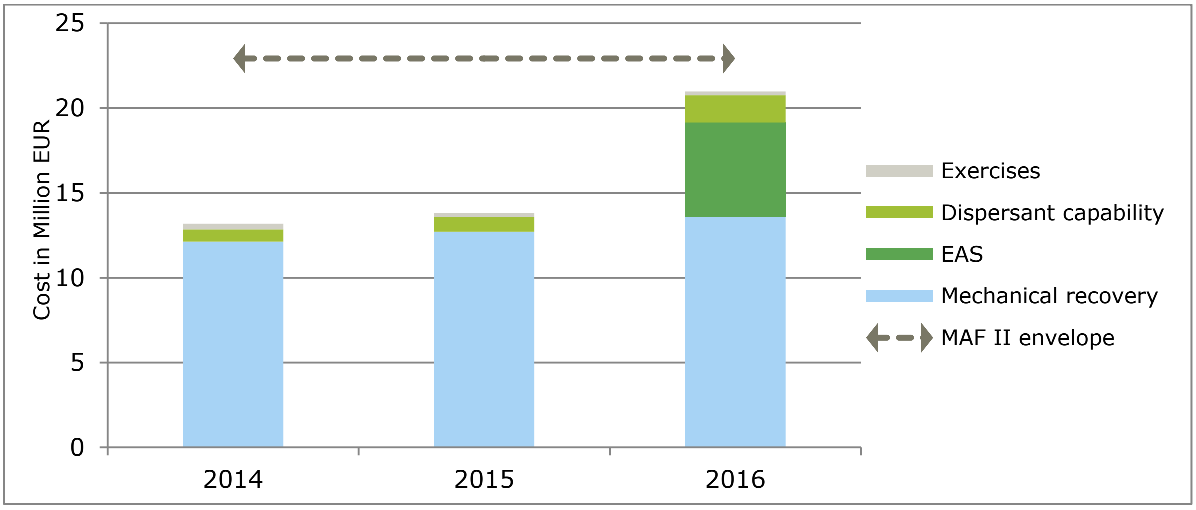
Table 18: Cash Flow - All parts of the service.

	2014	2015	2016	Total
OSRV	12,136,620	12,717,580	13,601,908	**38,456,108**
EAS	0	0	5,537,730	**5,537,730**
Dispersant capability	702,265	839,345	1,603,557	**3,145,167**
Exercises	337,832	251,012	237,420	**826,263**
Total cost in year	**13,176,717**	**13,807,937**	**20,980,616**	**47,965,270**

The chart below presents the same data, but also allows assessing the costs of the service per year against the split of the financial envelope over the 7 years covered by the MAF II, or approximately € 23 million per year. *Note that the MAF II budget also covers other costs than assessed in this study, such as CleanSeaNet or the MAR-ICE Service.*

[165] Note the complete separation of all costs related to the provision of the dispersant application capability from the vessels to which dispersant systems, stockpiles and related fees are associated.

Figure 20: Cash flow for all parts of the service per year and yearly MAF II financial envelope ceiling.



These figures show that EMSA is within the budget of the financial envelope allocated for the service under the MAF II, with an expected notable increase in costs with implementation of new parts of the service, mainly dispersants and EAS.[166]

3.4 Cost-efficiency analysis

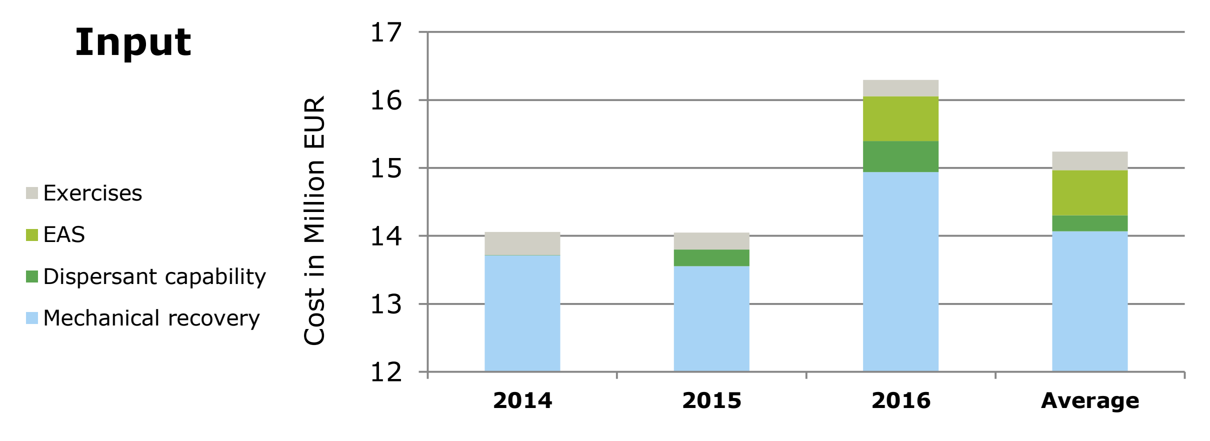
The results of the cost-efficiency analysis are structured so that general costs per year and per region are presented first. The analysis then looks further into costs for each part of the service, i.e. per vessel arrangement for the mechanical recovery of oil at sea, per EAS stockpile, per tonne of dispersant, and per exercise.

3.4.1 Total cost of the service to EMSA

The figure below shows the cost to EMSA of the three parts of the service for each year under scope in relation to the outputs of the service.

[166] It is important to note nevertheless that the envelope of the MAF II also includes other activities, such as information systems (CleanSeaNet), Cooperation and Information, and to some extent the Remotely Piloted Aerial Systems, not part of this study.

Figure 21: Total cost of the service per part of the service, per year.[167]



Output	2014	2015	2016	Average
Number of vessels[168]	16.1	15.1	17	16.1
Capacity in m^3	52,090	54,746	60,908	55,915
Number of EAS equipment items				
Fire Boom	-	-	8	
Speed Sweep	-	-	4	
Current Buster	-	-	2	
Roboom-Roskim Integrated System	-	-	1	
Trawl Net System	-	-	4	
Dispersant quantity in stock (in tonnes)	200	400	800	

The chart indicates a noticeable increase in the overall cost of the service. The main source of cost is the total cost of vessel arrangements for the service of mechanically recovering of oil at sea (OSRVs). The introduction of dispersant capability in 2015 and 2016[169] and of the EAS in 2016 also increased the total cost of the service.

[167] Note that this figure differs from the figure presented in the cash flow analysis, as prices are here controlled for the availability of the services and amortised according to the definition of each type of cost. This means that hypothetically, a VAF of € 200,000 per year for a contract starting on July 1st of a certain year will be accounted for as € 100,000 until the end of that year. The same applies for payment of the VAF from beginning of the last year of the contract until the end of the contract.

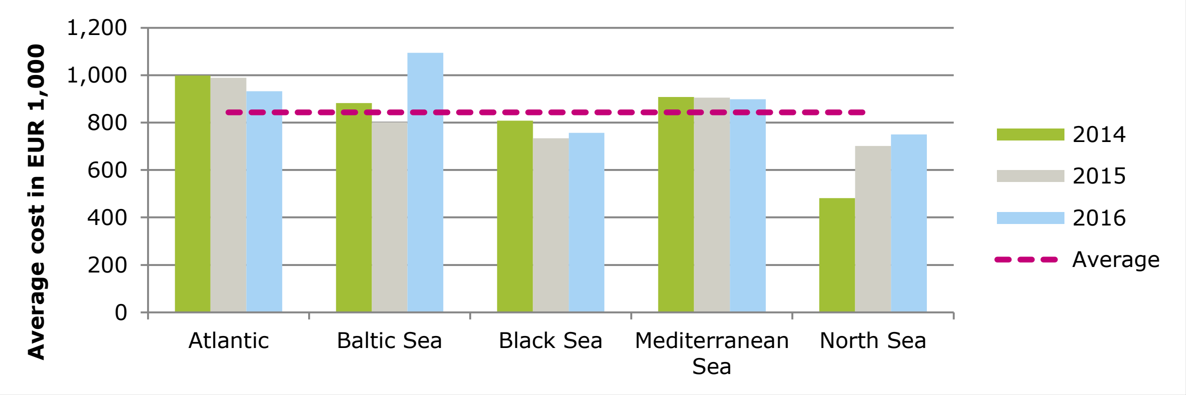
[168] The number of vessels and Capacity in ^{m3} is adjusted to the partial availability of each vessel during the year.

[169] And very marginally in 2014.

3.4.2 Cost per vessel arrangement

In this section we compare costs of arrangements per region and per type of vessel. The chart below shows the average cost to EMSA of maintaining each vessel arrangement over the three years under scope. A table showing the cost for all arrangements is presented in Appendix 4.

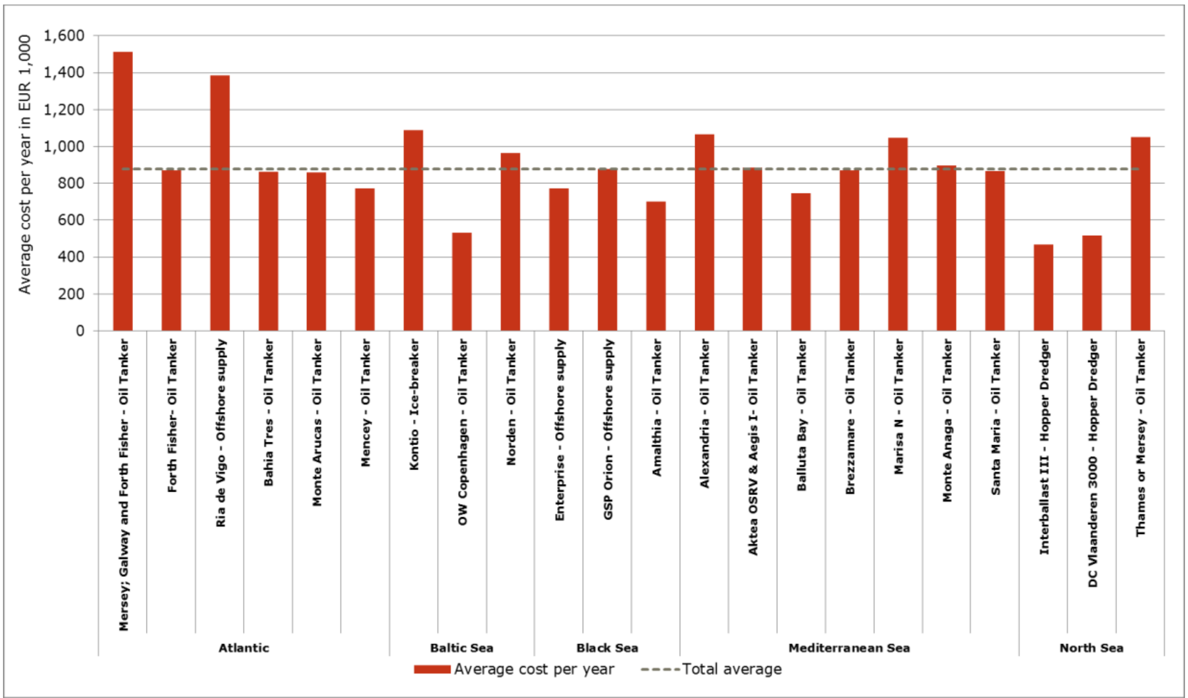
Figure 22: Average cost of vessel arrangements per region, per year.



The average cost per vessel arrangement is approx. € 865,000 per year.[170] The highest average costs is found for the Atlantic (€ 100,000 over average) and the lowest for the North Sea (€ 200,000 below average).

The chart below presents the cost per arrangement averaged over the years in scope. *It does not reflect the actual availability of the arrangement during the period*, thus allowing comparing the arrangement's potential full 'normalised' costs (i.e. this is not in the costs actually paid by EMSA for each year).[171]

Figure 23: Cost per arrangement, averaged over 2014, 2015 and 2016.[172]



[170] Average cost of arrangements, taking into account availability of a vessel in the year (in number of days it is available).

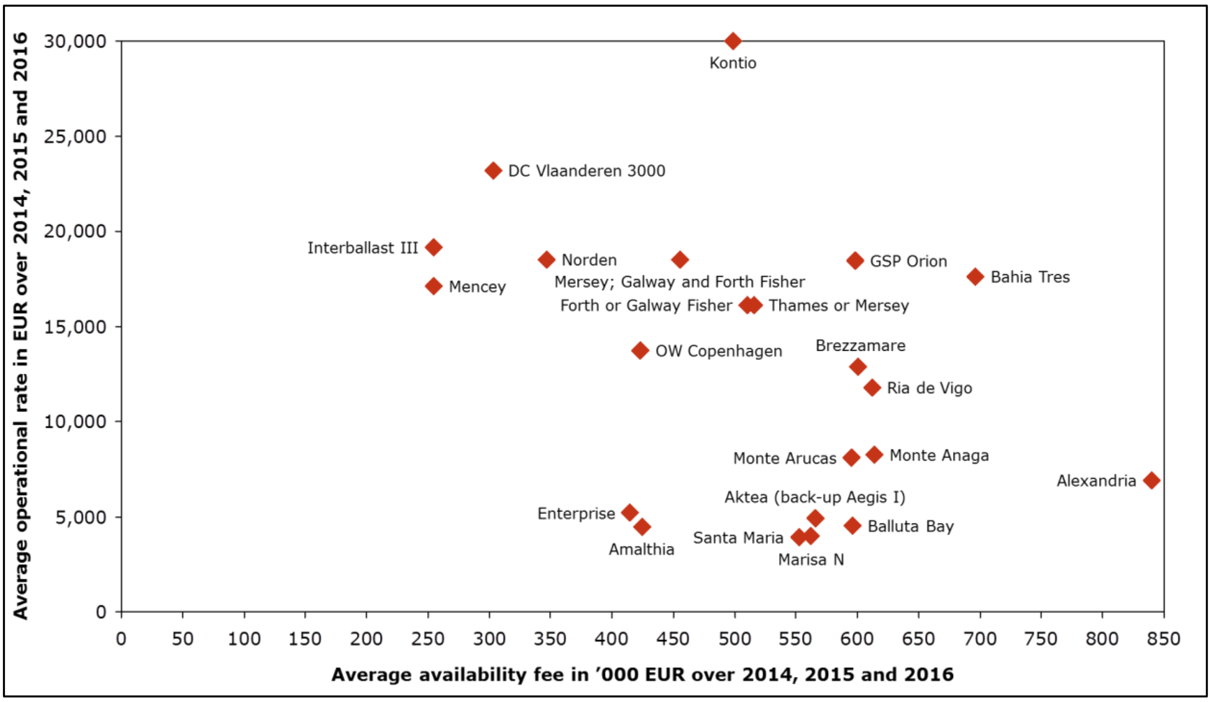
[171] See also Table 8 in Part 1 which contains the same data. For data on the cost of vessels actually paid by EMSA over the period, see Table 84 in Appendix 4.

[172] It does not control for availability, thus allowing normalising partial costs over a full yearly duration in order to compare the arrangement's potential full costs as negotiated with the contractors (i.e. not in the costs actually incurred by EMSA).

The average of all normalised arrangement costs is € 878,000.[173] Most expensive vessel arrangements above this line[174] are the Ria de Vigo (+ € 507,000), Kontio (+ € 210,000) and Alexandria (+ € 188,000). The least expensive vessel arrangements are the Interballast III and DC Vlaanderen 3000 (€ 410,000 and € 360,000 below the average, respectively) followed by the OW Copenhagen[175] (- € 346,000) and Amalthia (- € 178,000).

Another cost element to take into account is the cost to Member States for hiring EMSA vessels. Here we simply look for correlation between the daily operational rate (as a cost to Member States) with the availability fee. The figure below provides a visual representation of this relationship.

Figure 24: Average operational rate and average availability fee of vessel arrangements over 2014, 2015 and 2016.



As the operational rate of vessels is not negotiated with consideration of the amount set for the availability fee, the relationship between the two is weak.[176] A Pearson' r correlation test between the two variables shows a weak negative relationship (-0.39).

3.4.3 Average cost per cubic metre of storage capacity on board vessels

A ratio of the cost of vessel arrangements over on board storage capacity indicates the cost-efficiency of vessel arrangements for a better assessment of the cost of the level of service EMSA is providing to the Member States.[177]

On average, this cost-efficiency ratio is of € 252 per cubic metre for all vessels across the years under scope, ranging between € 116 and € 910 per cubic metre.

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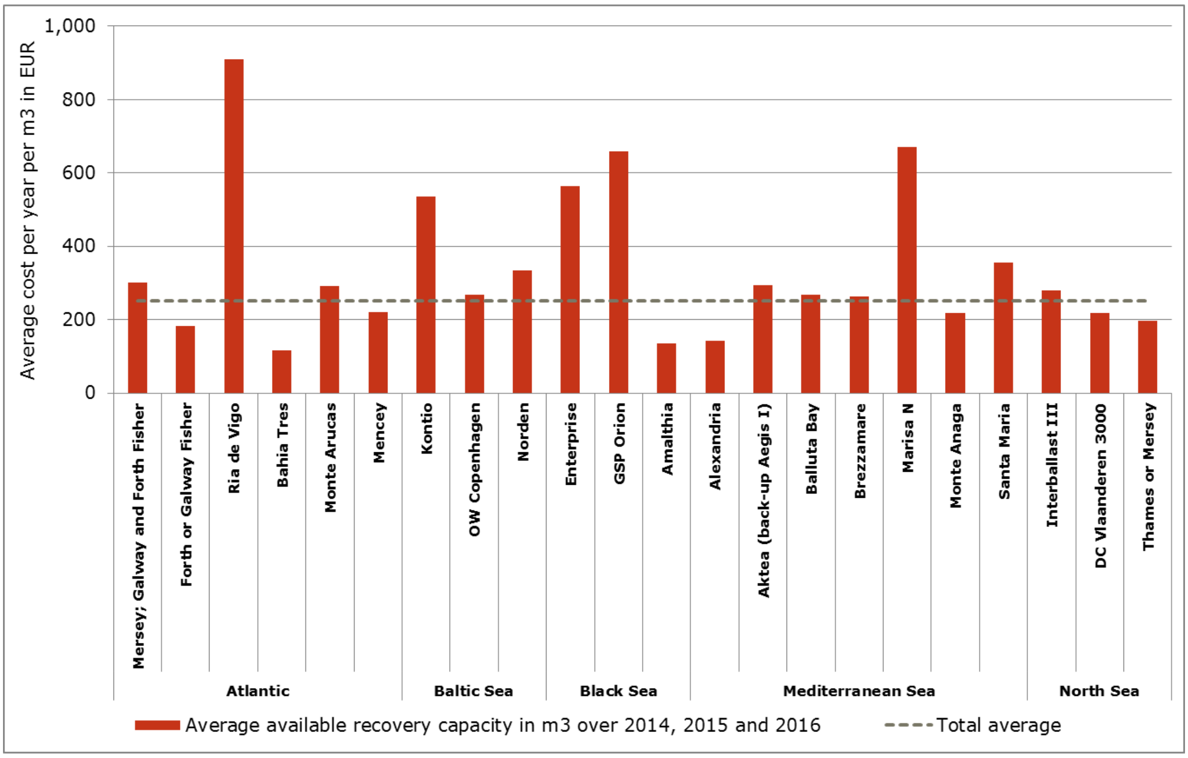
[173] This slightly higher average (compared to €865,000) is due to the use of vessels' full potential cost, regardless of yearly availability.
[174] Note that the high cost of the Mersey; Galway and Forth Fisher arrangements is because it covered the possible use of two vessels simultaneously. We therefore do not include is as being among the most expensive.
[175] The contract for the OW Copenhagen was interrupted by the contractor, allowing EMSA to recover 75% of the pre-fitting costs (€ 234,898 of € 314,248 invested) and reducing its overall cost.
[176] The operational rate is rather negotiated with regards to the type of the vessel as well as its area of operation.
[177] All cost and storage capacity figures in this section account for partial availability of the vessels in each year.

Below is a figure showing the cost per cubic metre in each vessel arrangement, averaged over the years under scope. A table showing the cost per cubic metre of storage capacity on board vessels and for all arrangements is presented in Appendix 4.

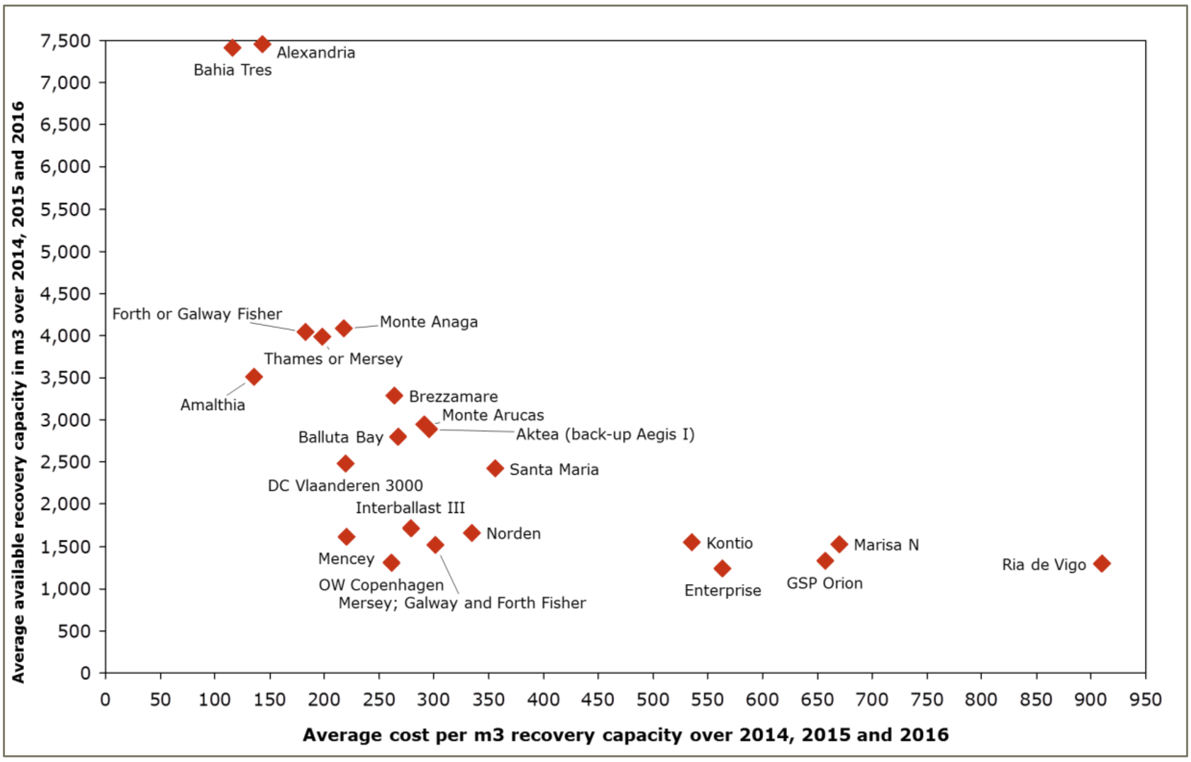
Figure 25: Average total cost of arrangements per cubic metre of oil storage capacity on board vessels.



The Enterprise and the GSP Orion are both vessels which came out of service after their first and second contracts respectively, and which, as offshore supply vessels, had the lowest oil storage capacity (about 1,350 m^3). The Ria de Vigo is also an offshore supply vessel with a low storage capacity. As expected, the cost-efficiency ratio (in terms of cost per cubic meter of storage capacity) of these three vessels was among the lowest.

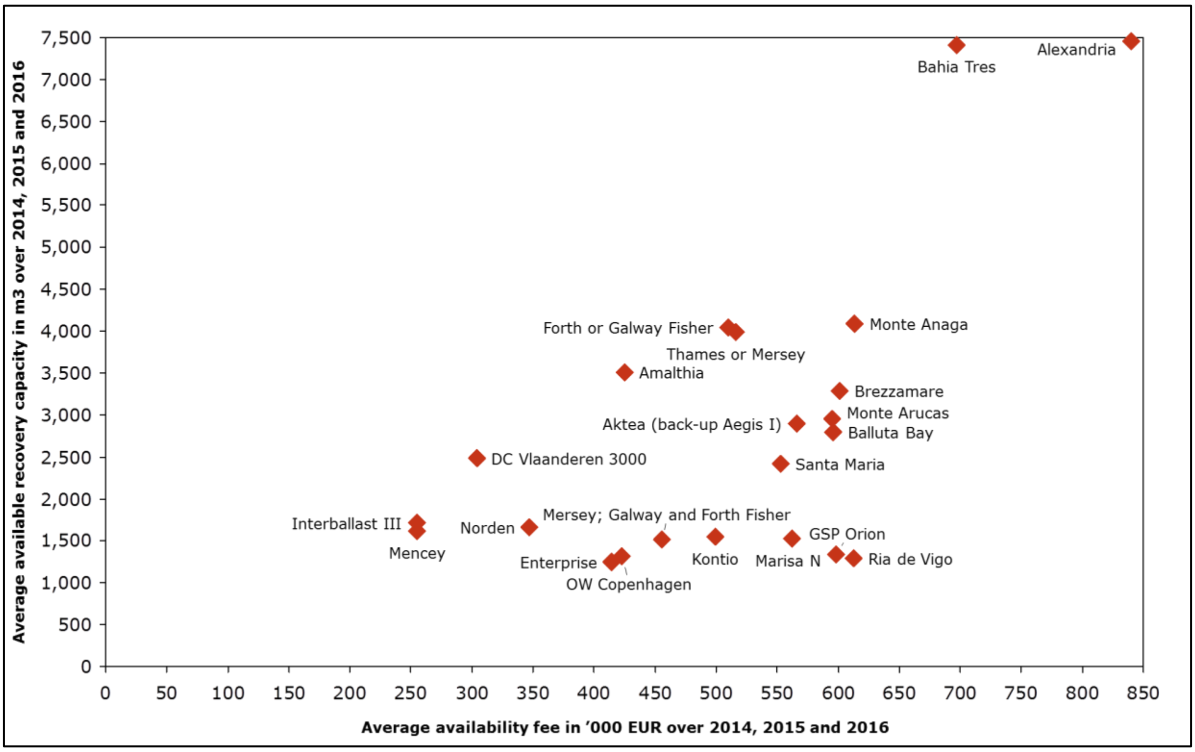
A Pearson's r correlation test between average cost per year per cubic metre of storage capacity with the average storage capacity of vessels shows moderate negative correlation (-0.62), indicating that vessels with the highest capacity are also likely to have the highest cost-efficiency ratio. The chart below helps visualize this correlation.

Figure 26: Average available storage capacity and average cost per m³ storage capacity of vessel arrangements over 2014, 2015 and 2016.



The comparison between availability fee and average available storage capacity on board vessels (see figure below) shows a similar but inversed result, with a moderate positive correlation (0.63), indicating that availability fee is relatively well proportioned with the storage capacity of the vessels.

Figure 27: Average available storage capacity in m³ and average availability fee of vessel arrangements over 2014, 2015 and 2016.



3.4.4 Average cost per tonne of dispersant

The average cost per tonne of dispersant is shown in the table below for each location of the dispersant stockpiles (and therefore in each corresponding vessel's home base). The average for all locations is € 599 per tonne of dispersant. Costs are adjusted to the date when the different parts of the service became available.

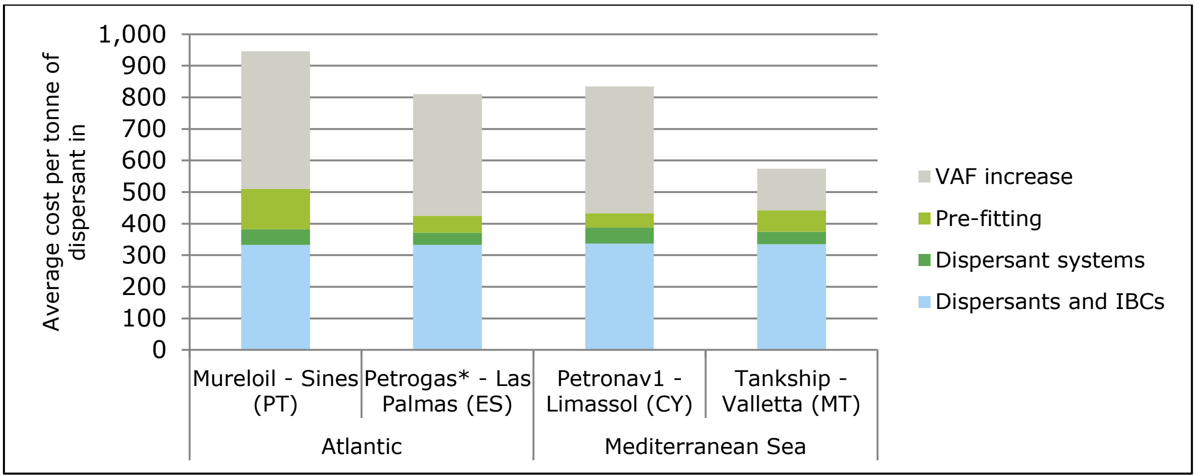
Table 19: Average cost per tonne of dispersant per year and in each stockpile.

Current contractor	Region	2014	2015	2016	All years' average
Mureloil	Atlantic	-	-	945	945
Petrogas*	Atlantic	-	-	810	810
Petronav1	Mediterranean Sea	388	796	834	672
Tankship	Mediterranean Sea	-	442	574	508

** For the Mencey (Petrogas), distinct costs related to the new dispersant application capability (except dispersant systems) could not be obtained. Consequently, the costs are estimated based on an average of these same costs for the other three vessels with dispersant application capability.*

The lower cost found in the Mediterranean Sea for 2014 is due to the vessel and equipment not yet being available, therefore costs only relate to dispersants in IBCs. In order to understand better which cost elements mainly influence the cost per tonne of dispersant and compare the average cost of the service for EMSA in making a tonne of dispersant available across regions, we present below a chart showing the all years' average of each cost element per location.

Figure 28: Share of the different cost elements incurred in the total cost per tonne of dispersant in each stockpile.



** For the Mencey (Petrogas), distinct costs related to the new dispersant application capability (except dispersant systems) could not be obtained. Consequently, the costs are estimated based on an average of these same costs for the other three vessels with dispersant application capability.*

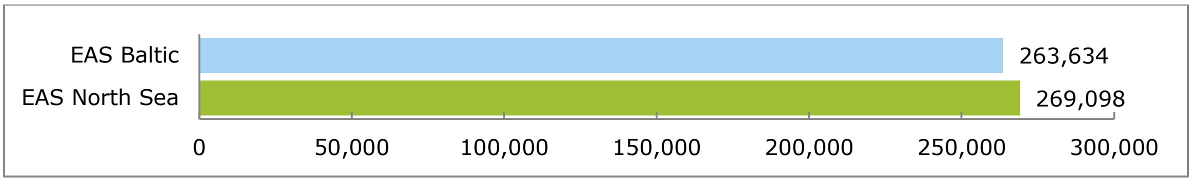
The chart shows that the variation in the cost per tonne of dispersant is mainly due to the variation in the cost of the VAF increase[178], pre-fitting[179], and more marginally, dispersant systems[180]. Dispersants and IBCs have a stable price. From this chart, we also see the variation in costs between the regions.

[178] The nominal cost of the VAF increase is between € 40,000 (Balluta Bay, Tankship) up to € 94,000 (Bahia Tres, Mureloil).
[179] The nominal cost of pre-fitting is between € 25,000 (Bahia Tres, Mureloil) up to € 68,000 (Balluta Bay, Tankship).
[180] The nominal cost of dispersant systems is between € 121,000 (Mencey, Petrogas) up to € 164,000 (Alexandria, Petronav).

3.4.5 Cost per type of equipment in EAS stockpiles

In this section we look at the cost of equipment in EAS stockpiles. This cost is influenced by two types of costs: the cost of the availability fee paid to the contractor warehousing and maintaining the equipment, and the purchase cost of equipment in the stockpile. The chart below compares the availability fee in both locations.

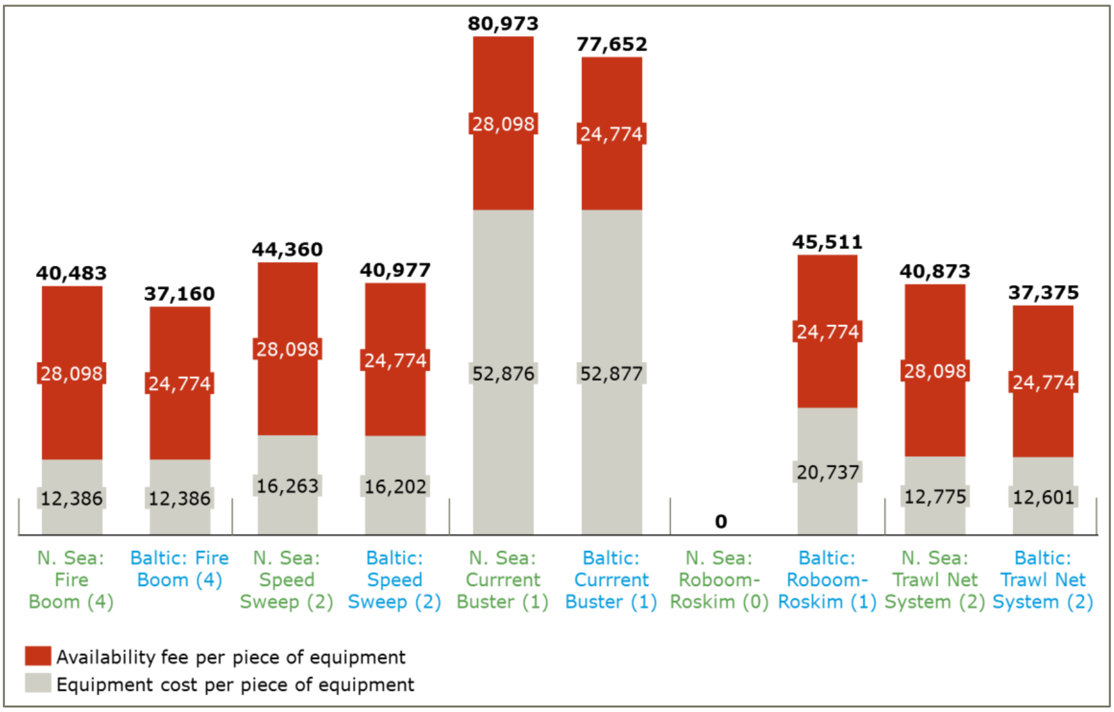
Figure 29: Yearly availability fee for each EAS location.



There is a relatively small difference in the availability fee between the two locations.

The chart below presents the full yearly cost per piece of each type of equipment in the North Sea EAS and Baltic EAS stockpiles.[181] Note that the availability fee is here apportioned to each piece of each type of equipment: thus the fee in the North Sea EAS is € 28,098 and € 24,774 in the Baltic EAS.[182]

Figure 30: Cost per piece of each type of equipment in each EAS location.[183]



There is a minimal difference in the cost of equipment (excluding the availability fee) in the two locations. The main source of difference in costs is mainly the overall lower fee in the Baltic EAS. It is also due to the greater number of pieces of equipment in the Baltic stockpile (10 pieces in the Baltic, 9 pieces in the North Sea), therefore reducing the cost of the availability fee per piece of equipment in the Baltic stockpile.

In conclusion, there is a relatively small difference in the cost of equipment purchased for one location or the other.

[181] Note that this is the total cost of the equipment regardless of availability. For the cost of equipment in each stockpile in 2016, see Table 86 in Appendix 4.

[182] This means that the total availability fee is divided by the number of pieces of equipment available in the stockpile.

[183] The number of pieces for each type of equipment is indicated in parentheses in the chart.

3.4.6 Average cost per exercise

The table below presents the total and average cost per exercise for each year under scope. The total cost of exercises is also averaged to the number of vessels participating each year.

Figure 31: Average cost per exercise.

	2014	2015	2016
Number of exercises	10	11	10
Number of EMSA vessels participating in exercises	12	11	12
Total costs of exercises (€)	**337,832**	**251,012**	**237,420**
Average cost per exercise	33,783	22,819	23,742
Average cost per EMSA vessel participating	28,153	22,819	19,785

While the number of exercises and participating vessels is relatively stable, the average cost of exercises is much higher in 2014 than in the other years. Also notable is the higher cost per exercise in 2016.

3.5 Comparative analysis

In this part of the analysis we perform a comparative analysis of the costs of an at-sea clean-up of 1 tonne of oil with the costs of a shore-line clean-up of 1 tonne of oil. This analysis allows concluding on whether EMSA's oil spill response services provide value for money by improving the effectiveness of interventions in cases of large spills, preventing drifting oil from reaching the shore.

3.5.1 Cost of recovering oil at-sea

In the absence of major spills in European waters in the past decade EMSA's capacities have not been mobilised in an oil pollution response operation. Therefore, in order to estimate the costs of recovery of one tonne of oil at sea for the network of EMSA vessels, **theoretical scenarios of intervention** have been constructed to simulate the intervention of a typical EMSA vessel to an oil pollution incident. The results of running such a theoretical scenario are described in this section.

Note that the unit of measurement used for vessels' storage capacity and for the equipment's recovery capacity is typically in cubic metres and cubic metres per hour, while the unit used for oil spilled at sea is typically in tonnes. The density of different types of oil differs and leads to varying volume-to-weight conversion rates, however we do not here include the conversion step and assume a one-to-one ratio of cubic metre to tonne. This is common practice in oil spill response, furthermore this additional step does not promise to provide higher accuracy to the calculations. The use made in this section of different oil types with varying densities remains relevant to assume different efficiency rates of the equipment (impacting the time of operation) as well as to hypothesize the behaviour of the substance at sea.

The scenario:

41,000 dwt Handymax tanker suffered serious structural failure carrying a cargo of 31,000 tonnes of IFO 380. It is estimated that a minimum of 18,000 tonnes of oil has been released into the sea while 13,000 tonnes remains on the vessel.

Parameters:

For the scenario, we assume the intervention of a 'typical' EMSA OSRV with an 'average' capacity of 3,437 m^3 and a set of sweeping arms or boom and high capacity skimmer which the vessel will use depending on weather and sea conditions.

The oil fate has been calculated using Adios 2 Version 2.0.12. A limitation of this software version is that it allows a model run of five days only. Therefore, losses shown in the Oil Budget due to evaporation and dispersion are accounted for in this time period only. It is recognised that there will be further losses from day five onwards, but these will be continuing to decrease and not considered to have a major impact on the scenario.

The Oil Budget has been calculated based on some simple assumptions for illustrative purposes, it is impossible to make an accurate assessment of the effectiveness of the vessels performance in a real oil recovery situation. These figures can be considered as a reasonable expectation of performance, but recovery rates will vary greatly from day to day in reality. The weather has been shown as being constant throughout the period of the scenario, but this is very unlikely to be the case.

The tables span a period of twenty days, this can be considered a reasonable time period for containment and recovery operations for the scenarios described; in a real scenario, the at-sea recovery operation could be shorter or longer, depending on a multitude of factors. It should be recognised that it will be become more difficult to encounter oil as time passes; this is mainly due to the spread and fragmentation of target oil slick. It is not possible to predict the impact this will have on the decrease in the daily recovered oil amount. It should be noted that for Version 2 of the scenario it is very unlikely that the EMSA vessel would continue to recover oil at the quantity shown (1,232 tonnes per day) until zero oil remains on the water.

The daily recovery capacity of the vessel is calculated solely on the containment systems' theoretical encounter rate with floating oil in the thicknesses shown in Table 21. The swath width of the containment system and the speed that it travels through the water (as shown in Table 20) determines the area that can be covered by the vessel. This is then multiplied by the oil thickness and assumes 100% coverage. The operational efficiency corrections factors by wave height (Table 22), as agreed with EMSA, are then applied. These are considered reasonable to take account of a range of operational variations. All of the vessels are fitted with high capacity skimmers and are considered to have sufficient skimming (oil recovery) capacity; this is not considered a limiting factor.

The tables have been produced based on a typical EMSA vessel, one of the most important factors being the storage capacity for recovered oil. This is 3,437 m^3. The scenario allows a periodical break in oil recovery operations to allow the vessel to return to a port and off-load its recovered oil cargo. It is considered reasonable that average loss of operational time would be 24 hours. This allows for transit to the port, entry to the port, off-loading operations and transit back to the spill site. For version 1, the vessel returns to port on days 5, 9, 12 and 16. For version 2, the vessel returns to port on days 11 and 20.

Table 20: Equipment oil recovery rates

	Swath (oil encounter) Width	Operational Speed	Recovery Rate (m^3 per day)[184]	
			Medium Viscosity Oil	Emulsion and Heavy Oil
Sweeping Arms	30m	2.5 knots	336	1,668
Boom and High Capacity Skimmer	150m	0.75 knot	504	2,496

Table 21: Oil layer thickness assumed

Type of oil	Thickness assumed
Emulsion and Heavy Oils	1mm
Medium Viscosity Oil (before emulsification)	0.2mm

Table 22: Operational Efficiency Corrections by Wave Height

Wave height	Efficiency correction
Wave Height up to 1 Meter	50%
Wave Height from 1 to 2.5 Meter	25%

Table 23: Oil Properties

Type	API	Pour Point	Viscosity
IFO 380	11.5°	16° C	16,000 @ 15° C

Table 24: Average consumption rates (in m^3 per 24h)[185]

Speed	HFO	MDO
Port / Idle speed	2.5	3.25
Full speed	19.75	0.75
Service speed	13.75	0.75
Low Speed (operational speed)	4	4.5

Evolution of scenario – Version 1

A typical EMSA vessel arrives on scene in 36 hours in good weather conditions: The environmental conditions are: Wind speed: 12 knots; Sea Temperature: 15° C; Wave Height: 1 Meter.

In accordance with these conditions, the vessel uses its Containment Booms and High Capacity Skimmer. The EMSA vessel can recover up to 1,248 tonnes per day in the conditions described.

The EMSA vessel will need to return to port to unload every 4 days, resulting in the loss of minimum of one operational period every 3 days.

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[184] 12 hour operational period

[185] This table contains the average consumption rates of the different vessels under contract for which technical specifications were available. Individual vessels may display different consumption rates.

Table 25: Oil Budget (tonnes) with recovery in good conditions (version 1)

+ days	Evaporated (Cumulative)	Dispersed (Cumulative)	Recovered		Remaining
			Daily	Cumulative	
0					18,000
1	732	46	0	0	17,222
2	1,347	96	624	624	15,933
3	1,629	129	1,248	1,872	14,370
4	1,796	152	1,248	3,120	12,932
5	1,902	170	0	3,120	12,808
6	N/A	N/A	1,248	4,368	11,560
7	N/A	N/A	1,248	5,616	10,312
8	N/A	N/A	941	6,557	9,371
9	N/A	N/A	0	6,557	9,371
10	N/A	N/A	1,248	7,805	8,123
11	N/A	N/A	1,248	9,053	6,875
12	N/A	N/A	941	9,994	5,934
13	N/A	N/A	0	9,994	5,934
14	N/A	N/A	1,248	11,242	4,686
15	N/A	N/A	1,248	12,490	3,438
16	N/A	N/A	941	13,431	2,497
17	N/A	N/A	0	13,431	2,497
18	N/A	N/A	1,248	14,679	1,249
19	N/A	N/A	1,248	15,927	1
20	N/A	N/A	0	15,927	1

Operational costs involved

The operational costs involved in the operation under version 1 are summarised in Table 26. The assumptions are clarified in the same table.

Table 26: Operational costs associated with the EMSA vessel[186]

Type of cost	Value (€)
Operational rate[187]	€ 279,107.49
Fuel costs[188]	€ 62,591.19
Cleaning costs	€ 400,000

[186] The calculation of operational costs for the EMSA vessel takes into account operational rates, fuel costs and cleaning fees. Port fees, harbour dues, assisting towing boat have not been taken into consideration

[187] Average daily operational rate of € 11,629.48 considered over 24 days of operations (including de-mobilisation and cleaning time)

[188] The consumption rates in Table 24 were considered, it has taken into account that the vessel was travelling at service speed for 5 * 24 hour periods, operating at low speed for 6 days and idle (at night) for 6 nights and in port for 3 *24 hour periods

Total	€ 741,698.68
Cost per tonne to recover the oil for Requesting State[189]	€ 71.68 / tonne
Cost per tonne to recover the oil for EMSA[190]	€ 223.81 / tonne

Evolution of scenario – Version 2

EMSA vessel arrives on scene in 36 hours less favourable weather conditions, the Environmental Conditions are: Wind speed: 20 knots; Sea Temperature: 15° C; Wave Height: 2.5 Meter.

Under these conditions the equipment used are the **sweeping arms.** The EMSA vessel with sweeping arms can recover up to 417 tonnes per day in the conditions described.

The EMSA vessel will need to return to port to unload every 10 days, resulting in the loss of minimum of one operational period in every 11 days.

Table 27: Oil Budget (tonnes) With Recovery in less favourable conditions (version 2)

+ days	Evaporated (Cumulative)	Dispersed (Cumulative)	Recovered Daily	Recovered Cumulative	Remaining
0					18,000
1	940	209	0	0	16,851
2	1,537	381	209	209	15,873
3	1,799	484	417	626	15,091
4	1,928	556	417	1,043	14,473
5	1,998	616	417	1,460	13,926
6	N/A	N/A	417	1,877	13,509
7	N/A	N/A	417	2,294	13,092
8	N/A	N/A	417	2,711	12,675
9	N/A	N/A	417	3,128	12,258
10	N/A	N/A	309	3,437	11,949
11	N/A	N/A	0	3,437	11,949
12	N/A	N/A	417	3,854	11,532
13	N/A	N/A	417	4,271	11,115
14	N/A	N/A	417	4,688	10,698
15	N/A	N/A	417	5,105	10,281
16	N/A	N/A	417	5,522	9,864
17	N/A	N/A	417	5,939	9,447
18	N/A	N/A	417	6,356	9,030
19	N/A	N/A	417	6,773	8,613
20	N/A	N/A	0	6,773	8,613

The operational costs involved in the operation under version 2 are summarised in Table 28. The assumptions are clarified in the same table.

[189] Operational rate + Fuel Costs + cleaning costs / Cumulative oil recovered according to Table 25

[190] Multi-annual costs of one arrangement / cumulative oil recovered according to Table 25; As current contracts are signed over 4 years, costs for EMSA take into account the maintenance of capacity of one fully equipped vessel for one contractual period.

Table 28: Operational costs associated with the EMSA vessel[191]

Type of cost	Value (€)
Operational rate[192]	€ 313,995.93
Fuel costs[193]	€ 45,602.22
Cleaning costs	€ 400,000
Total	€ 759,598.15
Cost per tonne to recover the oil for Requesting Parties[194]	€ 112.15 / Tonne
Cost per tonne to recover the oil for EMSA[195]	€ 526.29 / Tonne

3.5.2 Cost of shoreline clean-up

The calculation of the costs of a shore-line clean-up of one tonne of oil is based on available data for the latest three Tier-III oil spills having occurred in European waters in the past 20 years: the Erika, the Prestige, and the Alfa I incidents. These were spill incidents where oil reached the shoreline and extensive clean-up operations had to be initiated, requiring an important investment of resources.

The following analysis is based on IOPC Funds reports which refer to the amounts of oil spilled, and the financial amounts claimed for compensation related to the clean-up of the spills.[196] The data specific to the cost of shoreline clean-up operations is not available from these sources, which only indicate a total clean-up cost including shoreline and at-sea oil clean-up.

In principle, the calculation of this cost would require to know how much of the amount of oil spilled from the vessels reached the shore, how much of this oil was recovered at sea, and how much has evaporated or dispersed. Data sources sometimes indicate the weight of oil-water emulsion recovered at sea and oil wastes collected from the shore,[197] however these cannot be used directly as they tend to be much higher than the actual amount of oil spilled from the vessel due to the mixture of the oil with water or beach material.[198]

The literature on spill clean-up indicates that the cost of shoreline clean-up composes up to 80-90% of the total cost of clean-up operations.[199] In the absence of sufficient data, we calculate to the total cost of clean-up operations in these events where extensive shoreline clean-up operations were undertaken and therefore represented a large portion of the total cost of clean-up operations, for comparison with the clean-up scenarios developed above and only involving

[191] The calculation of operational costs for the EMSA vessel takes into account operational rates, fuel costs and cleaning fees. Port fees, harbour dues, assisting towing boat have not been taken into consideration

[192] Average daily operational rate of € 11,629.48 considered over 25 days of operations (including de-mobilisation and cleaning time)

[193] The consumption rates in Table 24 were considered, it has taken into account that the vessel was travelling at service speed for 3 * 24 hour periods, operating at low speed for 22 days and idle (at night) for 22 nights and in port for 2*24 hour periods

[194] Operational rate + Fuel Costs + cleaning costs / Cumulative oil recovered according to Table 27

[195] Multi-annual costs of one arrangement / cumulative oil recovered according to Table 25; as current contracts are signed over 4 years, costs for EMSA take into account the maintenance of capacity of one fully equipped vessel for one contractual period.

[196] IOPC. (2013). Incidents involving the IOPC Funds 2013. Retrieved from: http://www.iopcfunds.org/uploads/tx_iopcpublications/incidents2013_e.pdf

[197] See for example: Cabioc'h, F. (Cedre), Commander Nedellec (Ceppol), & Commissaire Lambert (Brest Maritime Prefecture). (2005). Erika vs Prestige; two similar accidents, two different responses. The French Case. *International Oil Spill Conference Proceedings May 2005,* Vol. 2005, No. 1 (May 2005), pp. 1055-1061.

[198] Taking the case of the Prestige as an example: from the initial 63,300 tonnes of oil which escaped the ship, 52,500 tonnes of wastes and emulsion were recovered at sea and 168,000 oily wastes were recovered on land. Source: *Ibid.*

[199] Etkin, D.S. (2001). Methodologies for Estimating Shoreline Clean-up Costs. *Proceedings of 24th Arctic and Marine Oil spill Program Technical Seminar.* pp. 647-70. Retrieved from: http://www.environmental-research.com/erc_papers/ERC_paper_4.pdf

at-sea mechanical recovery. A cost-effectiveness ratio is obtained using the known amount of oil spilled from the vessel and total cost of clean-up operations.

Calculating the cost of shoreline clean-up per tonne of oil in the three cases:
The table below uses available data to calculate the cost of clean-up per tonne of oil spilled in the three spill cases.

Table 29: Cost of clean-up per tonne of oil spilled for the Erika, Prestige and Alfa I incidents

Incident (vessel)	Erika	Prestige	Alfa I
Year	1999	2002	2012
Area	France (Bay of Biscay)	Spain, Portugal and France	Greece
Spill size	19,800 tonnes	63,300 tonnes	330 tonnes
Total cost of clean-up	€ 178.8 million[200]	€ 284.4 million[201]	€ 16.10 million[202]
Cost per tonne of oil	€ 9,030	€ 4,492	€ 48,788

In comparison to the average cost per tonne of oil recovered on-shore of € 5,744 (based on the data available on historical costs), the costs to EMSA of at-sea-recovery € 217-511 per tonne[203] is much lower. Similarly, the average cost of approximately € 70-170 per tonne of oil for requesting parties in case EMSA is activated to recover the oil also appears to be much lower. The findings indicate EMSA's services would be cost-effective when compared to the fall-out resulting from an absence of capacity to adequately recover oil reaching the shoreline.

3.6 Conclusion on Part 2

Part 2 has reviewed the costs of the services for oil pollution response established by EMSA over the period 2014-2016. In the table below we summarise these costs as well as main cost-efficiency indicators.

Table 30 Summary of costs of the service in the years 2014 to 2016.

	Average per year over 2014-2016	Total over 2014-2016
OSRV	**14,069,797**	**42,209,390**
Cost per vessel arrangement	865,287	-
Cost per m3 on board vessels	252	-
Dispersant capability	**235,629**	**706,887**
Cost per tonne of dispersant	599	-
EAS*	**660,091**	**660,091**
Exercises	**275,421**	**826,263**
Cost per exercise	26,781	-
Cost per EMSA vessel participating	23,586	-
All parts of the service	**14,800,877**	**44,402,632**

* The EAS was only available in 2016.

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200 Total claim for clean-up by the French government. Source: IOPC Funds Annual Report 2008, pp77-79. http://www.iopcfunds.org/uploads/tx_iopcpublications/2008_ENGLISH_ANNUAL_REPORT.pdf IOPC Funds. (2014).
201 Total approved claim for clean-up. Source: Report by the International Oil Pollution Compensation Fund 1992 on compensation paid for the costs of preventive measures and impairment of the environment since 2002, p3.
202 Claim for clean-up, claims are still being assessed. Source: Report by the International Oil Pollution Compensation Fund 1992 on compensation paid for the costs of preventive measures and impairment of the environment since 2002, p3.
203 See footnote 161.

4. PART 3 - COMPARATIVE ANALYSIS WITH OTHER SERVICE MODELS

Introduction

This section contains a comparative analysis of EMSA's current service arrangements versus other potential service models. The main question raised and answered by this section is whether EMSA could have achieved set objectives and be as cost-efficient as the current service model, considering alternatives. In this sense, the models are tested as if they had been implemented during the same MAF II period (i.e. from January 1st 2014 to December 31st 2020).

An estimated cost of the service of each alternative is proposed for comparison with the current cost of the service for the services presently being provided. We discuss the cost of the service both for EMSA and in terms of the overall cost, i.e. for all entities participating in setting up the service, thus including any co-financer of the model or charterer of the vessels when the charterer is not EMSA (i.e. the Member States or EU agencies). The cost for the requesting parties could only be assessed qualitatively and in relation to what it represents in the baseline model.

Data collected

This part of the study draws from the results and analysis described in Parts 1, 2 and 4, including risk assessments, assessment of EMSA's level of service, the legal framework for EMSA's mandate and service, and the Member States' capacities. It also includes the data collected in for the purpose of informing the construction of alternative models. In particular, ship owners, shipbrokers, shipyards and equipment providers were contacted, and they provided data regarding the costs of building, operating and chartering vessels, and the costs of hiring oil pollution response equipment. The organisations contacted are listed in Appendix 6.

Methodology

The methodology for devising and assessing alternative models is based on a five-step approach.

1. **Define exclusion criteria and comparison criteria:** The criteria given in the Terms of Reference for this study are operationalised and categorised as either exclusion criteria or comparison criteria in Table 31 for the purpose of screening (step 3) and assessing the models (step 4).
2. **Identify alternative service models:** We compile a list of possible alternative models and hypotheses for those models based on the tentative list proposed in the Terms of Reference for this study.[204] This list is presented in section 4.1 below. Specific options for the models are proposed, along with a set of hypotheses to be tested.
3. **Design and screen alternative service models:** The potential list of alternative models is further described and then screened and assessed using the exclusion criteria**.** This step ensures that only those options that can be defined by the criteria as being suitable are considered for final assessment.
4. **Test and assess selected models:** Testing and assessment is done on the basis of the comparison criteria using qualitative descriptors and quantitative indicators.
5. **Compare selected models**: As a final step, a comparative assessment of the advantages and disadvantages of each different pollution response model is presented in the form of a matrix showing the ranking of each model solution.

[204] See Appendix 6.

4.1 Step 1: Exclusion criteria and comparison criteria

The Terms of Reference of the study identify a set of criteria that form the basis for assessing alternative service formats and models. We further operationalize these criteria, and distinguish between exclusion criteria and comparison criteria:

- Exclusion criteria are used to exclude alternative models which would conflict with the legal framework for the services. Assessment norms are used to support this assessment;
- Comparison criteria are used to assess the models that have passed the exclusion criteria (setting minimum thresholds) in qualitative and quantitative terms against the baseline. The baseline is the model implemented in practice by EMSA during the MAF II period.

Table 31: Exclusion criteria, indicators/descriptors and norms

Criterion	Indicator (quantitative) or descriptor (qualitative)	Assessment norm
Compatibility with the EU's Financial Regulation and EMSA's legal mandate in the area of oil pollution response	Coherence of the service model with the legal framework *Ability of the model to provide operational assistance and support[205], on request, with additional means, such as stand-by anti-pollution ships and equipment in the event of accidental or deliberate pollution caused by Ships and Oil and Gas installations.*	Service model does not conflict with the legal framework of the EU Financial Regulation. The model is able to respond to the minimum requirements of EMSA's mandate in the area of oil pollution response.
Overall technical, financial and organisational feasibility	General feasibility, difficulty of implementation.	The model is feasible, and does not require fundamental changes to the management and operations of the Agency.
Top-up of Member States' capabilities/added value at EU level	Added value of EMSA's services with regard to existing risks. Member States' storage capacity per region (e.g. in number of vessels, and storage capacity for recovered oil).	In accordance with EMSA's mandate, the services provided top up, and do not replicate, the Member States' vessel capacity.
Suitability for Tier III at-sea pollution response	Suitability of on-board equipment (efficiency, suitability for recovering heavy oils). Location and mobilisation time of EMSA's services with regard to areas of risk.	Equipment can be used offshore for Tier-III oil pollution incidents. Resources are *"available within a short period of time"*.[206]

[205] Member States; Third Countries sharing a regional sea basin with the Union; States applying for accession to the Union and to the European Neighbourhood partner countries.

[206] Action Plan For Oil Pollution Preparedness and Response (2004) - "General Criteria", page 60.

Table 32 Comparison criteria, indicators/descriptors and norms

Criterion	Indicator (quantitative) or descriptor (qualitative)	Assessment norm*
Top-up of Member States' capabilities/added value at EU level	Level-of-service indicators: Number of vessels Total storage capacity of vessels (m^3) Average vessel storage capacity (m^3)	Comparison to baseline: 17.68** vessels 63,237 m^3 3,576 m^3
Suitability for Tier III at-sea pollution response* **	Types of vessels. Types of equipment on board vessels and in stockpiles.	Comparison to baseline: vessels and equipment
Cost efficiency** **	As defined in Part 2: Average cost per vessel arrangement. Average cost per m^3 of storage capacity. Average cost per EAS stockpile.	Comparison to baseline: € 830,848 per arrangement per year € 233 / m^3 per year € 435,634 per EAS stockpile per year
Budgetary impact** **	Increase / decrease of the cost of the service overall (for all co-financers and charterers) and for EMSA.	Comparison to baseline: € 16M per year.

** All figures presented differ from those in Part 2 as they are based on the **projected** costs of the service beyond the period for which historical data could be used (beyond 2014-2016). See section 4.4.1 under Step 4 on how the baseline was established.*

*** The use of a decimal relates to the actual average availability of vessels versus the number of days in the year. For example, if a vessel is available for 6 months (182.5 days) in a year it counts as 0.5 vessel.*

**** Note that although the mobilisation time appears as an indicator in the exclusion criteria, it is not assessed quantitatively in the comparison criteria as it was not possible to assess it realistically.*

***** The **cost efficiency** and **budgetary impact** of the alternative models is calculated on the basis of the **cost of establishing the service**. As in Part 2, this is the economic cost of each component of the service (OSRVs, EAS and dispersants) that comprises fees and one-off costs paid punctually, plus investment costs spread across the period of time during which the component of the service is being made available, i.e. the total life expectancy (TLE) of a piece of equipment and dispersant stockpiles, and non-recoverable investments for pre-fitting of the vessels spread across the period during which the vessels are available. In this sense the models do not assess the impact on **cash flow**, i.e. the upfront costs of purchasing equipment or vessels.*[207]

4.2 Step 2: Identify alternative service models

Below is the list of alternative service models identified. These are based on EMSA's list as proposed in the Terms of Reference for this study.[208] They will be further refined and described in the next step.

- **Model 1: EMSA improved service model**
- **Model 2: EMSA building or chartering dedicated oil spill response vessels**[209]
    - Model 2.1: EMSA building OSRVs to be operated by EMSA
    - Model 2.2: EMSA building OSRVs to be operated by a charterer
    - Model 2.3: EMSA chartering OSRVs from a ship owner
- **Model 3: EMSA building or chartering multi-purpose response vessels**[209]
    - Model 3.1: EMSA building MPVs to be operated by EMSA
    - Model 3.2: EMSA building MPVs to be operated by a charterer
    - Model 3.4: EMSA chartering MPVs from a ship owner

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[207] An analysis of the cash flow in the baseline scenario is presented in Appendix 6, showing how the model predicts EMSA's future spending for the OPR service.

[208] The actual list contained in the Terms of Reference can be found in Appendix to Part 3. The justifications for the changes made to each proposed model are presented in the discussion of their design.

[209] Under Models 2 and 3, the financing scheme can either involve EMSA financing 100% of the building/chartering of the vessels, or co-financing it with Member States or other EU agencies.

- **Model 4: EMSA outsourcing OPR services**
  - Model 4.1: EMSA outsourcing all services to private contractors
  - Model 4.2: EMSA outsourcing available services to private contractors while maintaining vessel availability contracts (VACs)
- **Model 5: EMSA financing vessels while maintaining VACs**
  - Model 5.1: EMSA replacing some VACs with purposely-built OSRVs
  - Model 5.2: EMSA replacing some VACs with chartered MPVs

4.3 Step 3: Design and screening of the alternative service models

In this step, the models proposed in the Terms of Reference are refined and further operationalised. We proceed through design and screening:

- **Design:** the aim is to find the best possible alternative sub-model within a range of possibilities that are capable of passing the exclusion criteria.
- **Screening:** each sub-model is discussed, explaining the motivation behind the potential changes that are being considered. If it is found that a potential change cannot be tailored to meet the criteria, the model is excluded from further assessment.

4.3.1 Model 1: EMSA improved service model

In order to design this model, we examine several possibilities in which the service model currently implemented by EMSA can be improved in order to reduce costs while offering a level of service that addresses the existing risks and is compatible with the legal framework of the EU Financial Regulation and EMSA's mandate. The potential changes which are considered at this stage result from a variety of sources, namely the considerations mentioned by the survey respondents, interviewees, EMSA and the consultants. As mentioned above, only those sub-models which pass the criteria will be retained as a possible "improved service model" for assessment in the subsequent steps.

A list of parameters of the service capable of reducing costs is drawn up, and a number of possible ways in which the parameter can be altered are proposed:

- **Parameter 1: Duration of vessel contracts**
  - Model 1.1: Increase the duration of contracts to eight years, renewable once. (currently 4 years, renewable once)
  - Model 1.2: Increase the number of possible contract renewals to two (currently renewable once)
- **Parameter 2: Size of vessels**
  - Model 1.3: Decrease minimum storage capacity to between 700 – 1,000 m^3, or below 700 m^3
- **Parameter 3: Vessels' technical specifications and equipment**
  - Model 1.4: Alter vessel specifications and equipment
- **Parameter 4: Number and location of vessel arrangements, EAS and dispersant stockpiles**
  - Model 1.5: Reduce capacity in the North Sea by one vessel arrangement and replace with an EAS stockpile or dispersant application service
  - Model 1.6: Reduce capacity in the Atlantic by one vessel arrangement and replace it with an EAS stockpile
  - Model 1.7: Reduce capacity in the Central Mediterranean by one vessel arrangement
  - Model 1.8: Decrease EMSA's dispersant capability

Each parameter and sub-model is discussed in Table 33 to Table 36 below. At the end of the exercise, we present the final options which passed the screening and will be assessed in Step 4.

Table 33: Design and screening of Model 1 – changes to duration of the vessel contract

Parameter: Duration of vessel contracts[210] **Rationale for the parameter:** changing the (cumulative) duration of vessel contracts has the potential to reduce the cost per vessel arrangement, as the investments made in pre-fitting (not recovered after the end of the contract) would be spread over a longer period.
Model 1.1: Increasing the duration of contracts to eight years, renewable once.
An increase in the duration of the contracts would allow the non-recoverable investments in pre-fitting vessels to be spread over a longer period of time. However, this change may limit the number of potential contractors willing to commit vessels to a particular area of operations for such a long period of time. Higher yearly availability fees resulting from lower competition could potentially offset the savings, and EMSA's flexibility in adapting to changing circumstances would be reduced. Lastly, the Financial Regulation rules and internal public procurement principles concerning the spending of the EU budget limit the duration of contracts to a maximum of four years, which would prohibit any increase in the duration of the contracts.[211]
Conclusion: Excluded **Exclusion criteria: Compatibility with the EU's Financial Regulation (article 122).**
Model 1.2: Increasing the number of possible contract renewals to two.
The cost of pre-fitting over a longer period of time could be spread by increasing the renewability of the vessel contracts, which are currently set at four years and renewable once. By allowing one additional renewal, the total duration of contracts for the same vessel could potentially extend to twelve years in total. The EU Financial Regulation does not set limits on the number of contract renewals.
Conclusion: Included: increasing the number of possible contract renewals to two, for a possible combined duration of contracts of twelve years.

Table 34: Design and screening of Model 1 – changes to the size of the vessels

Parameter: Size of the vessels[212] **Rationale of the parameter:** changing the size of the contracted vessels to reduce costs.[213]
Model 1.3: Decrease the minimum storage capacity to between 700 – 1,000 m^3, or below 700 m^3.
Changes to this parameter would reduce EMSA's ability to provide Tier-III response capacity to support MS with vessels characterised by a large storage capacity. During the interviews and in the survey conducted for this study, the Member States stressed the need to provide large vessel storage capacity to complement the Member States' mostly coastal fleets, 1,000 m^3 being mentioned as a relevant threshold.[214]
Conclusion: Excluded. **Exclusion criteria: Ability to top up Member States' capabilities; suitability for Tier-III at-sea pollution response.**

[210] The baseline value is 4 years of standby, renewable once for a maximum duration of 8 years.

[211] Article 122 of Commission Delegated Regulation (EU) No 1268/2012 of 29 October 2012 *on the rules of application of Regulation (EU, atom) No 966/2012 of the European Parliament and of the Council on the financial rules applicable to the general budget of the Union* limits the duration of all framework contracts to four years. Despite the fact that the Vessel Availability Contracts are direct contracts and the strict 4-year rule does not apply, the Commission Vade-Mecum on public procurement (for internal use) states that "*following the principle of broadest possible completion and by analogy with framework contracts, the performance of direct contract should not exceed a four year duration*".

[212] Currently, the minimum oil storage capacity for recovered oil is set at 1,500 m^3.

[213] As the data presented in Part 2 (see Figure 27) shows no correlation between vessel arrangement costs and storage capacity, we do not propose to assess a particular category of vessel size within the size range of EMSA's current vessels (1,300-7500 m^3). This is due to the fact that costs of pre-fitting and equipment, as well as the number of crew, necessary training, equipment maintenance, etc. included in the vessel availability fee do not vary on the basis of storage capacity and exhibit irregular variability. Decreasing the size of vessels within this range would therefore not prove more cost-efficient; rather, it would be likely to have the opposite effect in terms of euro/m^3 of established capacity.

[214] The advantage of having large >1,500 ^{m3} vessels is their ability to remain at sea for a longer time before they have to discharge in port. Note also that the switching of EMSA's focus to vessels with a storage capacity below 1,000 ^{m3} would be unlikely to result in a significant reduction of costs, as crew and ship maintenance costs do not vary significantly within this size range. See also the previous footnote.

Table 35: Design and screening of Model 1 – changes to technical specifications and equipment

Parameter: Technical specifications and equipment of vessel **Rationale of the parameter:** The purchase of different vessel equipment, or the selection of different specifications governing such characteristics of the vessel as pumping capacity, heated storage, type of skimmers or booms etc. could be considered as a way of reducing the costs of the service.
Model 1.4: Altering vessel specifications and equipment.
According to EMSA's equipment replacement policy,[215] all aging and obsolete equipment is to be replaced with state-of-the-art equipment that is adapted to the risks in the region and conforms with EMSA's mandate. This forms part of the current service model and is also assumed in Model 1; this option therefore considers a further alteration of the vessels' configuration. The specifications of EMSA's contracted vessels are defined and assessed in Part 1. Careful consideration of the vessels and their equipment shows that all the technical characteristics and vessel configurations established by EMSA are highly relevant for a state-of-the-art oil spill response vessel (see conclusion of Part 1). Scope for reducing costs exists in the reduction of the vessels' OPR capabilities. For example, the vessels are currently equipped with two recovery systems: the side sweeping arms, and booms and skimmers. These systems cannot be used at the same time, but are complementary in terms of providing the equipment needed to adapt to a variety of sea conditions.[216] This configuration involves high investment costs, but it gives the vessels the flexibility and capability to intervene using mechanical recovery methods.[217] Any other option would imply the purchase of lower-performance equipment, or the contracting of vessels with different characteristics, which would affect the flexibility of EMSA's services to respond to different types of spill and to provide a Tier-III response that tops up the Member States' capabilities.
Conclusion: Excluded. **Exclusion criteria: Top-up of Member States' capabilities; suitability for Tier-III at-sea pollution response.**

Table 36: Design and screening of Model 1 – changes to the number and location of the services

Parameter: Number and location of the services[218] **Rationale of the parameter:** under this parameter, a reduction in the number of vessel arrangements is proposed. For some of the vessel arrangements, we assess their replacement by EAS stockpiles or dispersant services to try and reduce the costs of the service. The decision to reduce the level of service and/or to implement a different service relies on the following assessments: (1) EMSA vessels' capacity overlaps in the area (taking into account 24-hour mobilisation radii and areas of operation); (2) the reduction of capacity would not create a significant gap in the coverage of risks; (3) the Member States' capacity in terms both of the vessels available and the equipment available in the area can already cover existing risks.[219]
Model 1.5: Reduce capacity in the North Sea by one vessel arrangement and replace it with an EAS stockpile or dispersant application service.
The North Sea is the region with the highest OPR capacity at the national level (72,000 m^3 of total storage capacity), supplemented by four EMSA OSRVs and one EAS stockpile in Scotland. The Channel in particular is covered by two EMSA vessels[220] and strong national capacity in the eastern part of the Channel, represented mainly by Germany, the Netherlands and Belgium. Also notable is the significant aerial dispersant spraying capability of France and the UK.[221] The two EMSA vessels can be mobilised simultaneously, and share the

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[215] EMSA. (2015). Equipment Replacement Guidelines.

[216] Booms and skimmers are well suited for relatively calm seas, whereas the sweeping arms can be used in more turbulent conditions.

[217] As opposed to the use of dispersants, which may not be favoured by in certain regions or by certain Member States. See section 0. Mechanical recovery is also EMSA's preferred method of intervention, as per EMSA's 2013 Action Plan for Response to Marine Pollution from Oil and Gas Installations.

[218] Currently, 17 vessels can be mobilised at the same time, with a total storage capacity of over 60,000 m^3; four dispersant stockpiles have been established together with two EAS. There is a map showing the number and locations of arrangements in section 2.5.1.

[219] As the Member States were not able to provide detailed information regarding their intentions to modify their own OPR capacity, the assessment could only be based on the current Member States' capacity despite the fact that the models tested are for the period up to 2020.

[220] The two EMSA vessels are the Interballast III and DC Vlaanderen 3000, both based in Ostend, Belgium.

[221] See sections 2.5.1, 2.6.3 and 5.2.

same area of activity and 24 hour mobilisation radius (see **Figure 56**). In this context, EMSA could consider reducing its presence in the North Sea by withdrawing one of the vessels currently based in the southern North Sea and replacing it with an EAS stockpile or dispersant application capability.

Any reduction of vessel capacity has to carefully consider the level of risk existing in the area and the capacity in place. The North Sea is the most traffic-intensive maritime region of Europe, and the one where the majority of offshore oil and gas extraction activities are taking place. Incidents in the Channel and southern North Sea potentially affect five Member States (the UK, France, Belgium, Germany and the Netherlands).

While most Member States around the North Sea have a high OPR capability, the importance of EMSA's vessels was particularly stressed by several interview respondents in relation to the risks for Belgium, which has the lowest OPR capability in the area.[222] This capability is assessed in the Bonn Agreement Counter Pollution Manual as being sufficient to respond to spills of up to 1,000 m^3 of oil, requiring support from neighbouring States or EMSA in the event of a larger spill.[223] The replacement of one vessel with an EAS stockpile in the Southern North Sea would offer additional capability to vessels of opportunity, but existing equipment stocks must also be considered. Belgium has several OPR systems adapted to offshore oil recovery (high sea booms and skimmers) near Ostend which can be used by its Navy.[224] France, the Netherlands, Germany and the UK have large equipment stockpiles, so there may not be a need for additional equipment.

The relatively low combined storage capacity in Belgium (500 m^3) and the current existence of a equipment and dispersant capability limits the added value of an EAS stockpile or dispersant service, and highlights the importance of EMSA continuing to provide its vessel storage capacity. For that reason, the withdrawal of a vessel in the North Sea would increase the vulnerability of Member States in the area.

Conclusion: Excluded.
Exclusion criteria: Top-up of Member States' capacities; suitability for Tier-III at-sea pollution response.

Model 1.6: Reduce capacity in the Atlantic by one vessel arrangement and replace it with an EAS stockpile.

EMSA has introduced important capacity in the Atlantic Region off the coast of Spain – it currently has 4 vessels with home bases all along the Atlantic coast of Spain and Portugal (Ferrol, Vigo, Sines and Algeciras). The 24-hour range from the home base and each vessel's area of economic activity is shown in **Figure 57**. As can be observed, overlap[225] exists between the vessels considered.

As this report notes, the risk of oil spillage in the Atlantic Ocean arises mainly from the high tanker traffic along the coasts of the United Kingdom, France, Spain and Portugal. The relatively high number of historically large spills (i.e. over 10,000 tonnes – see **Figure 17**) along these coasts highlights this risk.

The number of MS vessels with substantial recovery capabilities and a storage capacity of over 700 m^3 is limited to just two French vessels off the coast of Brittany and one vessel off Spain's northwestern coast. Spanish and French equipment capacity is relatively high, comprising several kilometres of booms,[226] high-capacity skimmers, sweeping arms, and dispersant application systems.[227]

In view of the existing risks, combined with the relatively low MS storage capacity available to cover the long shorelines that are comprised of the Spanish, Portuguese and French Atlantic coasts, a reduction in EMSA's vessel capacity would not be preferable to the provision of additional equipment.

Conclusion: Excluded.
Exclusion criteria: Top-up of Member States' capacities; suitability for Tier-III at-sea pollution response.

Model 1.7: Reduce capacity in the Central Mediterranean by one vessel arrangement.

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[222] Belgium has a total storage capacity of 500 m^3 consisting of floating storage tanks, and no dedicated OSRVs. Source: EMSA. (2016). Inventory of EU Member States' oil pollution response vessels 2016.
[223] Bonn Agreement Counter Pollution Manual, Vol. 1, Chapter 9, page 8. Retrieved from: http://www.bonnagreement.org/site/assets/files/1081/bonn_agreement_counter_pollution_manual.pdf
[224] EMSA. (2016). Inventory of EU Member States' oil pollution response vessels 2016.
[225] Defined as areas covered within 24 hours by multiple EMSA vessels.
[226] Spain reports having 60 km of booms (all categories). France and Portugal have respectively over 1.5 km and 2.5 km of high sea booms. Source: EMSA. (2016). Inventory of EU Member States' oil pollution response vessels 2016.
[227] Sources: interview with French competent authorities; EMSA's Inventory of EU Member States' oil pollution response vessels 2016.

EMSA currently contracts two vessels which are located off the coasts of Malta, and whose 24-hour ranges and economic area of activity overlap (see **Figure 58**). However, in this region there are no national vessels with a storage capacity exceeding 700 m^3, and a relatively low total storage capacity (less than 5,000 m^3, mostly provided by Italy). The EMSA vessels provide significant added value for addressing existing the spillage risks from high tanker traffic, as well as for the spillage risks from oil and gas installations, because these vessels are equipped to recover substances having a low flashpoint, and also possess a dispersant-spraying capability. This service can also be provided not only to the Member States, but to the eight Third Countries of North Africa and the Middle East which also have direct access to the Mediterranean. The addition of an EAS stockpile is not considered in this scenario, as EMSA already intends to implement this service in the region. In light of these considerations, reducing the number of EMSA vessels in the region would create a significant gap in the coverage of risks in these areas and diminish its capacity to provide assistance to Third Countries.
Conclusion: Excluded. **Exclusion criteria: Top-up of Member States' capacities; suitability for Tier-III at-sea pollution response.**
Model 1.8: Decrease EMSA's dispersant capability.
EMSA's dispersant application service is currently limited to four vessels, each of which covers a vast area having no overlaps. This being the case, EMSA's dispersant service is not particularly significant. A review of the Member States' policies and the existing risks (presented in Part 1) shows that overall, EMSA's dispersant application capability is appropriately located in those areas where the use of dispersants is appropriate (e.g. due to the presence of offshore installations) and can be used on a case-by-case basis, depending on the type of spill and its probability of reaching the shore. Those Member States in which this service is provided only hold limited dispersant stockpiles and systems, and all face the risk of spillage either from high tanker traffic or from oil and gas installations, or both. In addition, Third Countries around the Mediterranean and the Atlantic may also benefit from EMSA's dispersant application capability. In conclusion, there is insufficient evidence to justify the reduction of EMSA's dispersant capability in any of the four locations.[228]
Conclusion: Excluded **Exclusion criterion: Top-up of Member States' capacities.**

In conclusion, few of the vessels were capable of passing the Model 1 screening criteria. Model 1 is therefore to be tested for the following option:

- **Model 1.2:** Increasing the number of possible contract renewals to two (currently, renewable once)

4.3.2 Model 2: EMSA building or chartering dedicated oil spill response vessels

Model 2 explores alternative arrangements under which EMSA would offer similar oil pollution response services using dedicated oil spill response vessels (OSRV). This alternative arrangement explores the options for EMSA either building and operating vessels, or building and chartering vessels to an operator, or chartering vessels from a ship owner. Below is the list of alternative models based on the list proposed in this study's Terms of Reference:

- **Model 2: EMSA building or chartering dedicated oil spill response vessels**[229]
  - Model 2.1: EMSA building OSRVs to be operated by EMSA
  - Model 2.2: EMSA building OSRVs to be operated by a charterer
  - Model 2.3: EMSA chartering OSRVs from a ship owner

The number of vessels, their specifications and their costs are not discussed in this step. These variables are included in the final design stage, in which we assess what the capabilities of vessels that could cover the existing risks would need to be.

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[228] The entry into service of an aerial dispersant capability would make a reduction in seaborne dispersant application services more likely, as the intervention would be quicker. This was also mentioned on several occasions by the Member States consulted for this study.

[229] Under Models 2 and 3, the financing scheme can either involve EMSA financing 100% of the building/chartering of the vessels, or co-financing with Member States or other EU agencies.

Prior to the screening of Models 2 and 3, it is important to establish a common understanding of the concept of ship chartering, as there exist several options which may or may not be relevant, depending on the intended use and purpose of a given ship. We refer the reader to the text box below.

Figure 32: Defining time chartering and bareboat chartering

Among the main forms of chartering, two could be relevant in the context of OPR vessel chartering: **time chartering** and **bareboat chartering**.[230]

A time charter is a contract under which the *charterer* hires a vessel from the *ship owner* for his or her own purposes (generally the transport of cargo from one point to another) within a particular time frame. In this chartering model, the ship owner mans and operates the vessel, and provides for the maintenance and insurance of the vessel. Related expenses are therefore covered in the charter hire.[231] The charterer retains a certain degree of control over the activity of the vessel. The ship owner is remunerated for each unit of time and any additional costs incurred during the charter, such as fuel and port fees.

A bareboat charter is a contract under which the *charterer* hires a vessel for his or her own purposes from a *ship owner*, who may also be the ship-builder, for a certain period of time. However, the main difference with a time charter is that in this chartering model the charterer must man and operate the vessel him or herself, or else hire a ship management company to man and operate it. In this sense, the vessel is provided 'bare'. The ship owner is also remunerated per unit of time, but the charterer also pays the ship owner for insurance and maintenance, fuel, and other running expenses.

Note that variations exist in these forms of chartering; however, the main difference between a time charter and a bareboat charter is that a time charter hire will generally be more inclusive of the expenses related to the manning, operation, insurance and maintenance of the vessel. In a time chartering arrangement, the charterer does not need to man the vessel, but can equip it and coordinate its activities.

What chartering options exist for EMSA?

In this study, we propose to assess two possible roles for EMSA:

- EMSA as ship owner: EMSA finances the building of vessels to be chartered to the requesting parties (e.g. Member States) in a bareboat chartering model where EMSA provides the vessels 'bare' (without crew), or in a time chartering model where EMSA provides the crew or hires a ship management firm to operate the vessel.
- EMSA as ship charterer: EMSA does not own the vessels, but charters them from a ship owner, either operating them itself or leaving this aspect to a ship management firm in a bareboat chartering model, or else leaving the operation of the vessels to a charterer.

In the section below, we design the models on the basis of the Terms of Reference's suggestions and compliance with the exclusion criteria. The table also includes the conclusion which follows on from the screening of the models that have been refined using the exclusion criteria.

Table 37: Design and screening of Model 2

Model 2: EMSA building or chartering dedicated oil spill response vessels (OSRV) **Description:** This model explores the building or chartering of dedicated OSRVs. Dedicated OSRVs differ from vessels in the current arrangements in that they do not conduct commercial activities when they are not being mobilised for incidents, training or exercises. The vessels can either be built and owned by EMSA, or chartered by EMSA from a ship owner.
Model 2.1: EMSA building OSRVs to be operated by EMSA

[230] Other forms of chartering include voyage chartering, trip time chartering, passenger cruise ship chartering.

[231] The charter hire is the term for the price set for chartering the vessel.

Under this model, EMSA would build and operate its own OSRVs. EMSA would need to hire and train the crew to operate and maintain the vessels. In this sense, this model involves much higher transaction costs in the management of the service, as the Agency would become the owner and manager of the vessels. A better option would be for EMSA to hire a ship management firm to take care of the management and manning of the vessels. Under this option, the training of the crew would still be necessary and would covered by EMSA, but this is not expected to involve greater costs than exist with the current service model.

The vessels would remain in port when not mobilised, leading to them remaining idle for most of their life time. Although the model is feasible on the technical and organisational aspects, it appears financially absurd to maintain inactive vessel. The model is therefore excluded.

Conclusion: Excluded.
Exclusion criteria: Overall financial feasibility.

Model 2.2: EMSA building OSRVs to be operated by a charterer
Description: EMSA may build OSRVs to be operated by a charterer.

Under this model, EMSA would build and own OSRVs with the same advantages as in the model described above; however, the vessel would not be operated by EMSA. EMSA charter its vessels to either (1) Member States or (2) economic operators who would man and operate them. In this sense, EMSA would only be providing 'bare' vessels.

(1) If the vessels are to be operated by the Member States, the vessels would not be available to intervene in all EU waters as currently, but only in certain areas (especially in the context of Regional Agreements). The willingness of Member States to engage in such an arrangement could not be assessed sufficiently to determine its feasibility; nevertheless, we propose to assess this option.[232]

(2) The likelihood of finding economic operators to charter vessels from EMSA is low. This is because currently the provision and management of Tier III pollution response vessel service are mainly the tasks of EMSA (under a contract with an operator), or of the Member States. Independent economic operators only provide limited Tier III OPR equipment, and do not offer full operational service involving Tier III vessels, such as those provided by EMSA. This gap in the market can be explained by the fact that Tier III incidents are rare, so such a service is not attractive for economic operators to maintain if it is not supported by public funding. We therefore exclude this option.

Overall, although it is uncertain whether this model is feasible, we propose to assess its costs where EMSA charters vessels to Member States in a bareboat chartering model.

Conclusion: Included: EMSA building OSRVs to be operated by a charterer in a bareboat chartering model.

Model 2.3: EMSA chartering OSRVs from a ship owner
Description: OSRVs may be chartered by EMSA from a ship owner either in a bareboat charter model, a short-term time charter, or a longer-term time charter. We propose to review the three options individually.

Model 2.3.1: Bareboat chartering:[233]

Bareboat chartering would involve the same benefits as if EMSA built and owned its vessels. Once again, the vessels would remain in port when not mobilised, leading to them remaining idle for most of their life time. Although the model is feasible on the technical and organisational aspects, it appears financially absurd to maintain inactive vessel. The model is therefore excluded.

Conclusion: Excluded.
Exclusion criteria: Overall financial feasibility.

Model 2.3.2: Short-term time chartering:

From the outset, short-term chartering of OSRVs is a difficult option to envisage if EMSA is to find vessels with similar characteristics as those currently contracted (large storage capacity, OPR equipment, trained crew, etc.). Large OSRVs are currently either owned by Member States or under VAC by the Agency itself, meaning that the availability of such vessels is extremely limited. Private firms offering equipment and vessels for hire can sometimes provide teams that are able to operate the equipment, but a review of the existing services shows that these firms do not offer large Tier-III OSRVs.[234]

Other possible market options would be ship owners who operate vessels similar to those currently contracted by EMSA. However, EMSA is currently providing most of the equipment and investments involved in the pre-fitting of the vessels: prior to contracting by EMSA, the vessels are not dedicated OSRVs *per se*, they are converted tankers. This option would thus imply that the ship owners must adapt their ships to EMSA's requirements prior to having any contract with the Agency. This is highly unlikely, as the demand for such

[232] Only two interviewees stated that this could be a good model; others said it would not interest them.
[233] In a bareboat charter, the charterer mans and equips the vessel.
[234] See also the screening of Model 4.

vessels stems mostly from the Agency itself. Finally, the vessels are unlikely to be able to intervene on such short notice as is possible currently. Indeed, the advantage of the current model is that the ship owners are contractually bound to stay within a defined geographical area and to interrupt their commercial activity to make their vessel available in the event of a spill. In the absence of a prior agreement with the ship owner, EMSA would not have guaranteed access to a vessel that could be mobilised within 24 hours. The service would therefore not qualify as a Tier-III response option.
Conclusion: Excluded. **Exclusion criteria: Tier-III response capability; top-up of Member States' capacity; overall technical and organisational feasibility.**
<u>Model 2.3.3: Long-term time chartering:</u> A long-term time chartering of OSRVs (four years, within the limits set by the EU Financial Regulation) would be a similar model as the current one, with the exception that these vessels would not be undertaking commercial activities. Once again, the vessels would remain in port when not mobilised, leading to them remaining idle for most of their life time. Although the model is feasible on the technical and organisational aspects, it appears financially absurd to maintain inactive vessel. The model is therefore excluded.
Conclusion: Excluded. **Exclusion criteria: Overall financial feasibility.**

In conclusion, only Model 2.2 was selected to be further assessed.[235] Model 2 is therefore to be tested for the following sub-model:

- **Model 2.2:** EMSA building OSRVs to be operated by a charterer in a bareboat chartering model.

4.3.3 Model 3: Building or chartering of multi-purpose response vessels

Model 3 explores alternative arrangements whereby EMSA might provide similar oil pollution response services using MPVs that offer other maritime response services, such as hazardous and noxious substance (HNS) recovery, firefighting, emergency towing, search and rescue, fisheries control, surveillance and coast guard functions.[236] This alternative arrangement explores the options for EMSA to either build and operate vessels, or to build and charter vessels to an operator, or to charter vessels from a ship owner. In the text box below, we review some of the advantages and disadvantages of MPVs over OSRVs in relation to marine pollution response.

[235] Although Models 2.1 and 2.3.3 were excluded, we still carried out the calculation of their projected costs to find out what would be the costs of such models. Results show that that these were the most expensive models in Model 2. Model 2.3.1 could not be assessed due to a gap in data related to the cost of a bareboat charter for an OSRV, however it is also expected to be among the most expensive of these models.

[236] Figure 60 and Figure 62 of Appendix 6 describe the two types of MPV considered in this study.

Figure 33: Operational advantages and disadvantages of multi-purpose vessels

Because MPVs can carry out multiple functions encompassing fisheries and coast guard duties, **their use can be shared between different agencies** who can share the associated costs. This is the principal advantage and justification for assessing the possible use of these vessels.

In addition, MPVs offer advantages over OSRVs for EMSA's marine pollution response services in that they can not only carry out OPR duties, including mechanical recovery and dispersant application, but they also have some additional or superior characteristics compared to OSRVs:

- Whereas the OSRVs currently contracted can travel at an average maximum speed of 12.4 knots, the MPVs have an **average maximum speed** of 16.5 knots, allowing them to travel the same distance that an OSRV can manage in 24 hours (283 nautical miles, or 529 kilometres) in just 17.5 hours, or 390 nautical miles (720 kilometres) in 24 hours.
- MPVs may be capable of **recovering HNS** at sea, a service that was mentioned as being relevant by two interviewees for this study, and which complements EMSA's efforts in the area (e.g. the Marine Chemical Emergency Information Service (MAR-ICE)) with an at-sea HNS recovery service.
- Their **emergency towing** capability can also support EMSA's OPR services by helping to prevent spills from vessels that are at risk of wrecking.
- Their **salvage** capability can support operations to recover oil from a wrecked vessel, and refloat a vessel for towing following an incident.
- Their **firefighting** capability can be used to deal with fires on board ships or offshore oil and gas installations, potentially preventing further damage to a vessel or platform and thus mitigating the risk of spills.

However, MPVs tend to have **smaller recovered oil storage capacity** than OSRVs, in order to enable the performance of their other functions (recovery of hazardous and noxious substances (HNS), emergency towing, salvage operations, fire-fighting). For example, vessel towing is technically more difficult with larger MPVs. Consequently, on average the vessels have a smaller capacity than the currently contracted vessels.

Below is the list of alternative models based on the list proposed in this study's Terms of Reference:

- **Model 3: Building or chartering of multi-purpose response vessels**[237]
    - Model 3.1: EMSA building MPVs to be operated by EMSA
    - Model 3.2: EMSA building MPVs to be operated by a charterer
    - Model 3.3: EMSA chartering MPVs from a ship owner

The number of vessels, their specifications and costs are not discussed in this step. They are part of the last design stage where we assess what would be the necessary capacity of the vessels to cover existing risks.

Table 38: Design and screening of Model 3

Model 3: EMSA building or chartering multi-purpose response vessels (MPV)
Description: This model explores the building or chartering of multi-purpose vessels (MPVs). MPVs are a type of vessel which can be operated to conduct different types of activities, such as oil pollution response, border surveillance, search and rescue, fire-fighting, fisheries control, emergency towing. These vessels are seldom built to recover as much oil at sea as EMSA's current vessels for the reason that they may lose the flexible use of their functions if conceived too large. **Rationale of the model:** Under this model, EMSA would be able to share the use of the vessels

[237] Under Models 2 and 3, the financing scheme can either involve EMSA financing 100% of the building/chartering of the vessels, or co-financing with Member States or other EU agencies.

among different types of activities and therefore with other Agencies or Member States' competent authorities. The use of MPVs is interesting in the context of the recent creation of a European Border and Coast Guard Agency (EBCGA, or Frontex), which is expected to reinforce synergies and cooperation between this new Agency, the European Fisheries Control Agency (EFCA) and EMSA.
Model 3.1: EMSA building MPVs to be operated by EMSA
Similar to the building of OSRVs, the manning of MPVs raises the issue of a new management of the service. What is more, some MPVs can be complex to operate due to their multiple functions, inducing high transaction costs in training crew to operate on-board technology.[238] EMSA's mandate currently provides for the provision of OPR services, and its competencies currently lie in this domain. We hypothesize that EMSA together with EU agencies co-finance the building and operation of the vessels. Crew would appropriate training to use the OPR equipment, to be provided by EMSA.
Conclusion: Included: EMSA co-financing the building of MPVs.
Model 3.2: EMSA building MPVs to be operated by a charterer
In this model, EMSA would build MPVs and charter the vessels. The highly specialised functions of the vessels create issues in implementing Model 3.2, as it would be difficult to find interested parties to charter and operate the vessels. While EMSA could share the use of the vessels with other entities, a chartering model would not allow EMSA to share costs of building vessels, in contrast with Model 3.1. EMSA would bear the full costs of building MPVs while not using them most of the time due to their functions being outside of EMSA's remit.
Conclusion: Excluded: Overall financial, technical and organisational feasibility.
Model 3.3: EMSA chartering MPVs from a ship owner
<u>Model 3.3.1: Bareboat chartering:</u> This model hypothesizes the chartering of MPVs by EMSA. Due to the unique purpose which EMSA would make of the vessel (oil pollution response), a bareboat charter where EMSA is the sole charterer would raise the same issues as under Model 3.1 regarding the management of the vessels. The highly specific functionality of such vessels also makes it unlikely for EMSA to find a ship management firm to take care of the operation of the vessel.
Conclusion: Excluded: Overall technical and organisational feasibility.
<u>Model 3.3.2: Short-term time chartering:</u> Short-term time chartering of MPVs raises the same issue as for OSRVs, being the availability of such vessels to be chartered *ad-hoc* from a ship owner. This option indeed requires that owners of sufficiently large MPVs would allow EMSA to use their vessels on short notice. The vessels would also need to be equipped with Tier-III OPR equipment and its crew trained for use of the equipment. Such a model would not allow for rapid mobilisation in the absence of a prior agreement between EMSA and the contractor to have access to the vessels, consequently it is unlikely that EMSA could provide OPR capacity within a short period of time.
Conclusion: Excluded: Suitability for Tier III at sea pollution response; Overall technical and organisational feasibility.
<u>Model 3.3.3: Long-term time chartering:</u> Under this model, EMSA would charter MPVs on a long-term basis (e.g. 4 years). As the vessels are highly specialised, other EU Agencies or Member States' competent authorities could also share the functions of the vessels. In this sub-model, the vessels would be operated by the ship owner and their activities coordinated by the charterers (EMSA and other parties). We hypothesize these other charterers to be EFCA and EBCGA. The vessel would need to remain available for OPR in case of a spill. For that purpose, the terms of the charter must specify that OPR is one of the vessel's priority missions taking precedence in case of an oil spill. The vessel would also need to remain in waters of a specific area, allowing it to intervene where needed within reasonable time. In addition, the vessel's crew must be trained for using OPR equipment. EMSA would therefore also pay for training and participation to exercises. The main issue with this model is the actual possibility of finding suitable vessels. However the model is overall feasible and maintains EMSA's ability to provide Tier III response service topping-up Member States' resources.
Conclusion: Included: Long-term time chartering of MPVs.

[238] As raised by one ship-builder of MPVs interviewed in the context of this study.

In conclusion, a number of options pass the screening for Model 3. Model 3 is therefore to be tested for the following sub-models:

- **Model 3.1:** EMSA co-financing the building of MPVs.
- **Model 3.3.3:** EMSA chartering MPVs from a ship owner in a long-term time charter.

4.3.4 Model 4: EMSA outsourcing OPR services

Model 4 explores potential for EMSA to outsource its OPR services to private contractors, delegating all management of vessels and/or equipment to a third party. This model is assessed for feasibility with a potential contractor. Below is the list of alternative models based on the list proposed in the Terms of Reference of this study:

- **Model 4: EMSA outsourcing OPR services**
  - Model 4.1: EMSA outsourcing in full stand-by and mobilisation services provided by external service providers
  - Model 4.2: EMSA outsourcing available services while maintaining capacity through Vessel Availability contracts (VAC) following gap analysis

Table 39: Design and screening of Model 4.

Model 4: EMSA outsourcing available services
Model 4.1: EMSA outsourcing all services to private contractors
An assessment of existing private equipment and capacities for hire shows that private contractors' capacities cannot match EMSA's current level of service in terms of available quantity and type of Tier-III equipment. In particular, there exists no vessel on hire from these providers with a similar storage capacity as EMSA's OSRVs.
Conclusion: Excluded. **Exclusion criteria: Suitability for Tier III at sea pollution response, Top-up Member States' capabilities.**
Model 4.2: EMSA outsourcing available services to private contractors while maintaining vessel availability contracts
In this model, EMSA would consider outsourcing the part of its services which a private contractor would be in measure to provide in a shared service model, thus EMSA and private contractors complementing each other's stockpiles of equipment and services. Based on the review of equipment available on hire,[239] EMSA could consider replacing part of its EAS equipment and dispersant application systems and stockpiles with memberships with private contractors who could provide similar, but also different, equipment.[240] All vessels would be retained as there is no comparable vessel capacity to replace EMSA vessels. This shared services model offers flexibility to the service and maintains its rapid mobilisation.[241] The issue this model raises is the availability of the equipment for EMSA. Indeed a significant number of large spills that have occurred in the EU have included a response from an oil company, usually mobilising equipment contractors in the process. For incidents in the EU there is a high probability that an oil company that is also likely to be in contract with the equipment hiring firm may also be calling on the same resources for the same incident. Standard memberships to these organisations is not appropriate to meet EMSA's objectives. In this sense, the EAS stockpile offers better availability than equipment contractors' hiring services which would not top-up Member States' resources with additional means, as these contractors' resources are already made available to them.
Conclusion: Excluded. **Exclusion criteria: Suitability for Tier III at sea pollution response, Top-up Member States' capabilities.**

In conclusion, Model 4 could not be retained for assessment.

[239] See appendix 5.

[240] Private contractor equipment could potentially replace 3 fire booms, 2 current busters, 2 ro-skim systems, and 1 trawl net system from EMSA's EAS stockpile. Entirely different equipment includes, for example, underslung helicopter dispersant application systems.

[241] The equipment provided by large contractors is normally ready to be flown to the location of a spill.

4.3.5 Model 5: Mixed models

These models mix options for purposely-built or chartered vessels with maintaining vessel availability contracts (VAC) for certain vessels. The options presented are already designed based on previously identified best options, and therefore do not require the same extent of screening.

- **Model 5: EMSA financing vessels while maintaining VACs**
  - **Model 5.1:** EMSA replacing VACs for small vessels with purposely-built OSRVs with large storage capacity
  - **Model 5.2:** EMSA replacing certain VACs for small vessels and financing dedicated multi-purpose vessels

Model 5: EMSA financing vessels while maintaining VACs
Model 5.1: EMSA replacing VACs with 100% financed OSRVs
In this model, we assume the replacement of one VAC with one purposely-built OSRV in each region, maintaining the same or similar total storage capacity and the same number of vessels as in the baseline. The vessels may offer some flexibility in that they can be homebased in different ports, adapted to the location of vessels under VAC. This model would also ensure the availability of one sufficiently large vessel per region, reducing uncertainties related to difficulties in identifying new vessels meeting EMSA's minimum criteria to enter the network.
Conclusion: Included: EMSA financing one OSRV per region while maintaining VACs
Model 5.2: EMSA replacing VACs with the financing of multi-purpose vessels
In this model, we assume the replacement of two VACs with two MPVs. Based on a recent tender from the EFCA for MPVs to be located in the Mediterranean and the Atlantic, we propose that two vessels able to carry coast guard operations (fisheries control, border patrol, SAR, and pollution response) be chartered and located in these regions. This arrangement would provide some additional OPR capacity as well as other functions relevant for split use between EMSA, EFCA and EBCGA.
Conclusion: Included: EMSA chartering two MPVs while maintaining VACs

In conclusion, Model 5 is to be tested for the following sub-model:

- **Model 5.1:** EMSA replacing one VAC per region with purposely-built OSRVs.
- **Model 5.2:** EMSA chartering two MPVs while maintaining VACs

4.3.5.1 Included models

In summary, the screening has allowed to retain the following sub-models under each model:

- **Model 1: EMSA improved service model**
  - Model 1.2: increasing the number of possible contract renewals to two, for a possible combined duration of contracts of twelve years.
- **Model 2: EMSA building or chartering dedicated oil spill response vessels**
  - Model 2.2: EMSA building OSRVs to be operated by a charterer.
- **Model 3: EMSA building or chartering multi-purpose response vessels**
  - Model 3.1: Included: EMSA co-financing the building of MPVs.
  - Model 3.3.3: EMSA chartering MPVs from a ship owner in a long-term time charter.
- **Model 5: EMSA financing vessels while maintaining VACs**
  - Model 5.1: EMSA replacing one VAC per region financed OSRVs
  - Model 5.2: EMSA chartering two MPVs while maintaining VACs

4.4 Step 4: Testing and assessing alternative models

In this step, we test and assess each of the retained alternative models against the baseline to estimate the potential changes to the indicators defined in the comparison criteria (see Table 32). Before testing the models, we establish the baseline based on projected level and cost of the service beyond the period of scope for this study and used in Part 2.

For each model, we first define the terms under which the service is provided, including who purchases and owns the vessels, who operates or charters them, and who pays for the costs of the service (crew, training, and operational costs).[242] We also present assumptions and data behind cost calculations.

Secondly, we quantitatively assess the level of service of the model and its cost-efficiency using the indicators defined in Step 2. Here the cost of the service is calculated overall (i.e. for all entities), followed by an attribution of this cost to EMSA[243] and to co-financers[244] on the one hand and to charterers on the other, where relevant.[245] When this was possible, we also consider the change in the cost to the requesting State qualitatively and in relation to what this cost represents in the baseline model of service.

Finally, we conclude on the overall advantages and disadvantages of the service with regards to our criteria.

4.4.1 Establishing the baseline

The alternative models are tested against indicators of **level of service, cost-efficiency, and cost of the service** for the baseline scenario. The baseline is a projection of the indicators for the entire period of the MAF II (2014-2020) based on EMSA's actual level of service between 2014-2016 and plans for 2017, such as the creation of a new EAS stockpile in the Mediterranean, and the contacting of new vessels in the Baltic and in the Black Sea.

In this sense the models do not assess the impact on cash flow, i.e. upfront costs of purchasing equipment or vessels.[246]

The creation of this baseline relies on a number of assumptions on the way the service will evolve in the next four years, *using the same cost elements used in Part 2 of this study (see sections 3.2.1 and 3.2.2).* These assumptions are detailed in the text box below.

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[242] Possible entities include contractors (VAC contractors, or other economic operators and vessel owners), Member States (competent authorities), EU agencies (EFCA, EBCGA), and EMSA.
[243] Costs to EMSA systematically include the costs of OPR equipment, EAS, dispersant application capability.
[244] Co-financing options for OSRVs could not be explored in depth with Member States (as relevant co-financers of the vessels). Note that two interview respondents expressed that this was a good option to explore. Others noted that it was unlikely that they would be interested in a co-financing scheme. For MPVs, EMSA has provided a distribution of the costs based on a time share use of the vessels, presented in section 4.4.4.
[245] In some models, EMSA is the service provider and therefore the only entity to which costs are attributed.
[246] A cash flow analysis of spending under the baseline scenario is presented in Appendix 6 to show how the model does predict EMSA's spending for the OPR service between 2014-2020.

Figure 34: Assumptions used in establishing the baseline scenario.

The continuation of the service is assumed with the renewal of vessel contracts after they expire for the first time. Whenever a contract has already been renewed, a new vessel is assumed to be contracted in its place. New vessels are assumed to receive an 'average' pre-fitting costing € 650,000 and has an availability fee equal to the average of the past year. Its storage capacity is an average based on vessels under VAC during 2014-2016 (3,437 m3). Dates for the start of renewed contracts or new vessel contracts is assumed to be the end date of the previous contract which is renewed or replaced. Any equipment available from the previous vessel is transferred to the new vessel. Any equipment previously purchased by EMSA which reaches the end of its hypothetical total life expectancy (TLE) is assumed to be replaced. The cost of replacement is assumed to be the average cost for such equipment purchased either in recent years or, if it has not been recently purchased, then the cost in its latest instances of purchase. Some equipment which in principle should have been renewed according to their TLE was not renewed by EMSA within the period of 2014-2016. We assume the replacement of this equipment as of January 1st, 2017. One EAS is added: EAS Mediterranean. It is assumed to enter service on June 15th, 2017, after completion of the Acceptance drill and as per indicative dates in the planning provided in the Terms of Reference of the tender. Costs related to the new EAS are the average of the other two (availability fee of € 266,736 / year and total equipment investment cost of € 2,684,451). Purchase dates of the equipment are also assumed to be June 15th, 2017. We assume a yearly average number of exercises, number of participating vessels, and cost per exercise per vessel: • Number of exercises per year: 10.3 • Number of vessels participating in exercises per year: 11.7 • Cost per exercise: € 25,937 • Total cost per year: € 243,718

The terms of the service in the baseline are presented in the table below.[247]

[247] Similar tables are presented for subsequent alternative models.

Table 40: Summary of the terms of the service in the Baseline scenario.

Model	Vessel owner	Vessel charterer	Type of vessel contract	Entity in charge of crewing vessels	Payment of operational costs
Baseline	Contractors	EMSA	VAC	Contractors	Contractors

Service level and cost-efficiency indicators are presented in the table below.[248]

Table 41: Average level of service, cost efficiency and cost of the service under the Baseline scenario and over the period 2014-2020

	Service level indicators		Cost-efficiency indicators				Cost of the service
Region	Average number of EMSA vessels per region	Total EMSA vessel storage capacity per region (m3)	Average EMSA vessels storage capacity (m3)	Average yearly cost per vessel arrangement (€)	Average yearly cost per m3 recovery capacity (€)	Average yearly cost per EAS stockpile (€)	Average yearly cost of the service
Atlantic Ocean	4.55	18,701	**3,576**	**846,483**	**231.84**	**435,634**	**16,421,639**
Baltic Sea	1.65	5,044					
Black Sea	1.81	6,432					
Mediterranean Sea	6.83	23,542					
North Sea	2.83	9,518					
Total (2014-2020)	**17.68**	**63,237**					
					Total cost (2014-2020) (€)		**114,951,474**

Comparability of alternative models with the baseline

When building alternative models 2, 3, 4 and 5, it is important to note that we assume a similar model of service is terms of the **number of vessels** and observe variation on the other service level indicators, i.e. total vessel storage capacity and average storage capacity per vessels. The **cost of EAS stockpiles** is included but does not in fact vary across models

All costs related to the part of the service are included: provision of vessels for OPR (building or chartering, as a means of making the vessels available; OPR for the vessels; operation and crewing of vessels), EAS equipment purchase and availability fee, operational exercises, dispersant application capability and stockpiles. As an important limitation, **training costs** could not be extracted from the availability fee paid by EMSA to contractors (however the cost of exercises is included). This is an important discrepancy from the cost of the baseline.

4.4.2 Testing and assessment of Model 1

Table 42: Summary of the terms of the service.

Model	Vessel owner	Vessel charterer	Type of vessel contract	Entity in charge of crewing vessels	Payment of operational costs
Model 1	Contractors	EMSA	VAC	Contractors	Contractors

Model 1 is the same service model as the baseline, except that it is designed so that contracts of vessels can be renewed twice instead of once in the baseline scenario. This parameter is tested to allow spreading the costs of pre-fitting vessels over a longer period of time and observe savings.[249]

[248] Similar tables are presented for subsequent alternative models. The tables simply present the results of the calculations of the indicators. In this sense, they do not reflect the extent of calculations made to arrive at these results.

[249] Under this model, nine more VACs were renewed for a third 4 year contract than in the baseline scenario which assumes the entry into service of an entirely new vessel.

Assessment of the level of service and cost-efficiency of the model:
The table below presents the costs for EMSA to establish the service.

Table 43: Average level of service, cost efficiency and cost of the service under Model 1

	Service level indicators		Cost-efficiency indicators				Cost of the service
Region	Average number of EMSA vessels per region	Total EMSA vessel storage capacity per region (m3)	Average EMSA vessels storage capacity (m3)	Average yearly cost per vessel arrangement (€)	Average yearly cost per m3 recovery capacity (€)	Average yearly cost per EAS stockpile (€)	Average yearly cost of the service
Atlantic Ocean	4.55	18,687	**3,521**	**823,220**	**229.43**	**435,634**	**16,092,449**
Baltic Sea	1.65	5,044					
Black Sea	1.91	5,512					
Mediterranean Sea	6.83	24,342					
North Sea	2.83	9,032					
Total (2014-2020)	**17.78**	**62,617**					
					Total cost (2014-2020) (€)		**112,647,140**

Table 44: Assessment of Model 1

Criteria	Model Model 1:
Suitability for Tier III at sea pollution response	As the model assumes perfect continuity of vessel contracts (as in the baseline), minimal changes to the service level can be observed in this model including the overall reduction of capacity by 620 m^3 and 55 m^3 per vessel.
Top-up of Member States capabilities/added value at EU level	Minimal changes to the baseline can be observed. Note that the marginally higher number of vessels is due to the prolongation of contracts.
Cost-efficiency	The cost per arrangement is € 23,260 less expensive than in the baseline scenario. The cost per m^3 of storage capacity is just € 2 lower than in the baseline scenario due to the slightly lower storage capacity. The cost per EAS stockpile does not change.
Budgetary Impact	By allowing pre-fitting costs to be spread over a longer period of time, the cost of the service reduces by € 2.3 M over the entire MAF II period, a rather small difference.

Conclusion: Model 1 offers relatively small benefits compared to the baseline, but is also unlikely to create additional costs neither for EMSA nor the requesting State. The difference is likely to be within the margin of error of the model used, in particular with regards to possible increases in the availability fee of vessels as can be observed in some cases of contract renewals.[250] On the one hand, this model may save EMSA the costs of tendering new vessels and provide the opportunity to renew VACs which offer good cost-efficiency in terms of cost per cubic metre of storage capacity.

4.4.3 Testing and assessment of Model 2.2: EMSA building OSRVs to be operated by a charterer in a bareboat chartering model

Model 2 assesses options for EMSA to build OSRVs and charter their use to Member States. In Figure 35 below we review the assumptions made for the calculation of the costs.

[250] The model does not predict the evolution of the VAF, which is instead based on an average of VAF in the previous year.

Figure 35: Assumptions used in Model 2.

To estimate the cost of building, equipping and operating vessels, we collected cost data from ship owners contracted by EMSA regarding costs of building one of their vessels (tankers), or vessels matching EMSA's specifications. Other ship owners, ship builders and ship brokers were also contacted, however these contacts were either not responsive or provided data for vessels which did not meet the specifications criteria.

The building costs for four vessels could be collected. Operational expenditure for two could be collected, and were averaged. If the vessel received pre-fitting by EMSA after the beginning of contract, we included the cost of that vessel's pre-fitting in the purchase. The table below presents the types of vessels for which costs could be obtained and which are used in Model 2 and in Model 5.1.

Table 45: Storage capacity and costs of four types of OSRVs.

	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Average
Recovered oil storage capacity (m^3)	2,880	3,000	4,100	5,000	3,745
Building cost (€)	10,500,000	8,300,000	9,000,000	17,500,000	11,325,000
Pre-fitting cost (€)	400,000	602,346	741,942	None**	581,429
Equipment (€)	2,514,531	2,514,531	2,514,531	2,514,531	2,514,351
Total investment (building, pre-fitting & equipment) (€)	13,414,531	11,416,877	12,256,473	20,014,531	14,420,780
Yearly operational expenditure,* maintenance costs, dry docking (€)	Unknown	1,124,000	1,340,000	Unknown	1,232,000

Source: EMSA contractors.

* crewing, provisions, lubricant storage, spares, repairs, maintenance, P&I insurance, hull and machinery insurance, management fee, administration, registration, dry docking.

** Vessel 3 is an OSRV which is designed to have the minimum characteristics of an EMSA OSRV, based on EMSA's latest tender for the Baltic Sea (see vessel 3 in Model 2). It therefore does not require pre-fitting investments. Source: EMSA contractor.

Vessels are assumed to have a **total life expectancy** (TLE) of 15 years. The TLE of equipment are assumed to be 16 or 8 years, depending on the type and based on EMSA's equipment replacement policy. The cost of equipment is an average for latest equipment purchases. An 'average' equipment set purchased for all newly built vessels is assumed to be composed of:

- OPR equipment: booms, skimmers, HC skimmer OR weir boom, sweeping arms.
- Other equipment: slick detection, sampling/testing, communication, cleaning, PPE.

The **total cost of an equipment set** is estimated to be on average € 2,514,351 (€ 2,350,924 for OPR equipment, € 163,427 for other equipment).

Table 46: Summary of the terms of the service.

Model	Vessel owner	Vessel charterer	Type of vessel contract	Entity in charge of crewing vessels	Payment of operational costs
Model 2	EMSA	MS / economic operator	Bareboat charter	MS / economic operator	MS / economic operator

Under Model 2, expenses related to the management of the vessel are under the financial responsibility of a charterer. A charter hire is paid to EMSA for the use of the vessels. We assume that EMSA still covers the costs related to building the vessels and provides the equipment. The charter hire may include a part of the building and equipment cost, allowing EMSA to recover this cost.

Assessment of the level of service and cost-efficiency of the model:
The table below includes all costs to establish the service covered by EMSA in purchasing and equipping the vessels and by charterers in operating the vessels.

Table 47: Average level of service, cost efficiency and cost of the service under Model 2.2

	Service level indicators		Cost-efficiency indicators				Cost of the service
Region	Average number of EMSA vessels per region	Total EMSA vessel storage capacity per region (m3)	Average EMSA vessels storage capacity (m3)	Average yearly cost per vessel arrangement (€)	Average yearly cost per m3 recovery capacity (€)	Average yearly cost per EAS stockpile (€)	Average yearly cost of the service
Atlantic Ocean	4.55	17,050	**3,745**	**2,193,123**	**585.61**	**435,634**	**40,233,706**
Baltic Sea	1.65	6,188					
Black Sea	1.81	6,776					
Mediterranean Sea	6.83	25,595					
North Sea	2.83	10,612					
Total (2014-2020)	**17.68**	**66,221**					
					Total cost (2014-2020) (€)		**281,635,945**

In the table below we identify costs for EMSA and for charterers.

Table 48: Cost of the service to EMSA and to charterers under Model 2.2

	EMSA	Charterer	Total (100%)
Average yearly cost per vessel arrangement (€)	961,123	1,232,000	**2,193,123**
Average yearly cost of the service (€)	18,448,764	21,784,942	**40,233,706**
Total cost (2014-2020) (€)	**129,141,347**	**152,494,597**	**281,635,945**

Table 49: Assessment of Model 2.2

Criteria	Model Model 2.2:
Suitability for Tier III at sea pollution response	The overall storage capacity and average storage capacity of the vessels are higher than the baseline by about 3,000 m^3 and 170 m^3 respectively. This difference relates only to the choice of vessels to be built and remains in the same order of the baseline level of service.
Top-up of Member States capabilities/added value at EU level	Model 2.2 offers the same equipment and types of vessels as in the baseline. The vessels would only be available in certain regions, rather than in all EU waters.
Cost-efficiency	The cost per arrangement is € 1.35 M more expensive than in the baseline scenario. At € 586 / m^3 of storage capacity, the model has a significantly lower cost-efficiency ratio than in the baseline by € 354 / m^3. All EAS costs remain equal (no change from baseline).
Budgetary Impact	The cost of the service increases significantly by € 167 M over the entire 2014-2020 from baseline. The cost to EMSA increases more moderately, by € 14 M.

Conclusion: This model is costly to EMSA as well as to chartering Member States or economic operators. Some questions remain regarding the feasibility of this model.

Firstly, it is uncertain that Member States or economic operators would be interested in chartering and maintaining a Tier-III vessel in light of the rare occurrence of spills and the cost of operating and maintaining the vessels.

Secondly, a shared use of the vessels between Member States raises the issue of prioritisation of a vessel's intervention and possible conflicts in the case that a spill can affect the coasts of several Member States.

Lastly, this requires a long-term commitment for EMSA in having such vessels and poses a high risk for EMSA in not finding a party to charter the vessels. Overall this scenario bears risks and uncertainties which make it rather unattractive.

4.4.4 Testing and assessment of Model 3: EMSA building or chartering multi-purpose response vessels

Under Model 3 we also assume a same number of MPVs as VACs as in the previous models. The multi-purpose vessels (MPVs) proposed for building are of two types: the "Neptune Series" and the MPV 8116.[251]

In order to calculate the costs of a service model that includes MPVs in EMSA's network of vessels, data was collected related to the cost of building and operating such vessels. Below we present the assumptions used in the models.

[251] Note that the MPV 8116 is more specialised as it can conduct coast guard and fisheries control functions, while the Neptune Series model is rather oriented towards pollution control. Figure 60 and Figure 62 of Appendix 6, summarise their specifications and individual costs. Figure 33 also summarises advantages and disadvantages of MPVs over OSRVs.

Figure 36: Assumptions used in Model 3.

As the vessels are **already partly equipped** (with skimmers, and booms for the MPV 8116), we only assume the purchase of sweeping arms and booms for the Neptune Series at an average cost of € 1,251,341 and sweeping arms for the MPV 8116 at an average cost of € 886,744 based on latest purchases for such equipment. These MPVs are assumed to have a TLE of 25 years.

In Model 3, we average the costs of the two types of MPV to assume an equal number of each entering service. The table below summarises the calculation of costs for the vessel.

Table 50: Storage capacity and costs of the two types of MPVs.

	Neptune Series	MPV 8116	Average vessel
Recovered oil storage capacity (m^3)	1,700	1,100	1,400
Building cost (€)	35,300,000	53,408,000	44,354,000
Equipment (€)	1,251,341	886,744	1,069,042

A **cost of chartering** is calculated based on an estimated yearly chartering cost of € 5.5 M to have the vessel available 11 months per year (1 month being dedicated to dry docking and maintenance).

Because **crew costs could not be obtained when collecting operational costs,** we used chartering costs instead, as these normally cover costs of crew and all operational and maintenance costs. This means that these costs are slightly overestimated as a chartering cost normally includes a fee paid by the charterer for the management of the vessel.

As Model 3 assumes the shared use of the MPVs between EMSA, EBCGA and EFCA, a **distribution of the time** for using the vessels was devised and is presented in the table below. It serves as a basis for determining **co-financing rates** of the vessels' operational expenditure or chartering costs.

Table 51: Time-shared use of MPVs, co-financing rates between the European Border and Coast Guard Agency, the European Fisheries Control Agency, and the European Maritime Safety Agency.

	EBCGA	EFCA	EMSA	Total
Time-share distribution	6 months	4 months	1 month	**11 months**
Co-financing rate	50%	30%	20%	**100%**

The distribution for the EBCGA' and EFCA's share of the financing is based on each agency's **needs for coast guard and fisheries-related campaigns**. EMSA's time-share covers drills and exercises (1 month). An additional 10% of the costs is added to provide for EMSA's priority access to the vessel in case of an oil spill.

4.4.4.1 Model 3.1: EMSA co-financing the building of MPVs

Table 52: Summary of the terms of the service.

Model	Vessel owner	Vessel charterer	Type of vessel contract	Entity in charge of crewing vessels	Payment of operational costs
Model 3.1	EMSA / EU Agencies	-	-	EMSA / EU Agencies	EMSA / EU Agencies

Model 3.1 assumes that EMSA and EU agencies co-finance the building and operation of MPVs. EMSA pays for building and operational costs of the vessels at a rate equal to its time share and

need for use in case of a spill, i.e. 20% of total costs. In addition, EMSA also equips the vessels and trains the crew for OPR.

Assessment of the level of service and cost-efficiency of the model: While operational expenditure are available, costs obtained did not include costs related to crewing. We therefore used a chartering cost, likely to be slightly higher than actual operational and crewing costs.

Table 53: Average level of service, cost efficiency and cost of the service under Model 3.1

	Service level indicators		Cost-efficiency indicators				Cost of the service
Region	Average number of EMSA vessels per region	Total EMSA vessel storage capacity per region (m3)	Average EMSA vessels storage capacity (m3)	Average yearly cost per vessel arrangement (€)	Average yearly cost per m3 recovery capacity (€)	Average yearly cost per EAS stockpile (€)	Average yearly cost of the service
Atlantic Ocean	4.55	6,374	**1,400**	**7,340,975**	**5,243.55**	**435,634**	**131,084,840**
Baltic Sea	1.65	2,313					
Black Sea	1.81	2,533					
Mediterranean Sea	6.83	9,568					
North Sea	2.83	3,967					
Total (2014-2020)	**17.68**	**24,756**					
						Total cost (2014-2020) (€)	**917,593,877**

In the table below, we identify the cost of the service to the co-financers, based on the time share distribution defined previously.

Table 54: Cost of the service to EMSA and to charterers under Model 3.1

	EBCGA (50%)	EFCA (30%)	EMSA (20%)	Total (100%)
Average yearly cost per vessel arrangement (€)	3,670,488	2,202,293	1,468,195	**7,340,975**
Average yearly cost of the service (€)	64,903,702	38,942,221	27,238,917	**131,084,840**
Total cost (2014-2020) (€)	**454,325,912**	**272,595,547**	**190,672,418**	**917,593,877**

Table 55: Assessment of Model 3.1

Criteria	Model
Suitability for Tier III at sea pollution response	At 2,180 m^3 less storage capacity than in the baseline, the MPVs under Model 3 cannot compare to the capacity offered by the OSRVs in the current model. The combined storage capacity of this network is 38,500 m^3 lower than in the baseline.
Top-up of Member States capabilities/added value at EU level	EMSA would still be able to offer its dispersant application service with the Neptune Series vessels. Furthermore, equipment can still be used on board these vessels which matches EMSA's OPR equipment sets. The MPVs offer new capabilities such as HNS recovery, fire-fighting, emergency towing, salvage, and can travel faster (16.5 knots maximum speed).
Cost-efficiency	The cost per MPV is € 6.5 M more expensive than VACs in the baseline scenario. The cost per m^3 of storage capacity is € 5,000 higher than in the baseline scenario. The cost per EAS stockpile does not change.
Budgetary Impact	The cost of the service under this model far exceeds the baseline scenario's by € 803 M. The cost to EMSA is € 76 M higher than in the baseline.

Conclusion: This model is likely to be extremely costly to implement due to the costs related to the co-financers taking charge of the full management of the vessels. The cost to the requesting State is expected to increase under this model, due to the high costs related to the use of MPVs. The model does offer interesting prospects compared to the baseline based on the additional functions of the MPVs, although the replacement of OSRVs with MPVs does significantly reduce the overall capacity of EMSA's service in terms of recovered oil storage capacity. This is somewhat compensated by the vessels' higher speed which mean less time spent travelling between a spill location and a port to discharge a full tank of recovered oil.

4.4.4.2 Model 3.3.3: EMSA chartering MPVs from a ship owner in a long-term time charter

Table 56: Summary of the terms of the service.

Model	Vessel owner	Vessel charterer	Type of vessel contract	Entity in charge of crewing vessels	Payment of operational costs
Model 3.3.3	Contractors	EMSA / EFCA / EBCGA	Time charter	Contractors	EMSA / EFCA / EBCGA

Under this model, EMSA, EFCA and EBCGA charter MPVs from a ship owner taking care of the operation and maintenance of the vessels using a long-term time charter. The cost of chartering used for this scenario is assumed to be € 5.5 M per year per MPV, as defined in section 4.4.4. The vessels are also assumed to be equipped by EMSA for OPR. We calculate the total cost of these vessels to EMSA in the table below and based on the distribution of the use of the vessels defined in Table 51 of section 4.4.4.

Assessment of the level of service and cost-efficiency of the model: The table below includes all costs covered by EMSA and the charterers for the provision of the service.

Table 57: Average level of service, cost efficiency and cost of the service under Model 3.3.3.

	Service level indicators		Cost-efficiency indicators				Cost of the service
Region	Average number of EMSA vessels per region	Total EMSA vessel storage capacity per region (m3)	Average EMSA vessels storage capacity (m3)	Average yearly cost per vessel arrangement (€)	Average yearly cost per m3 recovery capacity (€)	Average yearly cost per EAS stockpile (€)	Average yearly cost of the service
Atlantic Ocean	4.55	6,374	**1,400**	**5,566,815**	**3,976.30**	**435,634**	**99,713,108**
Baltic Sea	1.65	2,313					
Black Sea	1.81	2,533					
Mediterranean Sea	6.83	9,568					
North Sea	2.83	3,967					
Total (2014-2020)	**17.68**	**24,756**					
						Total cost (2014-2020) (€)	**697,991,755**

In the table below, we summarise the cost of the service for each co-financing EU Agency.

Table 58: Share of the total cost of the service for each EU Agency.

	EBCGA (50%)	EFCA (30%)	EMSA (20%)	Total (100%)
Average yearly cost per vessel arrangement (€)	2,750,000	1,650,000	1,166,815	**5,566,815**
Average yearly cost of the service (€)	48,627,104	29,176,262	21,909,742	**99,713,108**
Total cost (2014-2020) (€)	**340,389,726**	**204,233,836**	**153,368,193**	**697,991,755**

Table 59: Assessment of Model 3.3.3.

Criteria	Model
Suitability for Tier III at sea pollution response	At 2,175 m^3 less storage capacity than in the baseline, the MPVs under Model 3 cannot compare to the recovered oil storage capacity offered by the OSRVs in the current model. The combined storage capacity of this network is 38,500 m^3 lower than in the baseline.
Top-up of Member States capabilities/added value at EU level	EMSA would still be able to offer its dispersant application service. Furthermore, equipment can still be used on board these vessels which matches EMSA's OPR equipment sets. The MPVs offer new capabilities such as HNS recovery, fire-fighting, emergency towing, salvage, and can travel faster (16.5 knots maximum speed).
Cost-efficiency	The cost per MPV is € 4.8 M higher than VACs in the baseline scenario. The cost per m^3 of storage capacity is € 3,700 higher than in the baseline scenario. The cost per EAS stockpile does not change.
Budgetary Impact	The cost of the service under this model exceeds current yearly cost of the service by € 583M. The cost to EMSA increases by € 39M.

Conclusion: While the costs of the model remain high, the long-term time chartering of MPVs can offer reasonable prospects for cost-efficiency for EMSA on the basis of the time-based sharing of costs between agencies. The service would also benefit from the MPVs' additional capabilities, in spite of their lower recovered oil storage capacity. The issue remains the actual possibility of being able to find suitable vessels for use by all three agencies.

4.4.5 Testing and assessment of Model 5: EMSA financing vessels while maintaining VACs

The mixed models assume that EMSA maintains a number of its VACs and replaces a few of them with purposely-built or chartered vessels which it equips. As the VAC model has so far shown to be relatively the most cost-efficient, these mixed models serve to assess different options combining advantages of building OSRVs (e.g. full availability of vessels, facilitated determination of their area of operation by EMSA) or of chartering MPVs (e.g. additional functions of the vessels, possibility to co-finance their use) with the VAC vessels.

Figure 37: Assumptions used in Model 5.

In order to 'replace' VACs with built OSRVs or chartered MPVs, we calculated the average cost of maintaining a VAC in each region and deduced this cost from the total, replaced by the average cost of an OSRV or of an MPV. The same costs are used as in previous models and include all costs for making a vessel available (i.e. including equipment, maintenance, crewing, etc.). The results are presented in the table below.

Table 60: Average yearly cost of a VAC in each region, and yearly cost of a purposely-built OSRV and of a chartered MPV (long-term time charter).

Average yearly cost of one VAC	Yearly cost of one built OSRV	Yearly cost of one chartered MPV
830,848	2,254,723	6,569,042

4.4.5.1 Model 5.1: EMSA replacing one VAC per region with purposely-built OSRVs

Table 61: Summary of the terms of the service.

Model	Vessel owner	Vessel charterer	Type of vessel contract	Entity in charge of crewing vessels	Payment of operational costs
Model 5.1	EMSA	-	-	Ship management firm	EMSA

Under Model 5.1, one VAC in each region is replaced with one purposely-built vessel which EMSA equips, maintains and operates with the support of a ship management firm.

Assessment of the level of service and cost-efficiency of the model:
The table below includes all costs covered by EMSA for the provision of the service.

Table 62: Average level of service, cost efficiency and cost of the service under Model 5.1

	Service level indicators		Cost-efficiency indicators				Cost of the service
Region	Average number of EMSA vessels per region	Total EMSA vessel storage capacity per region (m3)	Average EMSA vessels storage capacity (m3)	Average yearly cost per vessel arrangement (€)	Average yearly cost per m3 recovery capacity (€)	Average yearly cost per EAS stockpile (€)	Average yearly cost of the service
Atlantic Ocean	4.55	18,321	**3,649**	**1,416,483**	**388.21**	**435,634**	**26,500,701**
Baltic Sea	1.65	5,798					
Black Sea	1.81	6,647					
Mediterranean Sea	6.83	23,833					
North Sea	2.83	9,921					
Total (2014-2020)	**17.68**	**64,519**					
					Total cost (2014-2020) (€)		**185,504,905**

Table 63: Assessment of Model 5.1

Criteria	Model
Suitability for Tier III at sea pollution response	Minimal change to the baseline can be observed, with just 1,282 m^3 storage capacity added and 70 m^3 storage capacity per vessel.
Top-up of Member States capabilities/added value at EU level	Model 5.1 offers the same equipment and types of vessels as in the baseline.
Cost-efficiency	The cost per OSRV (under VAC and built) is € 570,000 higher than in the baseline scenario. The cost per m^3 of storage capacity is € 156 higher than in the baseline scenario. The cost per EAS stockpile does not change.
Budgetary Impact	The cost of the service under this model exceeds current total cost of the service by € 71M.

Conclusion: This model expectedly comes at a higher cost as built vessels are much more expensive than VACs. Costs of the built vessels to the requesting State are also likely to be higher compared to the baseline.

4.4.5.2 Model 5.2: EMSA chartering two MPVs while maintaining VACs

Table 64: Summary of the terms of the service.

Model	Vessel owner	Vessel charterer	Type of vessel contract	Entity in charge of crewing vessels	Payment of operational costs
Model 5.2	Contractors	EMSA / EFCA / EBCGA	Time charter	Contractors	EMSA / EFCA / EBCGA

Under Model 5.2, EMSA replaces two VACs in the Atlantic and Mediterranean with two MPVs, in accordance with plans from the EFCA and EBCGA to charter vessels in these regions. MPVs are chartered by the three agencies on a time-share basis presented above. All other VACs are maintained.

Assessment of the level of service and cost-efficiency of the model: The table below includes all costs covered by EMSA and the charterers (of the MPVs) for the provision of the service.

Table 65: Average level of service, cost efficiency and cost of the service under Model 5.2.

	Service level indicators		Cost-efficiency indicators				Cost of the service
Region	Average number of EMSA vessels per region	Total EMSA vessel storage capacity per region (m3)	Average EMSA vessels storage capacity (m3)	Average yearly cost per vessel arrangement (€)	Average yearly cost per m3 recovery capacity (€)	Average yearly cost per EAS stockpile (€)	Average yearly cost of the service
Atlantic Ocean	4.55	15,976	**3,295**	**1,481,610**	**449.64**	**435,634**	**27,652,317**
Baltic Sea	1.65	4,943					
Black Sea	1.81	6,387					
Mediterranean Sea	6.83	21,488					
North Sea	2.83	9,471					
Total (2014-2020)	**17.68**	**58,266**					
						Total cost (2014-2020) (€)	**193,566,216**

In the table below, we summarise the chartering cost of each vessel for each EU Agency.

Table 66: Share of the total cost of MPVs for each EU Agency.

	EBCGA (50%)	EFCA (30%)	EMSA (20%)	Total (100%)
Average yearly cost per vessel arrangement (€)	2,750,000	1,650,000	1,166,815	**5,566,815**
Average yearly cost of the service (€)	5,500,000	3,300,000	16,955,772	**25,750,722**
Total cost (2014-2020) (€)	**38,500,000**	**23,100,000**	**118,655,055**	**180,301,274**

Table 67: Assessment of Model 5.2

Criteria	Model
Suitability for Tier III at sea pollution response	With the replacement of 2 VACs with 2 MPVs, the average storage capacity per vessel decreases by 280 m^3. Total storage capacity decreases by 5,000 m^3.
Top-up of Member States capabilities/added value at EU level	Model 5.2 offers the same OPR equipment as in the baseline, however the MPVs offer new capabilities such as HNS recovery, fire-fighting, emergency towing, salvage, and can travel faster (16.5 knots maximum speed).
Cost-efficiency	The cost per arrangement is € 635,000 higher than in the baseline scenario. The cost per m^3 of storage capacity is € 280 higher than in the baseline scenario. The cost per EAS stockpile does not change.
Budgetary Impact	The cost of the service under this model exceeds current total cost of the service by € 79M. The cost to EMSA only increases by € 2.3M.

Conclusion: In a financing option where EMSA shares costs of the chartered vessels with Member States or replaces more VACs with chartered MPVs, this model could be more cost-efficient per arrangement but would continue to decrease in average storage capacity. Model 5.2 Model 5.2 offers the same OPR equipment as in the baseline, however the MPVs offer new capabilities such as HNS recovery, fire-fighting, emergency towing, salvage, and can travel faster (16.5 knots maximum speed) as described in Figure 33 of section 4.3.3.

4.5 Step 5: Comparative analysis

The comparative assessment of the current model and potential alternative service models for EMSA is based on a multi criteria analysis using the criteria defined in section 4.1 Step 1: Exclusion criteria and comparison criteria. The baseline is considered to be the average level of service and average costs related to it over the period of the MAF II (2014-2020). All alternative options are assessed against it. In Table 68, below, indicators of costs and level of service for the alternative models are compared with those in the baseline scenario. Figures in the top line are baseline indicators, the lines below are the difference in the figures for the alternative models (in plus or minus) compared to the baseline. In the last two columns, the cost of establishing the service is presented first for EMSA alone and then overall (i.e. for co-financers or charterers, if any).

Table 68: Difference in the level of service and costs between the Baseline scenario and the alternative models.

	Total EMSA vessel storage capacity (m3)	Average EMSA vessels storage capacity (m3)	Average yearly cost per vessel arrangement (€)	Average yearly cost per m3 recovery capacity (€)	Average yearly cost of the service (€)	Total cost of the service to EMSA (2014-2020) (€)	Total cost of the service (2014-2020) (€)
Baseline	**63,237**	**3,576**	**846,483**	**232**	**16,421,639**	**114,951,474**	**114,951,474**
Model 1.2	-621	-55	-23,263	-2	-329,191	-2,304,334	-2,304,334
Model 2.2	+2,984	+169	+1,346,640	+354	+23,812,067	+14,189,873	+166,684,471
Model 3.1	-38,482	-2,176	+6,494,492	+5,012	+114,663,200	+75,720,944	+802,642,403
Model 3.3.3	-38,482	-2,176	+4,720,332	+3,744	+83,291,469	+38,416,719	+583,040,281
Model 5.1	+1,282	+72	+569,999	+156	+10,079,062	+70,553,431	+70,553,431
Model 5.2	-4,971	-281	+635,127	+218	+11,230,677	+2,983,563	+78,614,742

Note: Figures in red perform less well than the baseline, green figures on the contrary perform better than the baseline.

In the table below, a scorecard summarises advantages and disadvantages of alternative service models compared with the baseline scenario. This scorecard takes into account qualitative assessments made above in Steps 3 and 4.

Table 69: Multi criteria analysis scorecard

Criteria	Model 1.2	Model 2.2	Model 3.1	Model 3.3.3	Model 5.1	Model 5.2
Short description:	2 possible contract renewals	EMSA builds OSRVs, chartered to MS (bareboat)	EMSA co-financing the building of MPVs with EU Agencies	EMSA charters MPVs, shared with EU agencies	EMSA replaces five VACs with built OSRVs	EMSA replaces two VACs with chartered MPVs, shared with EU
Suitability for Tier III at sea pollution response	0	0	-	-	0	+
Top-up of Member States capabilities/added value at EU level	0	-	-	-	0	+
Cost-efficiency (overall)	+	--	--	--	--	--
Cost-efficiency (EMSA)	+	--	--	--	--	-
Budgetary Impact (overall)	+	--	--	--	--	--
Budgetary Impact (EMSA)	+	--	--	--	--	-
Overall technical, financial, organisational feasibility	+	-	-	0	0	0
Compatibility with EU Financial Regulation and EMSA's Legal mandate	0	0	0	0	0	0

Note: The ranking of the different pollution response models are defined using the following coding: ++= very advantageous; += advantageous; 0= neutral; -= disadvantageous; --= very disadvantageous.

The tables above show that, overall, Model 1.2 is the least costly to implement with some positive budgetary from the baseline and minor difference in the level of service, however these differences are likely to be within the margin of error of the model used.

Model 5.2 appears to be an advantageous model: although it is more expensive to implement for EMSA than the baseline, the potential gains in the service associated with the use of MPVs are particularly interesting.

4.6 Conclusion on Part 3

The alternative models show that, in terms of establishing additional oil pollution response capacity, it is highly unlikely that EMSA could provide a similar or higher level of service at better cost-efficiency both for EMSA as well as for the requesting Member States. EMSA's current service model has the main advantage that it allows vessel owners to conduct an economic activity while maintaining the vessel available for OPR, if required. This greatly reduces overall costs for maintaining the level of service when not carrying out their OPR duties.

Any significant reduction of costs is likely to imply a reduction in the level of service. However some options appear more feasible and cost-efficient than other alternatives.

Model 5.2, in particular, offers interesting advantages linked to the additional capabilities of the MPVs and with regards to its costs, if shared with other EU Agencies as hypothesized in this model.

5. PART 4 – ANALYSIS OF EU MEMBER STATES' TRENDS IN THE LEVEL OF OIL POLLUTION PREPAREDNESS AND RESPONSE

Member States have their own capacities to respond to oil pollution. The present chapter is intended to provide an overview of the number and capacity of Member States' oil spill response vessels and identify trends.

The analysis is focused on the measures adopted by coastal Member States of the European Union and the EEA/EFTA to respond to oil pollution of the marine environment caused by vessels or oil and gas installations. Data is presented at national and regional level, allowing for a comparison with EMSA's own capacities.

The information presented is based on EMSA inventories of EU and EFTA Member States' Oil Pollution Response Vessels.[252] In addition, Member States' future plans for changes to the level of oil pollution response capacities have been collected during interviews.

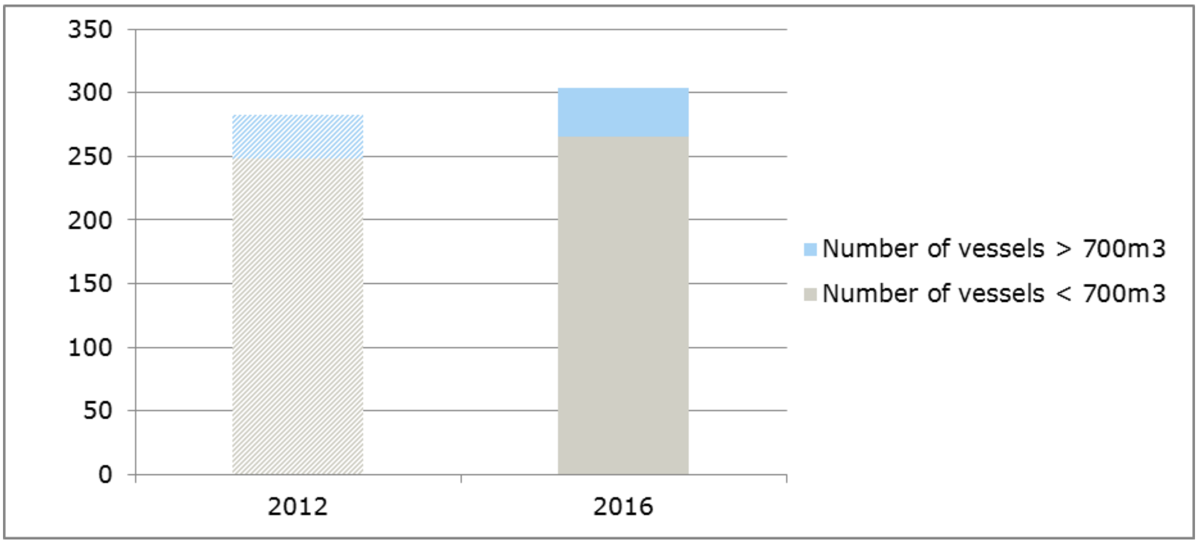
Data from 2012 and 2016 has been used primarily. Data for the previous years is not included as it lacks the level of detail and accuracy required to make a robust assessment.

5.1 Oil pollution preparedness and response capacities of the Member States

Between 2012 and 2016, the number and capacity of oil spill response vessels of the EU and EFTA Member States has seen a slight increase.

The number of vessels available nationally for oil pollution response increased by 7% (21 vessels), reaching a total number of 304 in 2016. This includes three additional vessels of a storage capacity higher than 700 m^3.

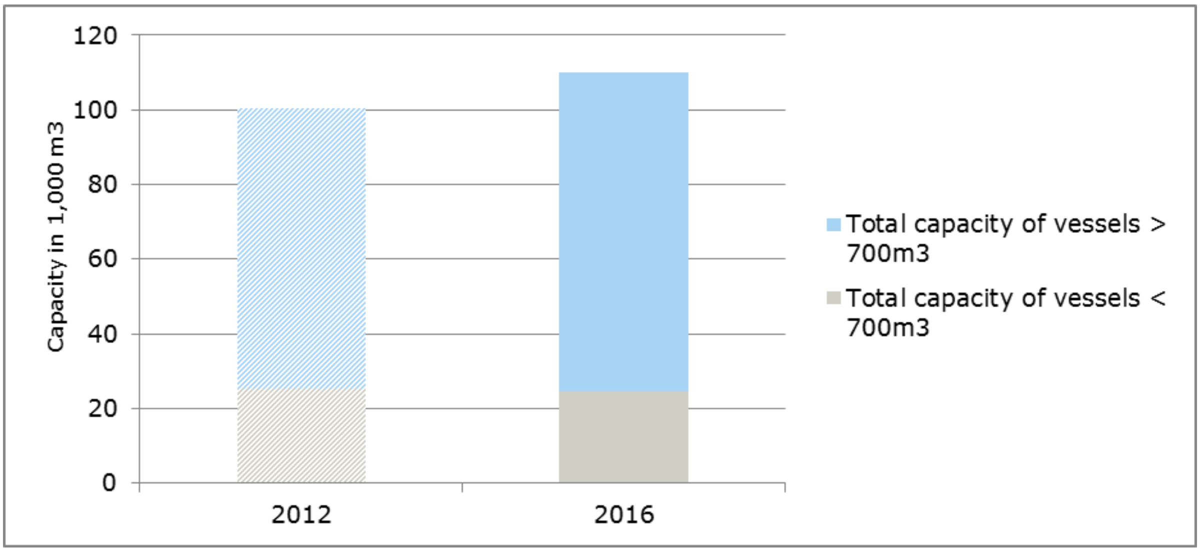
Figure 38: Evolution of number of Member States' vessels, 2012 to 2016.



[252] EMSA. (2016). Inventory of EU Member States Oil Pollution Response Vessels 2016. Retrieved from: http://emsa.europa.eu/hns-pollution/items.html?cid=280:manuals&id=2777
EMSA. (2012). Inventory of EU Member States Oil Pollution Response Vessels 2012. http://emsa.europa.eu/news-a-press-centre/external-news/2-news/487-inventory-of-eu-member-states-oil-pollution-response-vessels.html

The combined oil storage capacity the vessels increased by 9.5% reaching a total of 110,000 m^3 in 2016. The storage capacity of vessels above 700 m^3 increased by 14%. This development is depicted in Figure 39 below.

Figure 39: Evolution of capacity of Member States' vessels, 2012 to 2016.



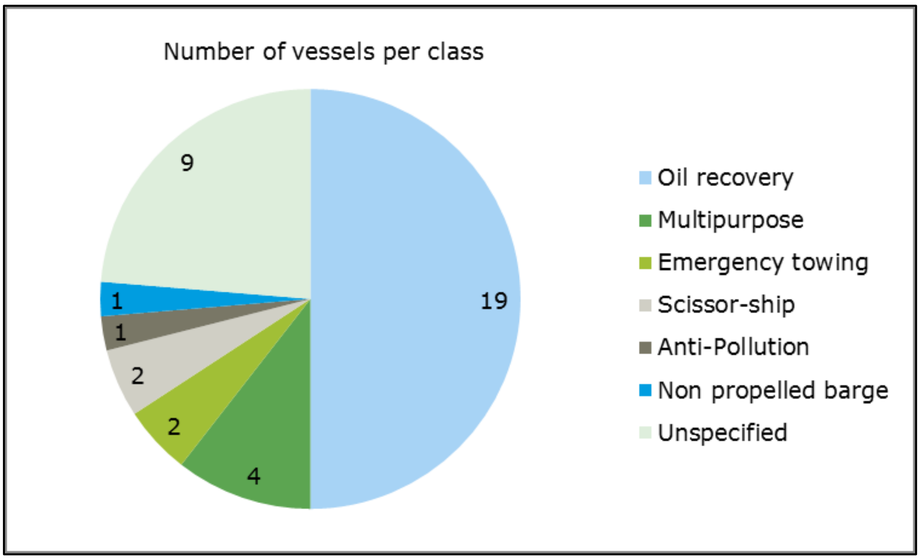
The described increase in the number of vessels and their capacity is due to the accession of Croatia to the EU in 2014. Some Member States added to, others reduced the number of their vessels slightly. However, in many of the countries under review, the number and capacity of vessels remained stable over the four years. As Croatian vessels do not have any storage capacity, the increase in storage capacity is due to changes in the vessels of the other EU and EFTA Member States.

Among the 25 EU and EFTA coastal Member States, all but the United Kingdom reported on their number and capacity of vessels. In 2016, most vessels are held by Italy (39), followed by Germany (30), Portugal (23) and Norway (23).

In the following, only vessels of a storage capacity higher than 700 m^3 will be considered, as these are most comparable to EMSA's capacities.

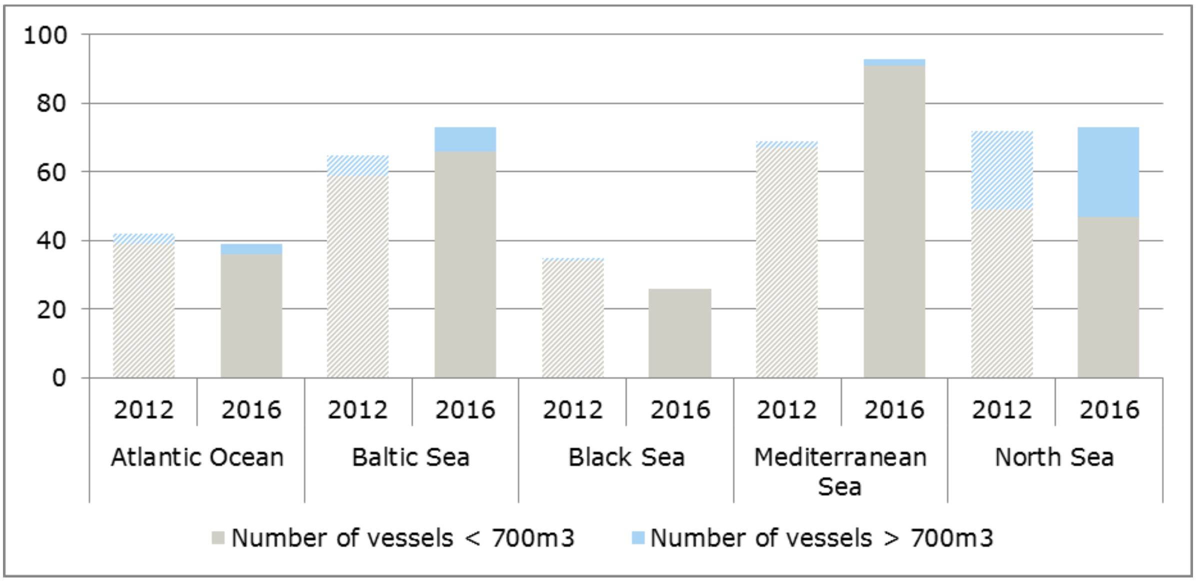
The **classes of Member States' oil spill response vessels** are presented in Figure 40 below. The majority of the vessels which can be used to respond to oil pollution events are dedicated oil recovery vessels. There are however various other types of vessels which are available to respond to oil pollution.

Figure 40: Classes of Member States' vessels with a capacity above 700 m^3, 2016.



The EU and EFTA Member States' vessels with a capacity above 700 m^3 are spread across **four regions** in 2016, as shown in blue in Figure 41 below. Most vessels are based in the North Sea region (including the Norwegian Sea). Here and in the Baltic Sea, the number of vessels increased between 2012 and 2016. The Member States no longer have any vessel with a capacity above 700 m^3 in the Black Sea.

Figure 41: Evolution of number of vessels per region, 2012 and 2016.



The equipment of the vessels with a capacity above 700 m^3 in the five regions is shown in Figure 42 below. Overall, the number of available equipment corresponds to the number of vessels available in each of the regions. Only in the data for the North Sea suggests that not all of the new vessels in 2016 are equipped with booms, skimmers and sweeping arms.

Figure 42: Evolution of Member States' vessel equipment of vessels with a capacity above 700 m^3, 2012-2016.

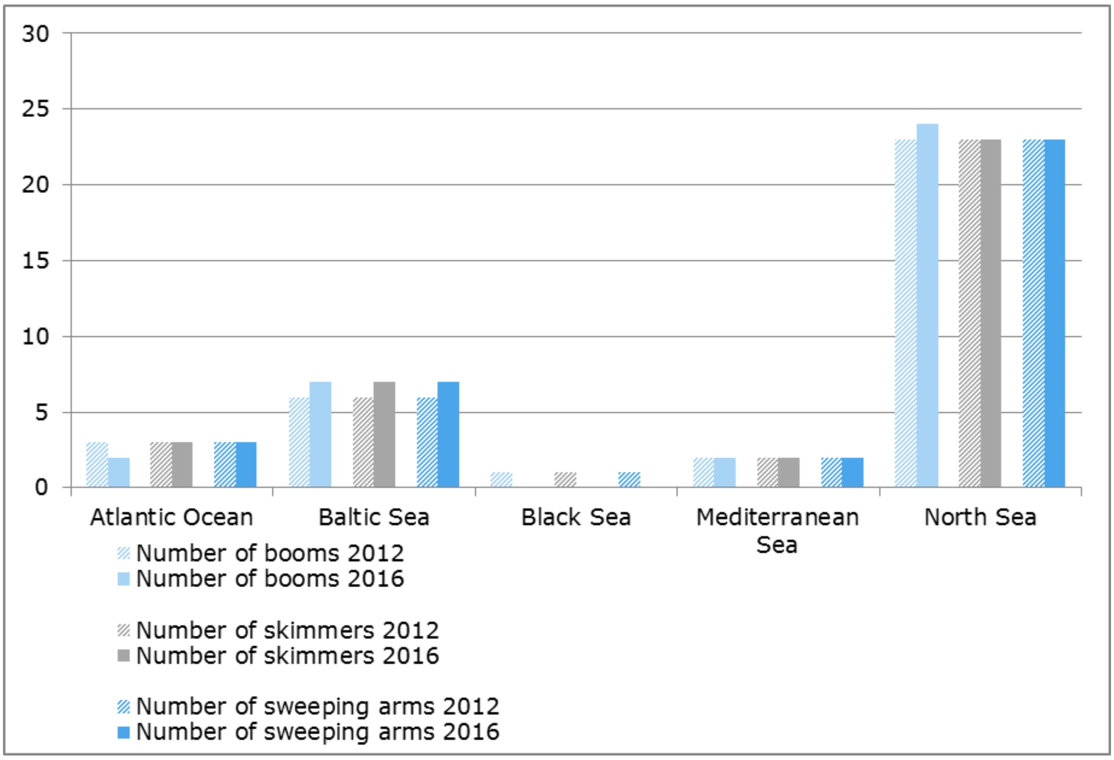
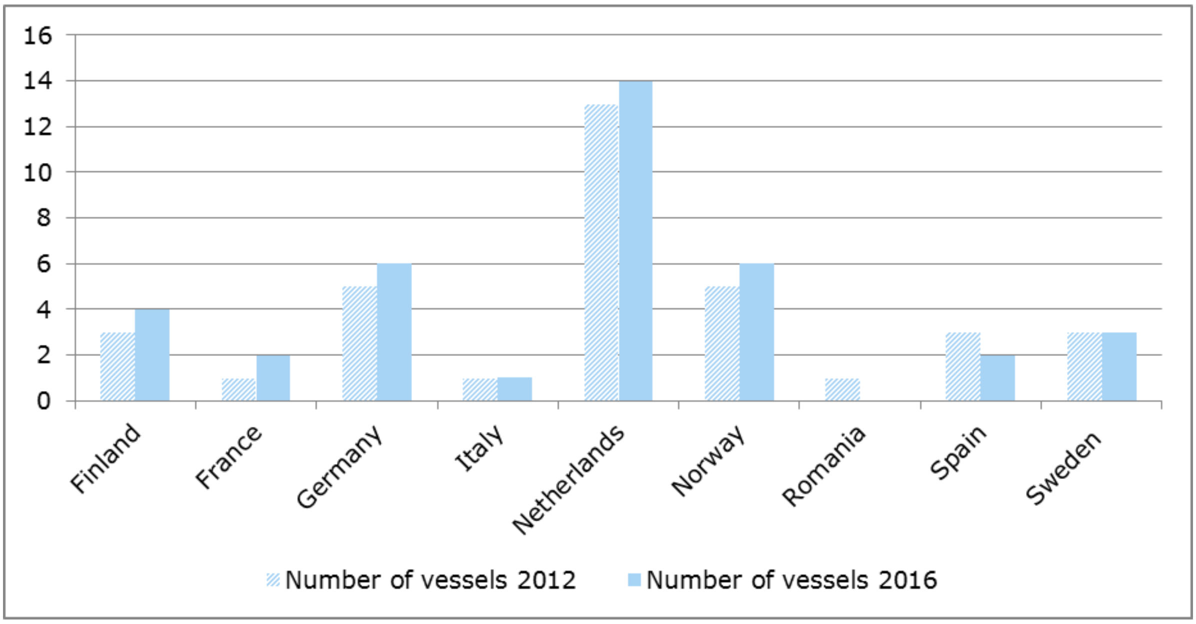


Figure 43 below shows the evolution of the number of Member States' oil spill response vessels with a storage capacity above 700 m^3.

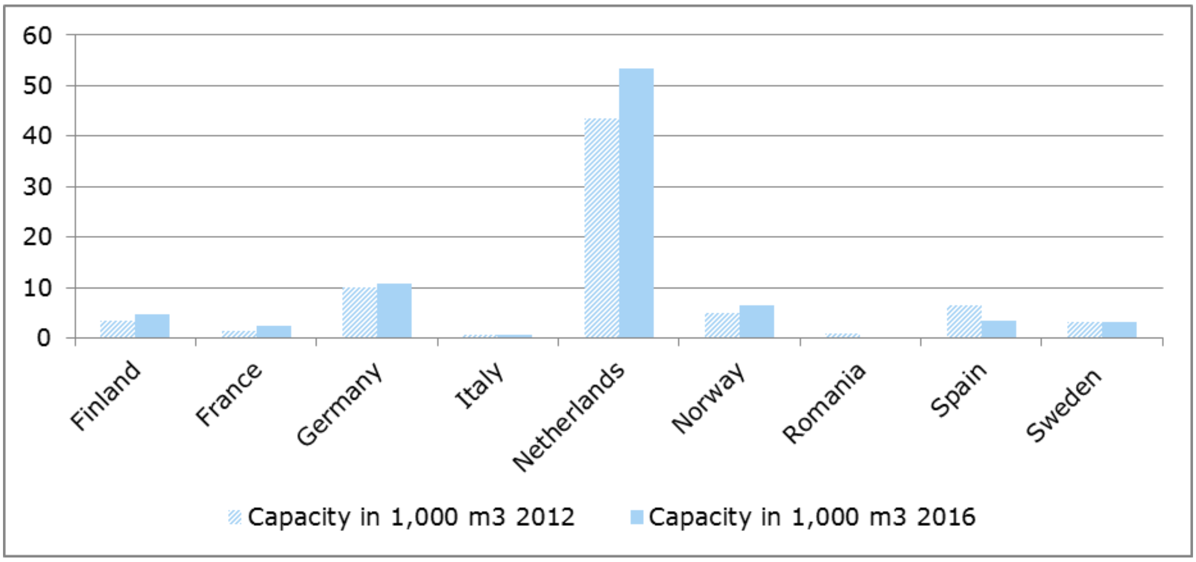
For 2012, nine EU and EFTA Member States reported vessels with **more than 700 m^3 capacity**. Between 2012 and 2016, the total number of vessels of this capacity has increased from 35 to 38. The Netherlands, Norway, Germany, France and Finland each added one vessel while Romania and Spain's number of vessels of this type was reduced by one.

Figure 43: Evolution of Member States' number of vessels with capacity above 700 m^3, 2012-2016.



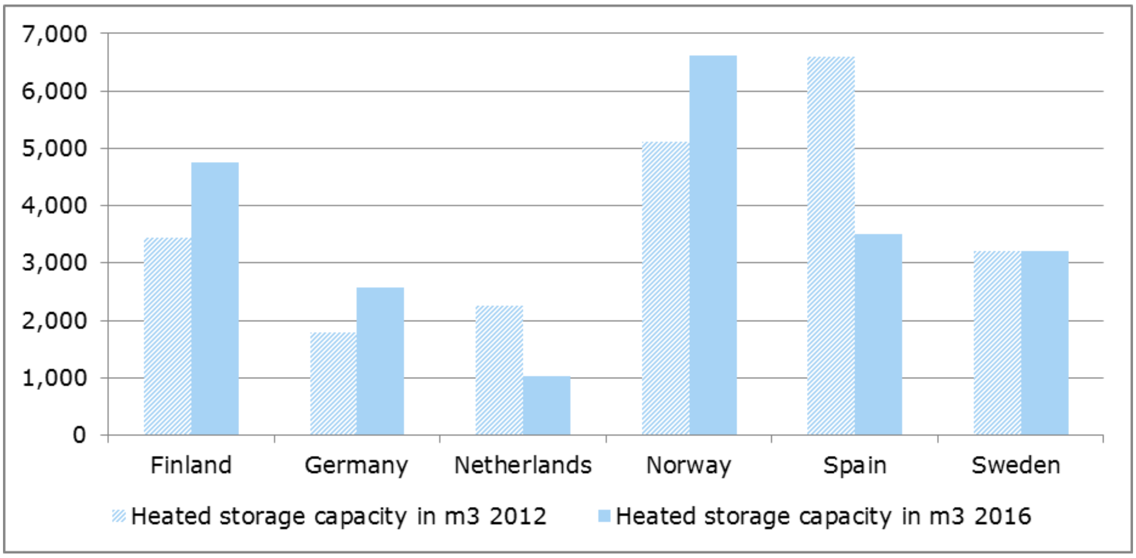
With the change in the number of vessels, the total **oil storage capacity** of EU and EFTA Member States' vessels increased as well. In five of the nine EU and EFTA Member States with vessels of capacity higher than 700 m^3 the total capacity increased between 2012 and 2016, as can be seen Figure 44 below. The highest increase can be observed in the Netherlands and Norway due to the acquisition of larger vessels. Oil storage capacity was significantly reduced in Spain and Romania after several large vessels left the fleets.

Figure 44: Evolution of Member States' total storage capacity of vessels with capacity above 700 m^3, 2012/2016.



Among the nine EU and EFTA Member States which have vessels of a capacity higher than 700 m^3, six have vessels with **heated storage capacity**. Between 2012 and 2016, this capacity saw a small reduction of 740m^3 (3%). This change is due to decreases in capacity the Netherlands and Spain, combined with increases in capacity in Finland, Germany and Norway as shown in Figure 45.

Figure 45: Evolution of heated storage capacity of Member States' vessels with capacity above 700 m^3, in 1,000 m^3, 2012 and 2016.

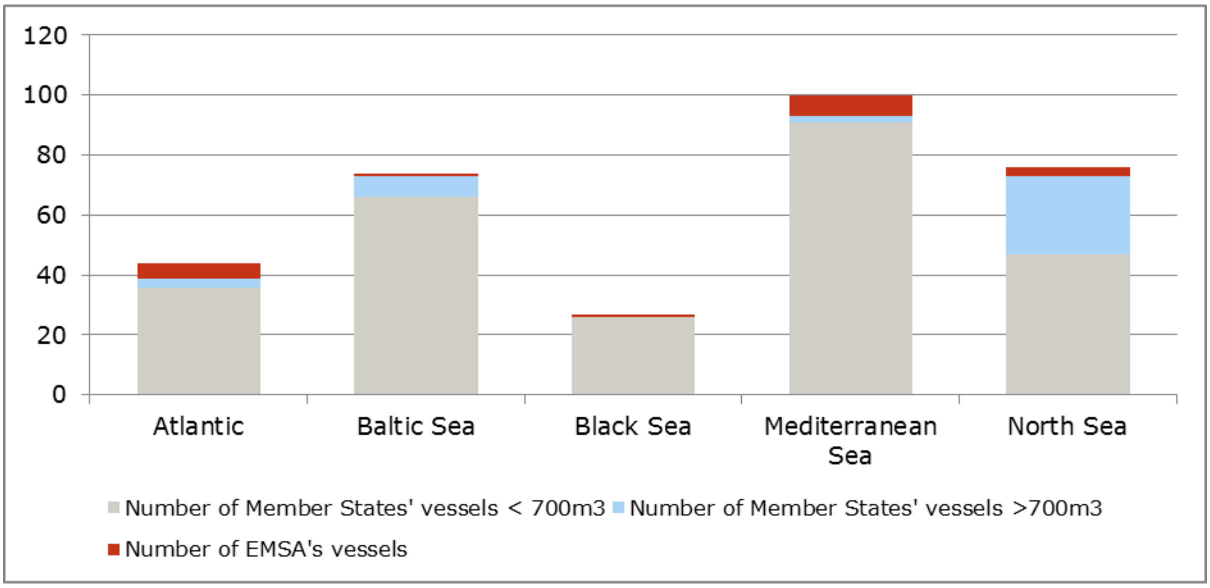


In addition to the Member States' capacities and resources, **industry-funded capacities** to respond to oil pollution exist. The main sources for this additional capacity are (i) Oil Spill Response Limited (OSRL) with vessels in the North Sea and oil pollution response equipment deployable globally and (ii) the Norwegian Clean Seas Association for Operating Companies (NOFO) with 20 to 30 vessels and associated oil pollution response equipment in the Norwegian and the North Sea.

5.2 Comparison of national capacities with EMSA's capacities

Across the seas surrounding Europe, a total of 323 **OSRVs** either held by EU and EFTA Member States or contracted by EMSA are available. Of these 19 (6%) are vessels contracted by EMSA whereas the large majority of vessels belong to the EU and EFTA Member States. The oil spill response vessels are spread across the different seas as depicted in Figure 46 below. Most vessels are placed in the Mediterranean Sea. The figure shows that while the EU and EFTA Member States have a large number of vessels with low or no storage capacity, EMSA's contracted vessels all have a capacity of more than 1,500 m^3. EMSA adds to the number Member States' vessels of a capacity above 700 m^3 in particular in the Atlantic, Mediterranean and the Black Sea where only few (or none for the latter) vessels of high capacity are available. In the Baltic and the North Sea, the number of Member States' vessels with a capacity above 700 m^3 is higher than the number of vessels chartered by EMSA.

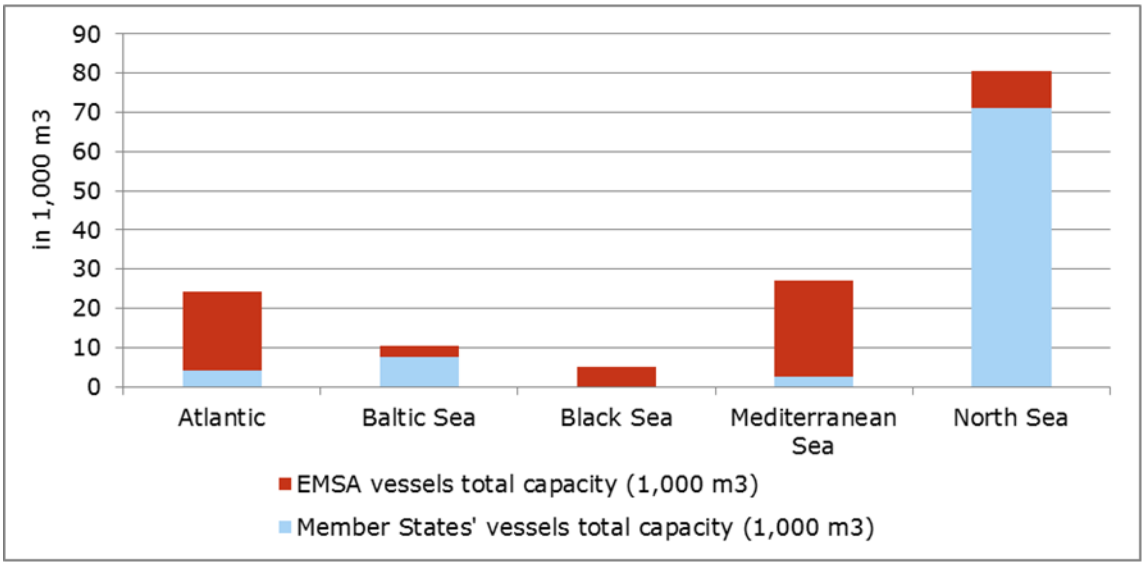
Figure 46: Number of oil spill response vessels per region, EMSA and Member States, 2016.



On average, taking all available vessels of all sizes into account EU and EFTA Member States' vessels in the Atlantic Ocean, the Baltic, Black and Mediterranean Sea have a storage capacity of less than 300 m^3. Only in the North Sea (combined with the Norwegian Sea) EU and EFTA Member States' vessels have higher average storage capacities, namely 1,066 m^3. EMSA's contracted vessels across the different regions all have an average storage capacity of more than 2,500 m^3.

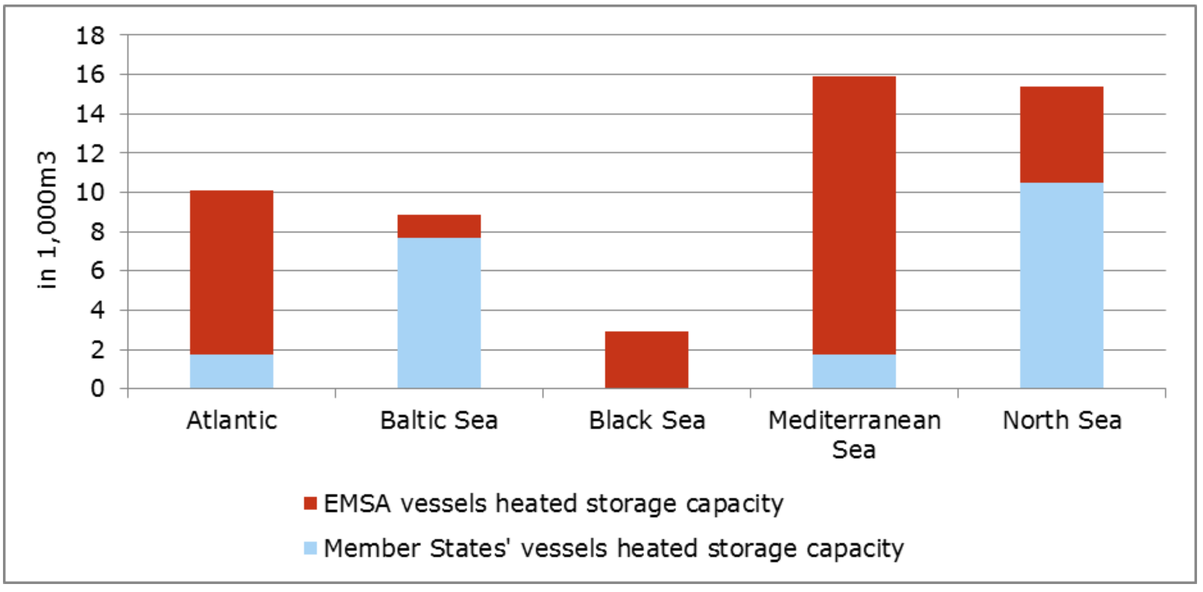
The combined **storage capacity** of EMSA's vessels and Member States vessels with a capacity above 700 m^3 amounts to 147,909 m^3. Of this capacity, 42% is attributed to EMSA's contracted vessels. Figure 47 below compares the storage capacity of vessels in different regions. The significant capacity of vessels in the North Sea should be noted, as well as the comparably high storage capacity of EMSA's contracted vessels in the Atlantic Ocean, the Black Sea and the Mediterranean Sea topping-up the vessels with small or no storage capacity of the EU and EFTA Member States in these regions.

Figure 47: Total capacity of EMSA vessels and Member States' vessels with a capacity above 700 m^3, 2016.



Across the regions, EMSA and the EU and EFTA Member States have a combined **heated storage capacity** of more than 90,000 m^3. When only taking Member States' vessels with a capacity above 700 m^3 into account the combined heated storage capacity amounts to 53,000 m^3. As presented in Figure 48 below, in the Baltic and North Sea the Member States have large scale vessels which can provide heated storage whereas across the other regions, EMSA's contracted vessels present the largest share of heated storage capacity.

Figure 48: Comparison of the heated storage capacity in m^3 of EMSA vessels and Member States' vessels with a capacity above 700 m^3, per region, 2016.



5.3 Expected future development of capacities

Interviews with officials from EU and EFTA Member States and Regional Agreements showed that most countries have plans to marginally **increase their oil pollution response capacities**, especially with respect to **equipment** such as booms or skimmers. Many suggested that they will update their equipment based on new technological developments.

Limited changes are expected in terms of the number and storage capacity of vessels. Among the 13 national officials interviewed, three indicated that they planned to increase the number of vessels by one or two until 2020. None of the countries reported plans to reduce their capacity in response to EMSA's provided services. It was reported that two additional Member States which were not interviewed were planning to increase their number of vessels. No indications were provided concerning the capacity of these planned vessels.

5.4 Capacities of Third Countries

In case of an oil spill in the Mediterranean and the Black Sea, Third Countries provide additional response capacities. Turkey's Coastal Safety Agency holds two oil spill response vessels with a combined storage capacity of 1,400 m^3, booms, skimmers and heated storage. These vessels can be deployed in the Mediterranean and the Black Sea.[253]

Private companies provide additional capacities in the Mediterranean Sea. Turkish oil spill response companies can deploy up to 46 emergency response vessels and provides floating and shore storage.

The international Oil Spill Response Alliance (OSRA) combines resources of its members across the Mediterranean Sea, including Malta, Tunisia, Greece, Libya (currently not available) and Gibraltar. Services are also provided in Egypt and Turkey.

OSRA provides OPR equipment for hire, agreements for Tier 2 stand-by capacity as well as Tier 3 emergency coverage through its network. In Sfax, Tunisia, OSRA has an oil spill response base for Tier 1 and 2 spills. The company provides support to various government agencies and operators in the oil and gas industry.[254]

Mavi Deniz, another private contractor based in Turkey, also provides OPR equipment for hire mostly adapted for Tier 1 and 2 spills.[255]

5.5 Conclusion on Part 4

The results of Part 4 show that overall, Member States' number of OSRVs has most significantly increased in the Baltic and Mediterranean, whereas it has decreased slightly in the Atlantic and Black Sea between 2012 and 2016. Interviewed national officials have not indicated that their fleet would decrease. Some Member States have, on the contrary, signalled future increases to their fleet in the order of one or two vessels. The interviewees have not indicated that the size of their country's fleet had changed based on the services provided by EMSA.[256]

When comparing EMSA' and the Member States' fleets, it appears that the Agency continues to provide the largest volume of storage- and heated storage capacity. The combined storage capacity of EMSA's vessels and Member States vessels with a capacity above 700 m^3 amounts to about 147,909 m^3. Of this capacity, 42% is attributed to EMSA's contracted vessels. Similarly, the total volume of heated storage capacity amounts to 53,135 m^3, of which 59% is attributed to EMSA's contracted vessels.

[253] Source: Turkish Coastal Safety Agency.

[254] OSRA: Tunisia Operations Base. Available at: http://www.osraint.com/sites/default/files/OSRA_factsheet_Tunisia_v2-1.pdf

[255] Source; Mavi Deniz, direct communication.

[256] This conclusion is based solely on data for the years 2012 and 2016 as anterior data has proven lacked detail and accuracy.

6. OVERALL CONCLUSIONS AND RECOMMENDATIONS

The findings of the study highlighted in the preceding sections of this report form the basis of this section, which contains the key conclusions and recommendations for improving the cost efficiency and/or cost effectiveness of EMSA's actions in the Pollution Response field.

In line with the Terms of Reference for this assignment, only such recommendations and service modifications as conform to EMSA's mandate are presented.

6.1 Key conclusions

This section presents the key conclusions arising from the findings described throughout this report.

Conclusion 1: Through its establishment of an extensive network of OSRVs, stockpiles of dispersant, and its equipment assistance service (EAS), EMSA has adequately implemented its explicit mandate of providing "*operational assistance and support, on request, with additional means, such as standby anti-pollution ships and equipment, Member States' pollution response actions in the event of accidental or deliberate pollution caused by ships and oil and gas installations".*[257]

The main arguments supporting this conclusion are that:

- EMSA's oil pollution activities adequately fulfil all the minimum criteria outlined in the documents that operationalise its mandate in this area.[258]
- In our assesment, EMSA's OPR services represent an effective, state-of-the-art oil spill response capability which is able to provide urgent support to one or more Member States, Candidate Countries or Third Countries that share a regional basin with the EU and are severely threatened by the consequences of a major marine oil spill.
- The deployment of new vessels, their technical specifications, and the stockpiles of dispersant established since 2013, all demonstrate that the Agency has taken steps to adapt its capabilities to meet its new mandate of addressing the risks connected with oil and gas installations.
- With regard to the Member States' current capabilities, EMSA seeks to cover the perceived existing gaps in Tier III response capacity by topping up the capacities of MS for all the waters of the EU.

Conclusion 2: Theoretical models suggest that EMSA's oil pollution response activities would be cost effective when compared to the economic consequences that would result from the absence of capacity on its part to adequately deal with an oil spill and prevent it from reaching the shoreline.

Conclusion 3: EMSA fulfils the requirements of its mandate within (and up to) the budget allocated to it for this purpose in a cost-efficient manner.

This conclusion is based on the fact that the level of service currently provided by EMSA could not be replicated at lower cost using any feasible alternative model. Nevertheless, a series of modifications to the current service model which have the potential to increase the efficiency of EMSA's services have been identified. These are presented and discussed below.

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[257] Art. 2 (3) d of Regulation 1406/2002/EC, as amended.

[258] The MAF II, the Action Plan for Oil Pollution Preparedness and Response of 2004, complemented by the 2013 Action Plan for Response to Marine Pollution from Oil and Gas Installations, as well as Regulation (EC) No 1406/2002 as amended establishing EMSA, and EMSA's 5-year Strategy.

Conclusion 4: The existence of EMSA's oil pollution response services for topping up national and private resources does not seem to be having an adverse impact on the level of preparedness of the EU Member States and EFTA countries; this has remained stable over the period analysed, and appears set to follow the same trend looking ahead towards 2020.

6.2 Recommendations

This section presents the list of recommendations stemming directly from the findings of this study.

In order to provide clarity and transparency, each recommendation is associated with indications with respect to:

- The content of the action proposed;
- The main arguments justifying its consideration;
- The anticipated impacts;
- Potential risks to be considered.

Table 70: Recommendation 1: Pursue opportunities to reduce the availability fees paid to contractors

Recommendation
Pursue opportunities to reduce total contract costs. EMSA can undertake a variety of actions to optimise its contract costs. Primarily, changes to the established procurement procedures could be enacted in pursuit of the following goals: (a) Expanding the pool of eligible candidates bidding for a given procurement contract, and (b) encouraging greater price competition among preselected candidates. In terms of increasing the potential pool of applicants, EMSA should streamline the tendering procedure by: (i) Continuing[259] to systematically promote the calls for tender as widely as possible among relevant target groups (e.g. ship owner associations, maritime authorities, equipment manufacturers, shipping companies and specialised media). (ii) Streamlining the tender specifications and associated annexes in order to provide a more user-friendly experience for potential tenderers (e.g. by means of better-structured tender specifications, in particular those pertaining to the second stage of the procedure, using fewer cross-references, listing the requirements more concisely, eliminating any information not directly relevant to the procurement procedure, etc.). (iii) Sending signals which emphasise the stability of the market being created (i.e. informing stakeholders in advance about the level of service EMSA plans to establish and maintain within each region over a particular period of time). With respect to the encouragement of greater price competition, EMSA could consider some of the options outlined below, depending on its needs and specific objectives as they relate to a given procurement process. (i) The Score for the Price of the 'Availability' criterion should be weighted much more heavily than the 'Score for the Price of Contracting the Vessels' criterion when calculating the 'Overall score for the price' award criteria (SP). (ii) The formula for calculating the Score for the Price of the 'Availability' criterion could be simplified in order to highlight its importance as a benchmark against which to judge competitors. (iii) EMSA should consider the feasibility and appropriateness of excluding equipment purchase (and hence all the costs associated with purchase) from the price criterion. In order to achieve this, EMSA would have to purchase equipment via separate equipment procurement procedures (which could offer a potential cost saving, but at the expense of adding to the Agency's administrative burden). (iv) EMSA should increase the total number of permitted contract renewals from one to two.
Justification: By designing the concept of vessel availability contracts, EMSA has created both demand and supply in a unique market that did not previously exist. At present, EMSA is the only buyer of vessel availability contracts, while in theory a large number of vessels within Europe could potentially become sellers of the service being sought by EMSA. This is a clear example of a monopsony, a market structure defined by the major advantage of the buyer (EMSA) over the sellers (contractors). Theoretically, because of the novelty of the market and the demanding

[259] EMSA has actively promoted procurement procedures for OSRVs in the past, such as in the context of procurement procedure EMSA/CPNEG/17/2016 for standby oil spill recovery vessels, which was launched in 2016 (covering the southern Black Sea). EMSA promoted the procedure using direct communication based on a list containing more than three hundred stakeholders; it also used specialised media to generate knowledge of the opportunity.

Recommendation
specifications set for potential vessels, the amount of possible sellers could be expected to be low to begin with, and to steadily increase as the opportunity becomes apparent to additional players. In this situation, the price paid by EMSA should decrease steadily over time until it stabilises at an equilibrium point dictated by the cost price plus a reasonable margin. Given the differences observed between the availability fees paid by the current contractors, both within regions and across the EU (see part 2 of this study), it is clear that this equilibrium has not yet been reached, implying that the market still has the capacity to evolve in a way that would benefit EMSA. Because of the specificity of the request, the tender documents are complex and require a high degree of procurement experience and managerial capacity for the potential players in the market to be in a position to submit a proposal. Such barriers may result in discouraging feasibly eligible sellers from participating in the market. In this situation, it is in EMSA's interest to encourage this market (by making the opportunity known to more potential sellers), to lower the barriers to entry (by simplifying and streamlining the tender documentation and making it easier for relevant sellers to participate) and, at the same time, to encourage price competition among the contractors (through the changes proposed to the manner in which the price criterion is calculated and assessed). The market for equipment is somewhat different than for VAC (because EMSA does not have the same buying power as in the case described above). Nevertheless, the current situation, in which contractors are asked to buy equipment and be reimbursed by EMSA, may be inefficient for two reasons: (i) it impedes EMSA's ability to encourage price competition in relation to availability fees (due to the fact that the final score for the Price of Availability will include both equipment costs, availability fees and pre-fitting costs) and (ii) it dilutes EMSA's buying power by transferring the buying responsibility to the contractors, who will arguably have less ability to seek and receive the best price for the items purchased. However, it is worth noting that this approach does provide EMSA with some benefits in relation to the administrative burden, by *inter alia* eliminating the need for separate procurement procedures for the purchase of equipment and ensuring that it is compatible with current (and prospective) vessels. The potential for cost savings and the additional benefits that accrue from separating equipment procurement from VAC procurement nevertheless justify the imperative for EMSA to consider the purchase of equipment separately from the contracting of vessels. However, it should be noted that as the current vessel contracts are likely to expire while EMSA's equipment continues to remain functional, such a separation between the procurement of vessel contracts and equipment will occur more often by a propitious alignment of circumstances than by default.
Expected impact: The market has not responded in accordance with the economic theory, and there are no strong indications that the market is changing in EMSA's favour. Nevertheless, the strong economic theory justification and the low costs of the actions recommended (compared with the anticipated benefits) justify this recommendation. The desired impact of the measures proposed is a steady decrease in the overall costs (in particular of the availability fees and, potentially, of the equipment costs) and the increase over time of the pool of relevant contractors which could provide EMSA with services of sufficient quality. There is a risk associated with the practice of systematically reducing the ceiling for availability fees, in the form of decreased interest leading to a correspondingly lower rate of response to EMSA's procurement notices.[260] Nevertheless, the actions taken to increase the pool of suitable and interested candidates should sufficiently offset this risk.
Timeline for implementation: Starting with next procurement procedure

[260] It is important to note that some of EMSA's attempts to procure vessels have not been successful, due to a lack of suitable candidates. However, in such cases other factors besides the motivational adequacy of the availability fee ceiling stipulated may have played a much greater role. While such factors (e.g. the existence of a commercial market for suitable vessels in the regions targeted by EMSA) are outside EMSA's control, the measures taken under Recommendation 1 would help to increase the pool of vessels interested in taking up such contracts.

Table 71: Recommendation 2: Match the contents of the EAS stockpiles to the needs of the Member States in the respective regions.

Recommendation
Cooperate more with Member States when establishing Equipment Assistance Stockpiles: EMSA should engage in a collaborative process with the Member States to ensure that the contents of the EAS stockpiles plug acknowledged gaps, top up the Member States' capacities in the regions they are placed in, and are suitable for responding to the specific risks identified in each region.
Justification: The costs of establishing and maintaining the EAS stockpiles are relatively high, and there is evidence to suggest that each stockpile contains some elements which may not provide the utility envisioned by EMSA in a realistic scenario, or that may be less appropriate in the actual risk context (e.g. the practical utility of fire booms is questionable if in-situ burning is unlikely to be a response measure that will be resorted to in any of the regions where EMSA is providing such booms).[261]
Expected impact: The aim of this recommendation is to match the contents of the EAS stockpiles to the needs of the Member States in the respective regions. The improvement of communication between EMSA and the Member States regarding the development and set-up of EAS stockpiles may be necessary, but the stockpile itself must also be adequate in reference to EMSA's mandate to provide tier-III response capacity.
Timeline for implementation: When planning to re-tender the contents of any EAS

Table 72: Recommendation 3: Support Member States to determine what comprises the adequate level of service to be provided by EMSA in each region.

Recommendation
Perform an oil spill risk assessment to analyse the need for oil pollution response services. EMSA should work with all the regional agreements and coastal Member States to determine the environmental risk of oil spills and their potential impacts, in order to provide input for the decisions that must be made regarding what comprises an efficient level and response options.
Justification: This study has found that EMSA has been successful in implementing its mandate, and that it has used the budget assigned to it for the purpose of providing a cost-efficient level of service which cannot be matched by alternative service models. Nevertheless, the broader stakeholder community has raised some concerns about the costs associated with EMSA's oil pollution response services. These perspectives are based on a perceived decrease in the level of oil pollution risks within the EU due to such factors as improved prevention measures, improvements in legislation, surveillance, monitoring, and the enforcement of standards. While the North Sea and Baltic Regional Agreements have taken steps to perform risk assessments within their regions, less analysis has been conducted regarding the Atlantic, the Mediterranean and the Black Sea. In any case, clear assessments of the level of risk and the corresponding level of preparedness which should be instituted to mitigate the perceived risk level are lacking. While the level of acceptable residual risk can only be set by the respective coastal Member States, the absence of data outlining these environmental risks and their potential impacts makes it difficult to determine the most efficient level of oil pollution response capacity that needs to be put in place to mitigate them. It is this lack of information that is giving rise to the concern expressed by some stakeholders regarding the funds that have been dedicated to the oil pollution response implemented by EMSA.
Expected impact: An updated risk assessment would help the EU Commission and co-legislators (i.e. the MS through the Council and the EU Parliament) to build consensus regarding the magnitude of EMSA's investments in the next financial framework (2021-2028), and to optimise their efficiency.
Timeline for implementation: 2018

Table 73: Recommendation 4: Continue to take part in operational exercises whenever possible

Recommendation
Take part in operational exercises whenever possible: EMSA should continue its policy of taking part in the operational exercises organised by the Member States, and should actively seek to be invited to participate in such exercises in order to highlight its capabilities, to improve the operational readiness of the OSRVs' crews, and to improve the joint coordination of the participating vessels and the organising authority.
Justification: The results of the drills and exercises show that EMSA has a well-structured system in place for maintaining the service, with regular quarterly drills being conducted with each vessel, and with 100% of these required drills having been executed. The ability of the crews of EMSA's vessels to deploy and

[261] This example is purely illustrative, as fire booms may also be used to contain burning oil spilled from a ship. This adds to their potential utility.

Recommendation
manoeuvre the spill response equipment is reported as being satisfactory overall. However, several survey respondents reported not having any direct experience with EMSA's Drills and Exercises Programme (7 out of 21 respondent countries[262] in the survey), and a few others suggested that additional exercises should be organised.[263]
Expected impact: The benefits from taking part in the operational exercises in terms of improved operational readiness, the increased awareness of EMSA's capabilities, and the value added to the response operations are clearly reflected in the data analysed in this study. EMSA would continue to derive benefit from continuing its practice of participating in the operational drills and exercises; but more importantly, by continuing to demonstrate the quality of its services, it would encourage the Member States to call on those services in the event of need.
Timeline for implementation: On-going

Table 74: Recommendation 5: Explore the possible shared use of multi-purpose vessels

Recommendation
Assess the availability of multi-purpose vessels with an oil pollution response capability for shared use among EMSA and competent authorities: EMSA and co-financers should assess the market availability of MPVs capable of carrying out coast guard, fisheries control and oil pollution response functions.
Justification: Due to their possible multiple functions, MPVs can be shared and co-financed among several Member State competent authorities and EU agencies, reducing the cost of the vessels to all co-financers. In addition, MPVs offer interesting advantages over OSRVs as they can possess additional capabilities to address oil and HNS spill incidents. Alternative Model 5.2 discussed in Part 3 offers interesting prospects for the inclusion of MPVs in EMSA's network of vessels in a sharing arrangement between EBCGA, EFCA and EMSA. While MPVs able to carry out the functions required from all three agencies do exist, the market availability of such MPVs for chartering could not be assessed in this study.
Expected impact: The cost of chartering MPVs is high relative to the chartering of an OSRV, mainly due to their high building and operational costs. In our estimations, if EMSA were to replace two VACs and charter two MPVs instead, bearing 20% of the total cost of chartering the MPVs for OPR, then the economic cost of establishing the service for EMSA would increase by about € 6 M over 7 years. The advantages of these vessels can counterbalance this cost.
Timeline for implementation: 2017 and onwards

[262] Including 19 EU Member States and 2 EEA/EFTA countries.

[263] The survey and interviews contained a specific question about whether the respondents were familiar with EMSA's Drills and Exercises Programme.

APPENDIX 1 - OVERVIEW DATA ON THE NETWORK OF OIL SPILL RESPONSE VESSELS

Table 75: EMSA OSRVs' general characteristics and contract information[264]

	Vessel	Vessel category	Contractor	Region	Class	Homebase	Age of vessel (years)	Contract expiry date	Contract renewal option (years)	Maximum mobilisation time (hours)
1	Monte Arucas	Main	Ibaizabal	Atlantic	Oil tanker	Ferrol	7	04/04/2017	4	12
2	Forth Fisher	Main	James Fisher Everard	Atlantic	Oil tanker	Cobh	19	12/06/2018	4	24
3	Galway Fisher	Secondary	James Fisher Everard	Atlantic	Oil tanker	Cobh	19	12/06/2018	4	24
4	Bahia Tres	Main	Mureloil	Atlantic	Oil tanker	Sines	9	17/07/2017	4	22
5	Mencey	Main	Petrogas	Atlantic	Oil tanker	Las Palmas	12	31/12/2020	4	24
6	Ria de Vigo	Main	Remolcanosa	Atlantic	Offshore supply	Vigo	31	11/03/2019	4	22
7	Norden	Main	Stena Oil	Baltic Sea	Oil tanker	Gothenburg	10	31/12/2020	4	24
8	Enterprise	Main	Bon Marine	Black Sea	Offshore supply	Varna	41	20/09/2016	4	14
9	Amalthia	Main	Petronav	Black Sea	Oil tanker	Constanta	18	20/05/2019	4	24
10	Marisa N	Main	Castalia	Mediterranean Sea	Oil tanker	Trieste	36	15/10/2018	4	7
11	Brezzamare	Main	Ciane	Mediterranean Sea	Oil tanker	Genoa	7	26/08/2017	4	24
12	Aktea	Main	EPE	Mediterranean Sea	Oil tanker	Piraeus	27	31/03/2018	4	16
13	Aegis I	Back-up	EPE	Mediterranean Sea	Offshore supply	Piraeus	31	31/03/2018	4	3
14	Santa Maria	Main	Falzon	Mediterranean Sea	Oil tanker	Marsaxlokk	39	25/06/2017	4	24
15	Monte Anaga	Main	Naviera Altube	Mediterranean Sea	Oil tanker	Algeciras	6	19/03/2016	4	24
16	Alexandria	Main	Petronav	Mediterranean Sea	Oil tanker	Limassol	8	04/05/2019	0	24
17	Balluta Bay	Main	Tankship	Mediterranean Sea	Oil tanker	Valletta	35	14/05/2016	4	12
18	Interballast III	Main	DC Industrial	North Sea	Hopper dredger	Ostend	36	23/06/2019	4	24
19	DC Vlaanderen 3000	Main	DC Industrial	North Sea	Hopper dredger	Ostend	14	30/06/2019	4	24
20	Mersey Fisher	Main	James Fisher Everard	North Sea	Oil tanker	Sunderland	18	13/05/2018	4	28
21	Thames Fisher	Secondary	James Fisher Everard	North Sea	Oil tanker	Sunderland	19	13/05/2018	4	28

[264] Source: EMSA. (2016). Updated EMSA inventory (July 2016). (Unpublished); and EMSA. (2014). Network of Standby Oil Spill Response Vessels and Equipment - Handbook 2014. Retrieved from: http://www.emsa.europa.eu/news-a-press-centre/external-news/download/2973/1439/23.html

Table 76: EMSA OSRVs' technical specifications and equipment capabilities[265]

	Vessel	Max. speed (kn)	Recovery oil storage capacity (m^3)	Heating capacity (kW)	Pumping capacity (m^3/h)	Vessel flash point threshold capability	Bow thruster (yes=1, no=0)	Number of sweeping arms	Nr of skimmers	High-capacity skimmer (yes=1, no=0)	Total nr of booms	Nr of heavy duty booms	Disp. spraying system	Oil Slick Detection System
1	Monte Arucas	10	2952	1800	950	>60C	1	2	1	1	2	0	No	Miros
2	Forth Fisher	12	4754	3488	3400	<60C	1	2	1	0	2	2	No	Miros
3	Galway Fisher	13	4754	3883	3400	<60C	1	2	1	0	2	2	No	Miros
4	Bahia Tres	12.7	7413	2300	2050	>60C	1	2	1	0	2	0	Yes	Seadarq
5	Mencey	*13*	3500	*2000*	*2230*	<60C	*1*	2	1	1	2	0	Yes	Miros
6	Ria de Vigo	14.25	1522	750	625	>60C	1	2	2	1	0	3	No	Miros
7	Norden	12	2880	1163	*900*	>60C	*1*	2	1	1	2	0	No	Navico
8	Enterprise*	12.7	1374	1000	700	>60C	1	2	1	0	0	3	No	Miros
9	Amalthia	12	5154	2907	*1050*	<60C	*1*	2	2	1	2	2	No	Miros
10	Marisa N	12	1562	1493	600	<60C	1	2	2	1	2	0	No	Miros
11	Brezzamare	12.1	3288	1813	1200	<60C	1	2	1	0	2	0	No	Consilium
12	Aktea	12.6	3000	3000	1000	<60C	1	2	2	1	2	0	No	Seadarq
13	Aegis I**	12.7		0	0	>60C	1	0	1	0	2	2	No	*None*
14	Santa Maria	14	2421	3630	1780	<60C	1	2	1	1	2	2	No	Seadarq
15	Monte Anaga	12.5		2000	1000	>60C	1	2	2	1	2	0	No	Seadarq
16	Alexandria	12.6	7458	5742	1850	<60C	1	2	2	1	2	2	Yes	Miros
17	Balluta Bay	12	2800	2209	1260	<60C	1	2	1	0	1	0	Yes	Seadarq
18	Interballast III	12	1886	785	1460	>60C	1	2	1	0	2	2	No	Miros
19	DC Vlaanderen 3000	13	2744	1226	1460	>60C	1	2	1	0	2	2	No	Miros
20	Mersey Fisher	12	5028	2907	3400	<60C	1	2	1	0	2	2	No	Miros
21	Thames Fisher	12	5028	2907	3400	<60C	1	2	1	0	2	2	No	Miros

[265] EMSA. (2016). Updated EMSA inventory (July 2016). (Unpublished)
EMSA. (2014). Network of Standby Oil Spill Response Vessels and Equipment - Handbook 2014. Retrieved from: http://www.emsa.europa.eu/news-a-press-centre/external-news/download/2973/1439/23.html
EMSA. (2016). Vessels Network: Technical Specifications. Retrieved from: http://www.emsa.europa.eu/oil-spill-response/oil-recovery-vessels/vessel-technical-specifications.html

** The contract for the Enterprise expired in September 2016. EMSA has not foreseen to renew the contract but will launch a tendering procedure for that region in 2017.*
*** The function of the Aegis I as a back-up vessel for the Aktea reduces its needed capabilities.*

Table 77: EMSA OSRVs' equipment specifications

	Vessel	Equipment
1	Monte Arucas	- 2 Koseq sweeping arms - 2 Lamor heavy duty SPI 250m (LSP 1900) booms - 1 Lamor High-capacity skimmer weir/brush (LWS 1300) skimmer
2	Forth Fisher or Galway Fisher	- 2 Koseq sweeping arms - 2 Vikoma heavy duty SPI 250m (Hi-Sprint 2000) booms - 1 Desmi weir (Tarantula) skimmer
3	Bahia Tres	- 2 Lamor sweeping arms - 2 Norlense SPI 250m (NO-800R) booms - 1 Lamor brush (LFF 100 2C) skimmer - 1 Jason dispersant spraying system (2 arms)
4	Mencey	- 2 Lamor sweeping arms - 2 Lamor SPI 250m (Ocean Master 1900) booms - 1 High-capacity skimmer weir/brush (LWS 1300) skimmer - 1 Lamor dispersant spraying system (2 arms)
5	Ria de Vigo	- 2 Koseq sweeping arms - 2 Desmi heavy duty SPI 250m (Ro-Boom 2000) booms - 1 Desmi weir/brush/disc (Tarantula) skimmer - 1 Framo High-capacity (Transrec 150) skimmer - 1 Vikoma weir boom 180
6	Norden	- 2 Lamor sweeping arms - 2 Lamor SPI 250m (Ocean Master 1900) booms - 1 Noren High-capacity (Normar 250TI) skimmer
7	Enterprise	- 2 Lamor sweeping arms - 2 Lamor heavy duty 250m (HDB 2000) booms - 1 Lamor weir/brush (LWS1300) skimmer - 1 Vikoma weir boom 180
8	Amalthia	- 2 Lamor sweeping arms - 2 Lamor heavy duty 250m (HDB 2000) booms - 1 Lamor brush (LFF 100 2C) skimmer - 1 Framo High-capacity (Transrec 150) skimmer
9	Marisa N	- 2 Lamor sweeping arms - 2 Markleen SPI 250m (Uniboom X-1900) booms - 1 Lamor brush (LFF 100 2C) skimmer - 1 Lamor High-capacity skimmer weir/brush (LWS 1300)
10	Brezzamare	- 2 Koseq sweeping arms - 2 Markleen SPI 250m (Uniboom X-1900) booms - 1 Desmi weir/brush/disc (Tarantula) skimmer
11	Aktea	- 2 Koseq sweeping arms - 2 Markleen SPI 250m (Uniboom X-1900) booms - 1 Foilex weir (TDS 250) skimmer - 1 Noren High-capacity (Normar 250TI) skimmer
12	Aegis I	- 2 Desmi heavy duty SPI 250m (Ro-Boom 2000) booms - 1 Desmi weir/brush (Tarantula) skimmer
13	Santa Maria	- 2 Koseq sweeping arms - 2 Desmi heavy duty 250m (Ro-Boom 2000) booms - 1 Noren High-capacity (Normar 200TI) skimmer
14	Monte Anaga	- 2 Lamor sweeping arms - 2 Norlense SPI 250m (NO-800R) booms - 1 Lamor brush LFF (400 W) skimmer - 1 Noren High-capacity (Normar 250TI) skimmer
15	Alexandria	- 2 Lamor sweeping arms - 2 Lamor heavy duty SPI 250m (LAN 2200) booms - 1 Lamor weir/brush (LWS1300) skimmer

	Vessel	Equipment
		- 1 Noren High-capacity (Normar 250TI) skimmer - 1 Jason dispersant spraying system (2 arms)
16	Balluta Bay	- 2 Koseq sweeping arms - 2 Markleen SPI 300m (Uniboom X-1900) booms - 1 Desmi weir (Tarantula) skimmer - 1 Jason dispersant spraying system (2 arms)
17	Interballast III	- 2 Koseq sweeping arms - 2 Vikoma heavy duty SPI 250m (Hi-Sprint 2000) booms - 1 Markleen weir (WMS 280) skimmer
18	DC Vlaanderen 3000	- 2 Koseq sweeping arms - 2 Vikoma heavy duty SPI 250m (Hi-Sprint 2000) booms - 1 Markleen weir (WMS 280) skimmer
19	Mersey Fisher or Thames Fisher	- 2 Koseq sweeping arms - 2 Vikoma heavy duty SPI 250m (Hi-Sprint 2000) booms - 1 Desmi weir (Tarantula) skimmer

Table 78: Number and type of stand-alone equipment sets per location with pumping capacity[266]

OPR Equipment	Fire Boom (150 m)	Speed Sweep	Current Buster	Roboom-Roskim Integrated System	Trawl Net System
No. of sets in EAS Baltic Sea	4	2	1	1	2
No. of sets in EAS North Sea	4	2	1	0	2
(Maximum) pumping capacity per set of equipment	N/A	100 m^3/hour	100-125 m^3/hour	100 m^3/hour	N/A

Table 79: Number of Drills and Exercises per year (2014-2016)[267]

Year	Quarterly drills	Operational exercises (and number of vessels involved)	Notification exercises (and number of contractors involved)	Total
2014	61	10 (12)	11 (14)	92
2015	62*	9 (11)	10 (14)	89
2016	79**	10 (12)	10 (14***)	99

* Includes 2 repeated drills.
** Includes 7 equipment condition tests for the EAS and 3 acceptance drills.
*** Includes 12 vessel contractors and, for the first time, 2 EAS contractors.

Acceptance drills are carried out to demonstrate that pre-fitting and modifications to a (newly contracted or upgraded) vessel and that OPR equipment and crew training were successful to prepare the vessel for the tasks under its contract, therefore they are only conducted in the event of a new contract (prior to entering into service) or modification of a vessel's equipment.

Quarterly drills are conducted four times a year subject to the vessel's period of service. They aim verify that the capability of the vessel and specialised equipment, and the skill of the crew, is at an appropriate level to carry out oil pollution response services efficiently. The acceptance of the contractor's quarterly drill report by the Agency is a condition for the payment of the Availability Fee by the Agency.

At-sea operational exercises usually involve the release of simulated oil, the deployment of pollution response vessels from the participants, and the establishment of a unified command structure and lines of communication. These exercises are organised in cooperation with EU Member States and/or Regional Agreements. Because they also involve Member States' own vessels, these exercises assist the integration of EMSA's resources within the response

[266] Source: EMSA. (2016). Key aspects of the Equipment Assistance Service. Retrieved from: http://www.emsa.europa.eu/oil-spill-response/vessel-inventory/key-aspects-of-the-eas.html

[267] Sources: EMSA (direct communication) and EMSA's 2014, 2015 and 2016 Drills and Exercises Annual Reports. Retrieved from: http://www.emsa.europa.eu/

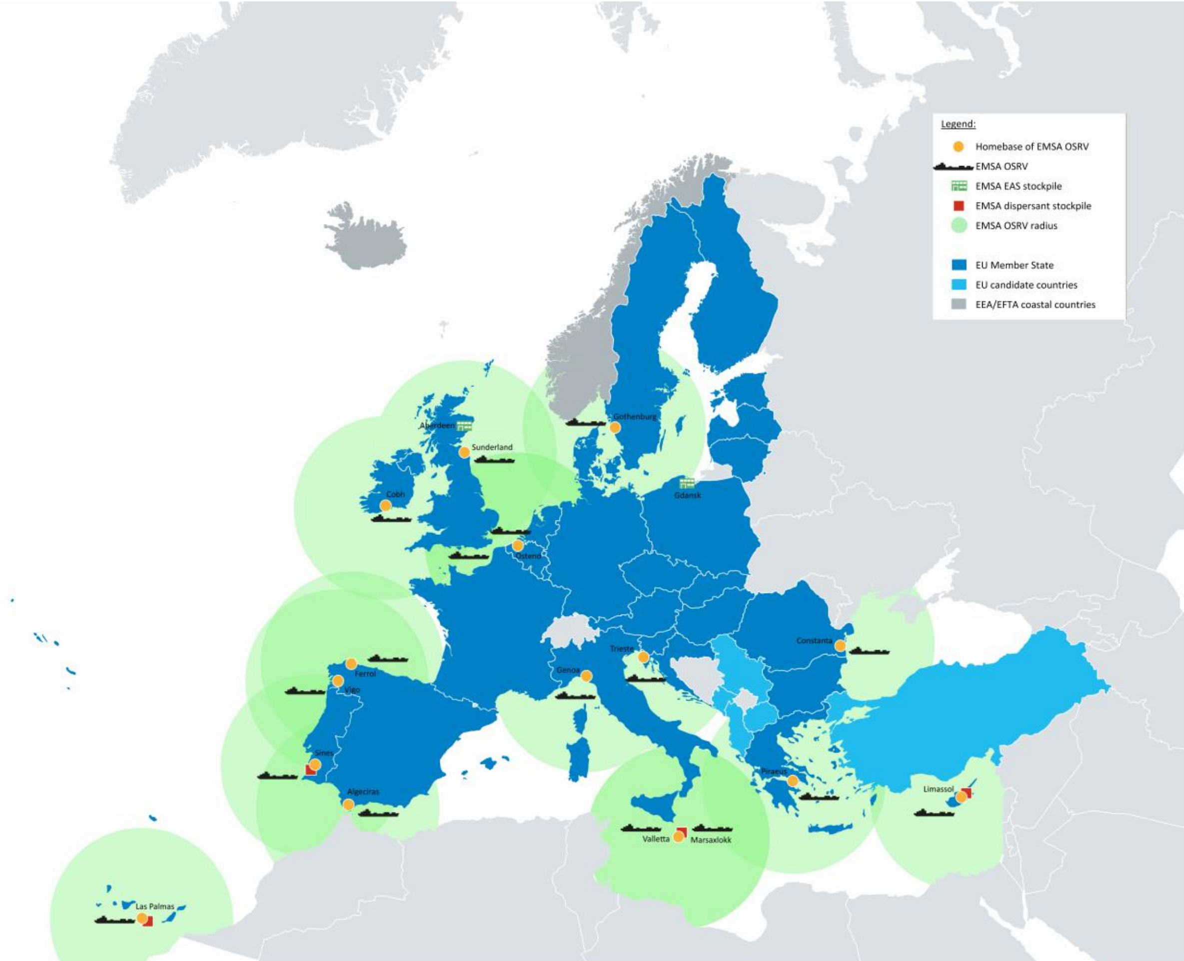
mechanisms of Member States, improving the necessary coordination and cooperation of the EMSA vessels with the coastal State response units.

Notification exercises are usually conducted in conjunction with operational exercises. In addition, ‘standalone’ notification exercises are occasionally carried out. The aim of these exercises is to test and implement agreed procedures and lines of communication for reporting incidents and for requesting and providing assistance. In 2014, the Common Emergency Communication and Information System (CECIS) operated by DG ECHO became the common tool for conducting the notification exercises in the field of response to marine pollution. The main criterion for the evaluation of the notification exercise is the time needed for the Incident Response Contract-Vessel (IRC-V)[268] to be signed by both the EMSA contractor and the Member State requesting assistance

[268] “Incident Response Contract”: This contract is to be concluded between the ship operator and the affected State. This pre-established model contract addresses the actual oil recovery operations. It covers the terms and conditions of the service and includes the associated daily hire rates. Following a request for assistance, EMSA will activate or even pre-mobilise the vessel to facilitate the operation. The command and control during an incident rests with the coastal State using the vessel.

APPENDIX 2 - FIGURES FOR THE ANALYSIS OF THE LOCATION OF EMSA'S OIL POLLUTION RESPONSE SERVICES

Figure 49: Estimated coverage of EMSA OSRVs within 24h from the end of mobilization time, 2016.[269]

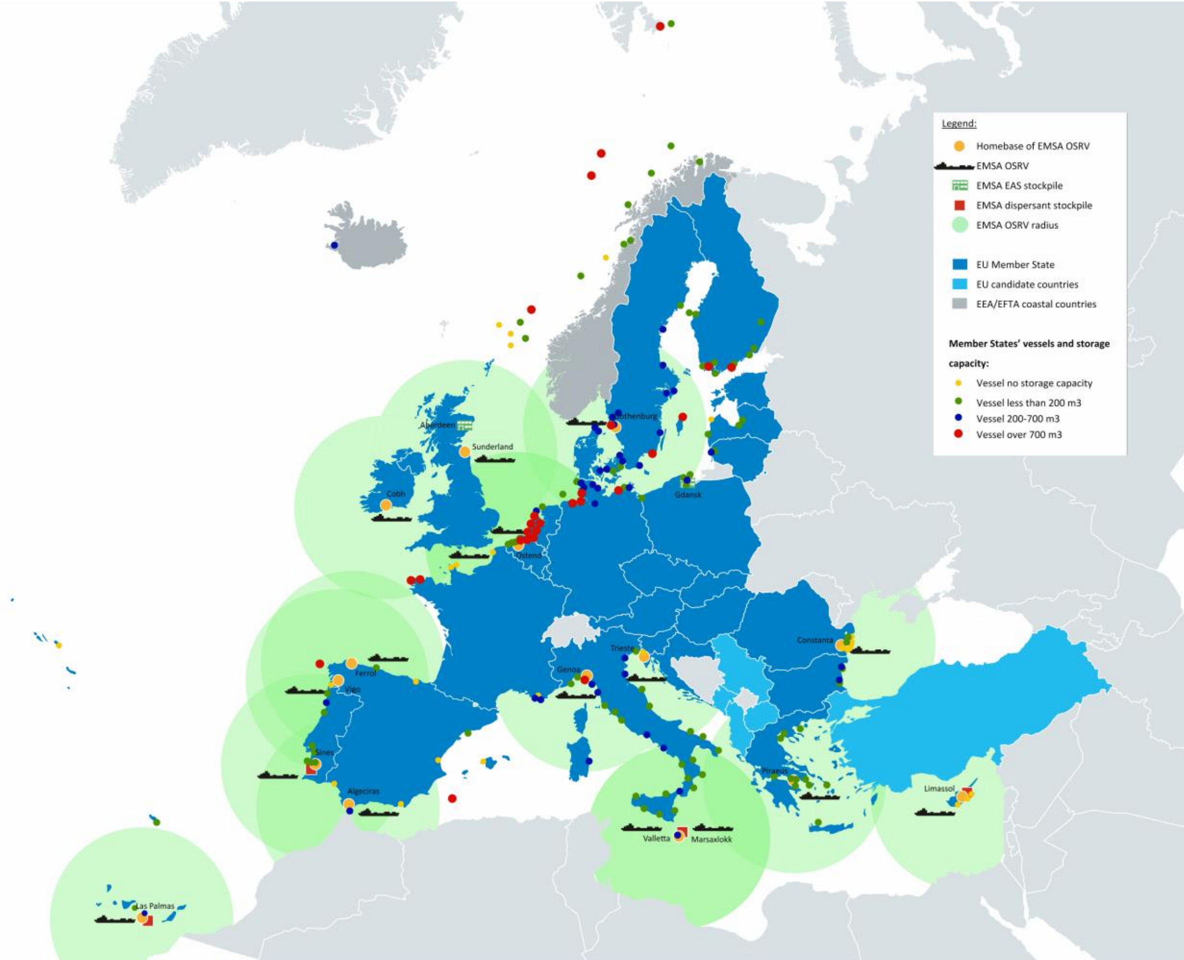


Source: Ramboll, based on EMSA (2016): EMSA's Operational Oil Pollution Response Services (November 2016)[270]

[269] This figure includes vessels Norden and Mencey

[270] Retrieved from: http://www.emsa.europa.eu/operations/pollution-response-services.html. Note that the 24 hour radii on this map are indicative and present some limitations, as ships cannot take direct paths across land. For example, the radius for the vessel located in Gothenburg cannot realistically reach the South East of the Baltic Sea in 24 hours as it must cross the Danish-Swedish strait.

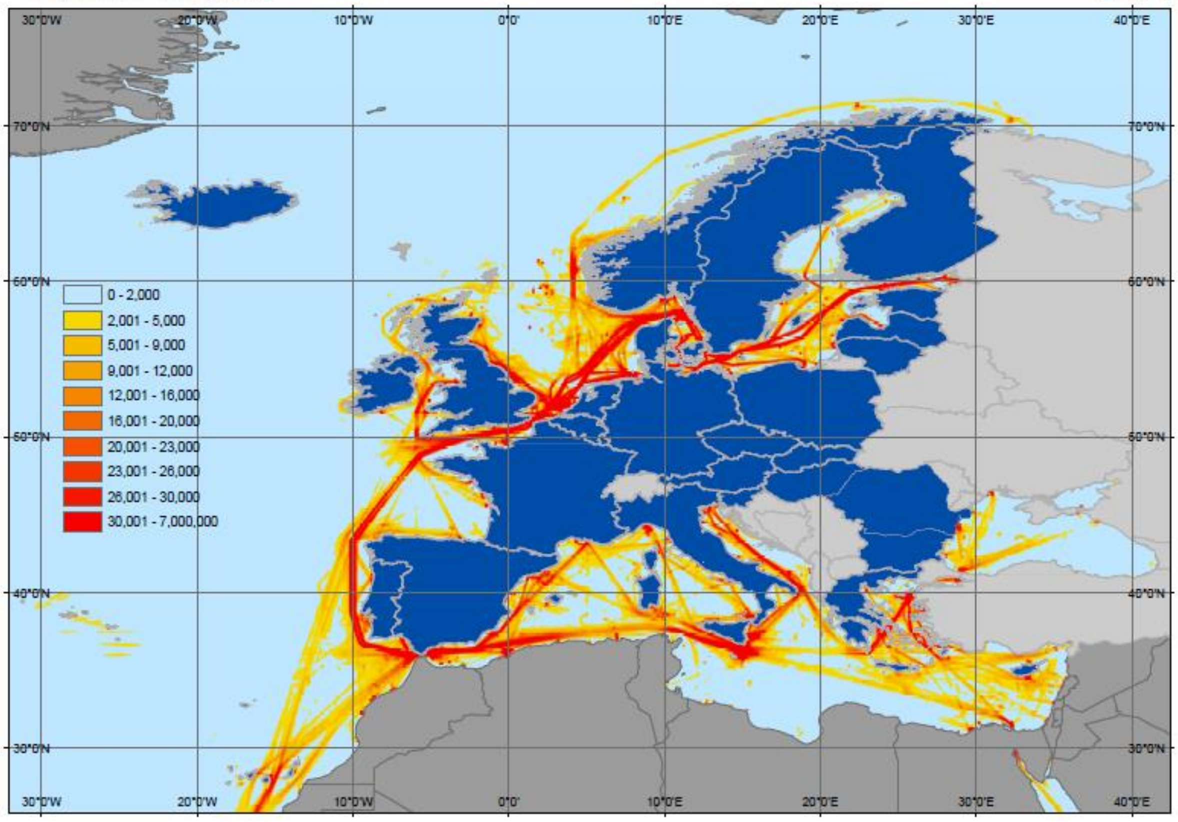
Figure 50: Map of EMSA's services in relation to Member States' vessels and storage capacity for oil recovery in 2016. [271]



This map only shows Member States' vessels and does not include private vessels available for hire or additional vessel capacity such as vessels belonging to ports and municipalities.

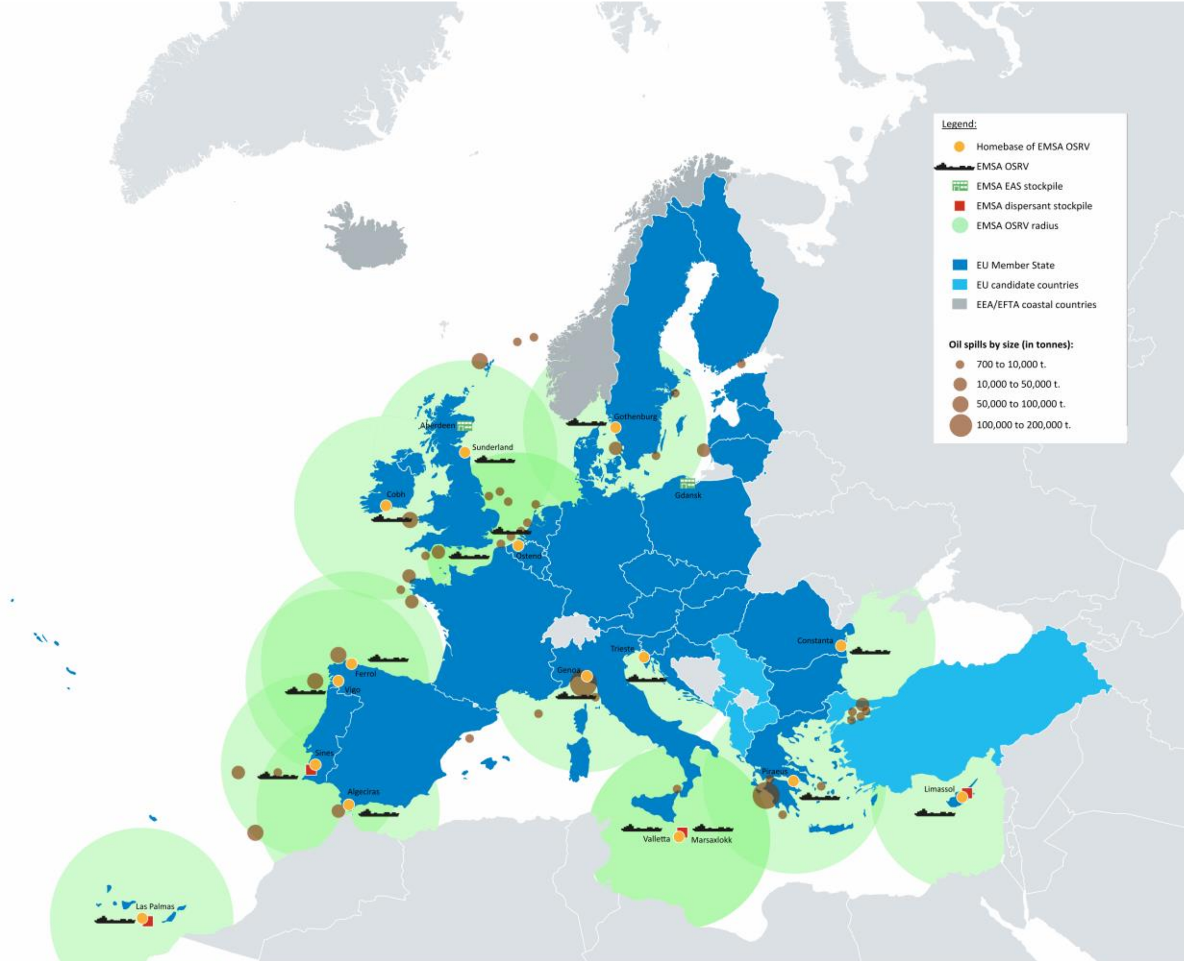
[271] Adapted from: EMSA. (2016). Inventory of EU Member States Oil Pollution Response Vessels 2016. MEMBER STATE VESSELS AND STORAGE CAPACITY FOR OIL RECOVERY, p204.

Figure 51: Tankers traffic density, based on SafeSeaNet data (September 2016).



Source: EMSA Maritime Support Services (2016).

Figure 52: EMSA's services in 2016 and major oil spills (over 700 tonnes) from ships and oil and gas installations between 1980 and 2015.



Data on oil spills collected by ITOPF originates from the shipping press and other sources. This data may differ from other sources.

The map above takes into account all historical data on oil spills provided by ITOPF[272] and triangulated with various sources, including CEDRE's oil spills database,[273] REMPEC data for the Mediterranean,[274] and other web sources.[275] Spills represented in this map are presented in the table below.

It is worth noting that over the period 1980 to 2015, only one recorded spill of over 700 tonnes was attributed to an oil platform (in 2007, about 4,000 tonnes) and the rest to incidents involving ships.

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[272] Historical data for spills from ships in European waters was obtained upon request to ITOPF. (2016). For oil and gas installations, information was triangulated from various sources, including a

[273] Cedre. Retrieved from http://wwz.cedre.fr/en/Our-resources/Spills.

[274] REMPEC. 2016. Mediterranean Integrated Geographical Information System on Marine Pollution Risk Assessment and Response (MEDGIS).

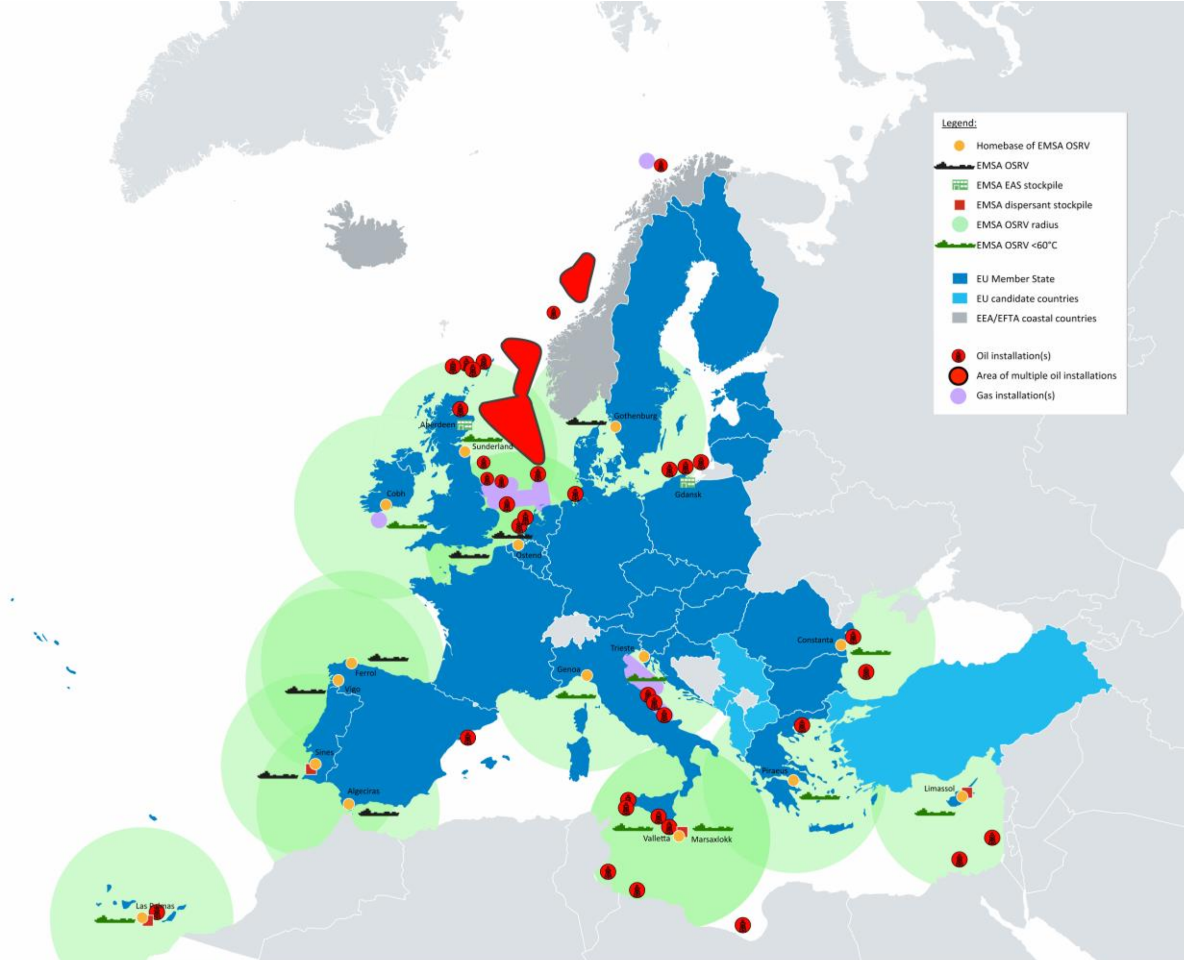
[275] Rig Incident List. Retrieved from http://home.versatel.nl/the_sims/rig/losses.htm

Table 80: List of oil spills between 1980 and 2015 [276]

Year	Oil type	Location	Type of structure (vessel/platform)	Spill size (tonnes, nearest thousand)
1980	Fuel (cargo)	Brittany, France	Oil tanker	14,000
1980	Bunker, crude	Navarino Bay, Greece	Oil tanker	100,000
1980	White product	Turkey, Bosporus	Oil carrier	1,000
1980	Unknown	United Kingdom, South Coast	Oil carrier	1,000
1981	Fuel (cargo)	Klaipedarussia, West Coast	Oil tanker	16,000
1981	White product	Spain, East Coast	Oil tanker	18,000
1981	Fuel (cargo)	Near Dalaro, Sweden	Oil tanker	1,000
1982	Fuel (cargo)	Hook Of Holland, Netherlands	Oil carrier	1,000
1982	White product	Sweden, West Coast	Oil carrier	1,000
1983	Crude	Humber Estuary, United Kingdom, East Coast	Oil carrier	6,000
1985	Crude	Straits Of Messina, Italy	Oil tanker	1,000
1986	Crude	United Kingdom, East Coast	Oil carrier	2,000
1987	Crude	Near Borga, Finland	Oil tanker	1,000
1987	Fuel (cargo)	Netherlands	Oil carrier	1,000
1988	Fuel (cargo)	Off Brittany, France	Oil tanker	2,000
1989	Crude	Portugal, Madeira	Oil tanker	25,000
1989	Crude	United Kingdom, East Coast	Oil tanker	1,000
1990	Fuel (cargo), other	Gibraltar	Combined carrier	10,000
1990	Crude	Greece, South Coast	Oil tanker	1,000
1990	Other	Sweden, South Coast	Oil tanker	1,000
1990	Other	Turkey, Bosporus	Oil tanker	2,000
1990	Crude	Devon, United Kingdom, South Coast	Oil tanker	1,000
1991	Crude	Livorno, Italy, West Coast	Oil tanker	2,000
1991	Crude	Genoa, Italy, West Coast	Oil tanker	144,000
1992	Crude	Greece, East Coast	Oil tanker	2,000
1992	Crude	Norway	Oil tanker	1,000
1992	Crude	Spain, North Coast	Combined carrier	74,000
1993	White product	Belgium	Oil tanker	4,000
1993	Crude	Toulon, France	Oil tanker	2,000
1993	Bunker, crude	Shetland Isles, UK	Oil tanker	85,000
1994	Crude	Oporto, Lisbon, North Portugal	Oil tanker	2,000
1994	Crude	Portugal	Oil tanker	11,000
1994	Crude	Turkey	Oil tanker	33,000
1996	Crude	Milford Haven, Uk	Oil tanker	72,000
1997	White product	Dunkerque, France	Combined carrier	7,000
1997	White product	Cape Pappas, Greece	Oil tanker	1,000
1999	Fuel (cargo)	Bay Of Biscay, France, West Coast	Oil tanker	20,000
1999	Fuel (cargo)	Turkey, Sea Of Marmara	Oil tanker	2,000
2001	Fuel (cargo)	Denmark	Oil tanker	2,000
2002	Bunker, fuel (cargo)	Spain, West Coast	Oil tanker	63,000
2007	Crude	Norway	Oil platform	4,000
2010	White product	Scheveningen, Netherlands	Oil tanker	6,000
2015	White product	Turkey	Combined carrier	1,000

[276] Historical data for spills from ships in European waters was obtained upon request to ITOPF. (2016). For oil and gas installations, information was triangulated from various sources, including a Rig Incident List (retrieved from http://home.versatel.nl/the_sims/rig/losses.htm) and Cedre (retrieved from http://wwz.cedre.fr/en/Our-resources/Spills).

Figure 53: EMSA’s services (and vessels’ radius) and oil and gas installations, 2016.



Source: Ramboll, based on data published by EMSA for EU and EEA/EFTA oil and gas installations[277]

For the approximate location of oil installations in Third Countries, sources are risk assessment studies and online specialised media sources.[278] Locations of oil and gas installations are not directly drawn from precise geographical data or indicative of the specific number of platforms. In addition, new installations may have been set up and others stopped their operations.

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[277] EMSA. (2013). Action Plan for Response to Marine Pollution from Oil and Gas Installations. Figure 1 – Map of offshore installations across ope, p9.

[278] European Commission DG Environment. (2013). Safety of offshore exploration and exploitation activities in the Mediterranean: creating synergies between the forthcoming EU Regulation and the Protocol to the Barcelona Convention. Retrieved from: http://ec.europa.eu/environment/marine/international-cooperation/regional-sea-conventions/barcelona-convention/pdf/Final%20Report%20Offshore%20Safety%20Barcelona%20Protocol%20.pdf

Egypt: European Commission DG Environment. (2013). Safety of offshore exploration and exploitation activities in the Mediterranean.

Israel: http://www.independent.com.mt/articles/2015-02-04/local-news/Maltese-government-signs-new-two-year-oil-exploration-agreement-with-Israeli-company-6736130098

Lybia: http://www.offshore-technology.com/projects/bouri-field-mediterranean-sea/

Tunisia: http://www.offshore-technology.com/projects/hasdrubal-field/

Turkey: http://www.naturalgasworld.com/turkey-tpao-shell-exploration-oil-and-gas-black-sea

APPENDIX 3 – SUMMARY OF MEMBER STATES' POLICIES, CAPACITIES AND EXPERIENCE REGARDING THE USE OF OIL SPILL DISPERSANTS

Table 81: Summary of Member States' national policies, capacities and experience regarding the use of oil spill dispersants.[279]

Member State	Dispersant use allowed[280]	Number of vessels with dispersant system	Sets of extra dispersant systems, vessel mountable	Number of aircrafts/ helicopters	Aircraft/helicopter application capacity (tonnes)	Number of stockpiles	Quantity of dispersant in stockpiles (tonnes)	Previous experience with dispersant usage
Belgium	Yes, as a secondary response option	1	4	0	0	2	11	Yes
Bulgaria	No, only with permission	0	0	0	0	0	0	No
Croatia	Yes	0	11	0	0	5	11	Yes
Cyprus[281]	Yes	2	10	2	Unspecified	Unknown	22	Yes
Denmark	Yes, as a last response option	0	0	0	0	0	0	No
Estonia	Yes, as a last response option	0	0	0	0	0	0	No
Finland	Yes, as a last response option	0	0	0	0	0	0	No
France	Yes, if it is the most appropriate response option	21	0	1	Unspecified	11	1171.8	Yes
Germany	Yes, as a last response option	0	0	0	0	0	0	No
Greece	Yes, as a secondary response option	11	55	0	0	211	691.9	No
Iceland	Yes, as a last response option	0	0	0	0	0	0	Yes
Ireland	Yes, as a secondary response option	0	0	0	0	0	0	No
Italy	Yes, as a last response option	43	35	3	7.5	5	125.475	No
Latvia	Yes, as a last response option	1	0	0	0	1	2	No
Lithuania	Yes, as a last response option	0	1	0	0	1	0.2	No
Malta	Yes, as a secondary response option	0	3	2	Unspecified	2	25.08	No
Netherlands	Yes, as one of the response options	0	0	0	0	0	0	Yes

[279] Source: EMSA. (2014). Inventory of National Policies Regarding the Use of Oil Spill Dispersants in the EU Member States 2014. Retrieved from: http://www.emsa.europa.eu/news-a-press-centre/external-news/item/618-inventory-of-national-policies-regarding-the-use-of-oil-spill-dispersants-in-the-eu.html

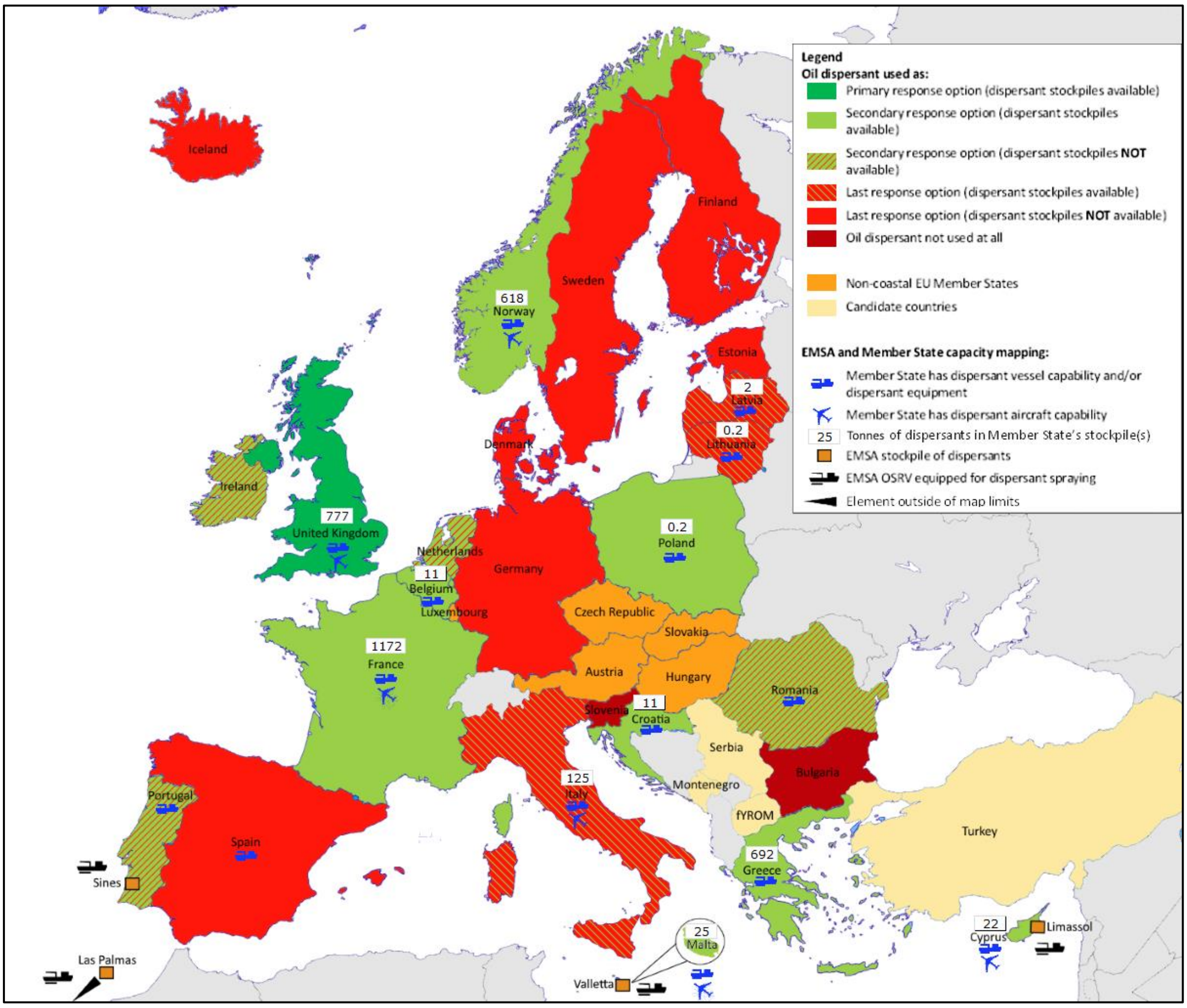
[280] The colour scheme reflects the legend of the map below.

[281] 22,000 litres of oil dispersants is here estimated to be roughly equivalent to 22 tonnes. This and other quantitative data regarding Cyprus' dispersant capacities were retrieved from: EMSA. (2016). Inventory of EU Member States Oil Pollution Response Vessels 2016. Page 32.

Member State	Dispersant use allowed[280]	Number of vessels with dispersant system	Sets of extra dispersant systems, vessel mountable	Number of aircrafts/ helicopters	Aircraft/helicopter application capacity (tonnes)	Number of stockpiles	Quantity of dispersant in stockpiles (tonnes)	Previous experience with dispersant usage
Norway	Yes, as a secondary response option	11	0	2	1.6	7	618	Yes
Poland	Yes, as a secondary response option	0	1	0	0	1	0.2	Yes
Portugal	Yes, as a secondary response option	1	0	0	0	0	0	Yes
Romania	Yes, as a secondary response option[282]	2	1	0	0	0	0	No
Slovenia	No	0	0	0	0	0	0	No
Spain	Yes, as a last response option	11	0	0	0	0	0	Yes
Sweden	Yes, as a last response option	0	0	0	0	0	0	No
United Kingdom	Yes, as a primary response option	0	8	7	35.5	31	777.23	Yes

[282] Romania's policy on the use of oil dispersants was under development as of 2014. The use of dispersants is not recommended in the Black Sea.

Figure 54: Map of Member States' policies and capacities for the use of dispersants



Adapted from: EMSA. (2016). EMSA's Operational Oil Pollution Response Services (August 2016). Retrieved from: http://www.emsa.europa.eu/operations/pollution-response-services.html
And: EMSA. (2014). Inventory of National Policies Regarding the Use of Oil Spill Dispersants in the EU Member States 2014. Pages 124, 127, 128, 129. Retrieved from: http://www.emsa.europa.eu/news-a-press-centre/external-news/item/618-inventory-of-national-policies-regarding-the-use-of-oil-spill-dispersants-in-the-eu.html

APPENDIX 4 – APPENDIX TO PART 2: INDICATORS CALCULATION METHODOLOGY AND SUMMARY OF FINANCIAL DATA

1. Calculations methodology

The following table presents the calculation methodology for cost-efficiency indicators. Cost elements used in the formulae in this Appendix are defined in section 3.2.1.

Note that for indicators related to vessels (i.e. the first and second in the table), the costs (including pre-fitting) as well as capacity are proportional to the number of days the vessel was active over a particular year (e.g. if a vessel was active from 1st July) only 50% of all costs are included as well as 50% of capacity.

Table 82: Methodology for calculating cost-efficiency indicators.

Indicator	Methodology
Average cost per m3 of recovery capacity on board vessels	<u>For each vessel active between 2014-2016:</u> *(Yearly availability fee + Yearly pre-fitting cost (as spread over the period from date of purchase until end of the latest contract)* + Yearly equipment costs aboard (as spread over TLE, according to model)) / recovery capacity in m3 of the respective vessel* <u>For any vessel for which the contract was ended before the 4 year contracting period:</u> *(Yearly availability fee + Yearly pre-fitting cost (as spread over the period until end of contract)* + Yearly equipment costs aboard (as spread over TLE, according to model)) – unamortised pre-fitting cost / recovery capacity in m3 of the respective vessel* <u>Overall cost to EMSA:</u> *(Yearly Availability fees + Yearly pre-fitting costs (as spread over the period until end of contract) + equipment costs (as spread over TLE according to model) / total recovery capacity in each year*
Cost per arrangement and average cost per arrangement by region and by type of vessel	*(Yearly availability fee + pre-fitting cost (as spread over the period until end of contract) + Yearly equipment costs aboard (as spread over TLE, according to model)) / number of arrangements* <u>For each region</u>: Same as above but for each region separately. <u>For each type of vessel:</u> Same as above but for each type of vessel separately.
Average cost per type of equipment in EAS stockpiles	<u>For each EAS equipment type</u> (Fire boom, Speed Sweep, Current Buster, RoBoom-Roskim Integrated System, Trawl Net System): *(Total purchase price + (EAS availability fee / total number of all units of equipment in the EAS location)) / total number of units of purchased*

Average cost per tonne of dispersant	For each stockpile: *Total purchase price of IBC with dispersant (as spread over TLE, according to model) + VAF increase for each year + yearly pre-fitting cost + yearly dispersant spraying system cost / total number of tonnes of dispersant* Calculate this cost also for each of the 4 locations.
Average of exercises cost per exercise	For each year (annual average): *Total costs of exercises / total number of exercises each year*
Average of exercises cost per vessel	For each year (annual average): *Total costs of exercises / total number of vessels involved*

** This calculation takes into account whenever a vessel's contract was ended early and pre-fitting costs were partially reimbursed.*

2. Summary of financial data

Table 83: Cash flow on all parts of services, 2014-2016

	2014	2015	2016	Total
OSRV	12,136,620	12,717,580	13,601,908	**38,456,108**
EAS	0	0	5,537,730	**5,537,730**
Dispersant capability	702,265	839,345	1,603,557	**3,145,167**
Exercises	337,832	251,012	237,420	**826,263**
Total cost in year	**13,176,717**	**13,807,937**	**20,980,616**	**47,965,270**

Note: Nominal prices.

Table 84: Cost per vessel arrangement

Current contractor	Vessel	Type of vessel	2014	2015	2016
Atlantic			**3,846,114**	**3,512,016**	**4,159,519**
James Fisher Everard	Mersey; Galway and Forth Fisher	Oil Tanker	455,507	0	0
James Fisher Everard	Forth or Galway Fisher	Oil Tanker	542,603	812,608	807,415
Remolcanosa	Ria de Vigo	Offshore supply	1,101,487	958,680	1,321,521
Mureloil	Bahia Tres	Oil Tanker	888,645	882,856	815,409
Ibaizabal	Monte Arucas	Oil Tanker	857,872	857,872	857,872
Petrogas	Mencey	Oil Tanker	0	0	357,301
Baltic Sea			**1,752,362**	**1,029,635**	**941,005**
Arctia Icebreaking	Kontio	Ice-breaker	953,057	953,057	383,195
OW Tankers	OW Copenhagen	Oil Tanker	799,304	76,578	0
Stena	Norden	Oil Tanker	0	0	557,810
Black Sea			**1,616,050**	**1,000,117**	**1,301,872**
Bon Marine	Enterprise	Offshore supply	738,993	747,131	602,326
Grup Servicii Petroliere	GSP Orion	Offshore supply	877,056	0	0
Petronav	Amalthia	Oil Tanker	0	252,986	699,545
Mediterranean Sea			**5,354,553**	**6,293,237**	**6,286,687**
Petronav	Alexandria	Oil Tanker	1,118,431	1,041,788	1,037,020
EPE	Aktea (back-up Aegis I)	Oil Tanker	827,132	869,978	860,528
Tankship	Balluta Bay	Oil Tanker	755,545	739,631	743,799
Ciane	Brezzamare	Oil Tanker	868,824	868,824	868,824
Castalia	Marisa N	Oil Tanker	0	1,008,966	1,038,628
Naviera	Monte Anaga	Oil Tanker	902,909	895,387	884,694
Falzon	Santa Maria	Oil Tanker	881,712	868,664	853,195
North Sea			**1,146,219**	**1,720,786**	**2,249,219**
DC Industrial	Interballast III	Hopper Dredger	352,357	354,507	572,329
DC Industrial	DC Vlaanderen 3000	Hopper Dredger	350,900	372,719	683,329
James Fisher Everard	Thames or Mersey	Oil Tanker	442,962	993,560	993,560

Note: Adjusted to 2015 prices.

Table 85: Cost per arrangement per type of vessel,

	2014	2015	2016
Oil Tanker	9,341,448	10,169,698	11,375,600
Offshore supply	2,717,536	1,705,810	1,923,847
Ice-breaker	953,057	953,057	383,195
Hopper Dredger	703,257	727,226	1,255,659
Total	**13,715,298**	**13,555,792**	**14,938,300**

Note: Adjusted to 2015 prices.

Table 86: Cost per type of equipment in – EAS stockpiles

	2014	2015	2016
EAS North Sea			
Fire Boom	0	0	35,563
Speed Sweep	0	0	35,984
Currrent Buster	0	0	56,201
Roboom-Roskim	0	0	0
Trawl Net Systen	0	0	34,153
Total			**161,901**
EAS Baltic	0	0	0
Fire Boom	0	0	31,832
Speed Sweep	0	0	32,631
Currrent Buster	0	0	38,102
Roboom-Roskim	0	0	30,626
Trawl Net Systen	0	0	30,022
Total			**163,214**

Note: The EAS Availability Fee is split equally among the number of pieces for each type of equipment in the stockpile.

Table 87: Cost of each part of the service per region.

	2014	2015	2016	All years
Atlantic	**3,902,419**	**3,580,474**	**4,372,598**	**11,855,491**
Mechanical recovery	3,846,114	3,512,016	4,159,519	11,517,649
Dispersant capability	-	-	176,474	176,474
EAS	-	-	-	0
Exercises	56,305	68,458	36,606	161,369
Baltic Sea	**1,808,667**	**1,052,454**	**1,331,392**	**4,192,513**
Mechanical recovery	1,752,362	1,029,635	941,005	3,723,002
Dispersant capability	-	-	-	0
EAS	-	-	338,727	338,727
Exercises	56,305	22,819	51,661	130,785
Black Sea	**1,616,050**	**1,000,117**	**1,311,102**	**3,927,269**
Mechanical recovery	1,616,050	1,000,117	1,301,872	3,918,038
Dispersant capability	-	-	-	0
EAS	-	-	-	0
Exercises	-	-	9,230	9,230
Mediterranean	**5,501,478**	**6,672,766**	**6,659,612**	**18,833,857**
Mechanical recovery	5,354,553	6,293,237	6,286,687	17,934,478
Dispersant capability	6,162	242,614	281,638	530,413
EAS	-	-	-	0
Exercises	140,763	136,915	91,288	368,966
North Sea	**1,230,677**	**1,743,605**	**2,619,219**	**5,593,501**
Mechanical recovery	1,146,219	1,720,786	2,249,219	5,116,224
Dispersant capability	-	-	-	0
EAS	0	0	321,365	321,365
Exercises	84,458	22,819	48,636	155,913
Total	**14,059,291**	**14,049,417**	**16,293,924**	**44,402,631**

Note: Adjusted to 2015 prices.

APPENDIX 5 - PRIVATE RESOURCES FOR OIL POLLUTION RESPONSE

The tables below summarises the oil pollution response capacity at the disposal of the major private service providers (OSRL and NOFO):

Table 88: Oil Pollution response equipment available in the North of the North Sea, provided by NOFO

Type	Number and description
Towing vessels	33 vessels
Offshore OPR vessels	27 vessels Vessels have oil spill detection and radar + infrared capacity.
Total Tank Storage capacity for recovered oil	30,000 tonnes
Total number of OPR system	27 systems: • 12 systems are on-board (12) vessels. • 13 systems are stand-alone, on 5 bases on Norwegian coastline. Each system comprises of Framo 150 pump with Norlense 1200 boom, skimming capacity is 400m^3/hour
Dispersant capacity	10 stand-alone dispersants systems for vessels and 800 m^3 of dispersants.

Source: NOFO. (2013). NOFO resources including development of coastal oil spill response as of 22. May 2013[283]

Table 89: List of equipment made available by OSRL

Type	Number and description
Offshore Booms	Offshore Equipment: - 13 Roboom 200 metres Bay Boom, on reel without power pack - 1 Hi Sprint rapid boom with reel (300 metres long without power pack) Active Boom Systems: - 2 Ro-skim system, tandem, 120tph skimmer, without power pack - 1 set of 2 pump weir boom capacity (120 tph) - 2 Nofi Current Buster 2 Fire Boom: - 3 Elastec Hydro Fire Boom 150 metres - Offshore
Inshore Booms	Inshore Boom: - 89 Air/Skirt boom 10 metres air/skirt for coastal areas - 216 Air/Skirt boom 20 metres air/skirt for coastal areas - 0 Air/Skirt boom 200 metres on reel with power pack for coastal areas - 43 Beach Sealing boom 10 metres - 0 Beach Sealing boom 15 metres - 91 Beach Sealing boom 20 metres - 8 Troil Boom GP 750 (20metres) (price per 20 metres) Inshore Boom Ancillaries: - 31 Air & water pump support box - 3 Boom Vane Small - boom deployment unit - 1 Boom Vane Medium - boom deployment unit
Skimmers	Offshore Recovery Skimmers: - 2 Komara 50k skimmer without power pack - 4 Desmi DS 250 skimmer without power pack - 2 Ro-Disc attachment for DS250 - 4 GT 185 weir skimmer without power pack - 4 Termite weir skimmer without power pack

[283] Retrieved from: http://www.nofo.no/Documents/V%C3%A5r%20virksomhet/NOFO%20ressurser%20-%20engelsk%20%20pr%2022.05.2013.pdf

	- 1 Terminator weir skimmer (with thrusters) without power pack Heavy Oil Recovery - 1 Giant Octopus skimmer - 2 Komara Star incl power pack - 1 WP 130 drum skimmer without power pack - 2 Rotodrum without power pack - 3 Sea Devil skimmer without power pack - 1 Helix Skimmer - 1 Scan Trawl System Inshore Recovery Skimmers: - 1 Diesel driven rope mop system OM 240 Capacity 6 tph - 4 Diesel driven rope mop system OM 140 Capacity 3-5 tph - 2 Diesel driven rope mop system 9D Capacity 12 tph - 3 Komara 20k disc skimmer inc power pack - 4 Komara 12k disc skimmer inc power pack - 11 Komara 7k disc skimmer inc power pack - 2 Elastec combi drum skimmer inc power pack - 5 Vikoma Minivac vacuum system - 5 Roclean Minivac vacuum system - 1 Egmolap belt skimmer inc power system (requires working platform)
Dispersant Systems	Dispersant Application: - 1 Neat Sweep dispersant boom system - 10 Boat Spray sets for use as vessel mounted Type 3 dispersant application system - Fluorometer for dispersant application analysis (Technician required)
Vessels	Vessels: - 1 2.4 metres - 2.9 metres inflatable + outboard - 1 3.1 metres - 4.2 metres inflatable + outboard - 1 Rigiflex Workboat + outboard - 1 5 metres infl atable + outboard - 1 6.2 metres semi rigid + outboard - 1 8.2 metres semi rigid workboat - 1 12 metres displacement workboat - 1 Egmopol belt skimming barge system inc propulsion for sheltered waters - 1 20 metres EARL oil spill response vessels (in use only) Pre-loaded equipment: - 1 Load Four - Offshore Containment and Recovery (Weir Boom) - 1 Load Six - Offshore Containment and recovery - 1 Load Seven - Egmopol Barge
Storage Equipment	Offshore Storage Equipment: - 7 Storage Barge - $25m^3$ - 8 Storage Barge - $50m^3$ Transfer Pumps - 12 Spate diaphragm pump 30 m^3 - 5 Desmi DOP 160 pump without power pack - 5 Desmi DOP 250 pump without power pack - 3 Water injection fl ange for DOP pump Inshore Storage Equipment: - 63 Fastanks - capacity $9m^3$ / 2400 US gallons - 4 Fastank - capacity $2m^3$ / 600 US gallons
Oil Tracking	Oil tracking - 1 Oil Spill Tracking Buoy - I-Sphere - 2 Oil Spill Tracking Buoy - ISMDB
Aircrafts	Aircraft systems - 1 ADDS Pack dispersant spray system (aircraft not included) - 1 Nimbus dispersant system (aircraft not included) - 2 Underslung helicopter mounted spray system (150-240 gallons) Aircraft - BOEING 727

Miscellaneous	Oiled Wildlife Response Package - Search and Rescue - Intake and triage - Cleaning and rehabilitation UKCS AERIAL SERVICES - Surveillance aircraft c/w infra red and digital video Vehicles: - 4 6 wheel all terrain vehicle - 3 MPV people carrier (£0.45/mile) - 2 4x4 Vehicle (£0.45/mile) - 1 Tractor unit (£1.70/mile) - 11 Trailer - Arctic/Semi (£0.50/mile) Communication Equipment: - 90 Single VHF handset - 71 Handheld GPS - 5 VHF Base station - 3 VHF Base/Repeater Station - 6 VHF Sky masts - 4 Iridium satellite phone - 1 BGAN Hughes Network Systems (HNS) 9201 - 3 BGAN Nera WorldPro 1010 - 3 Portable infl atable shelter Ancillaries – Power Packs and Generators - 13 Generator - 1kw-3kw - 1 Diesel Generator - 1 GP10 power pack (7.4kw) - 4 GP30 power pack (21.9kw) - 4 Lamor 25 power pack (23kw) - 3 Desmi power pack (50kw) - 6 Tiger power pack (84kw) - 2 Vikoma power pack (80kw) - 4 Grizzly power pack (98kw) Ancillaries – Site Safety and Cleanup - 15 Hydraulic Hose reels - 5 Hydraulic pressure washers (without power pack) - 4 Mobile diesel drive high pressure and temperature washer for sea water use - 5 Crane unit - 4 Powered fl oodlights - 2 Peli lights - 1 Orimulsion Refl otation Device without power pack - 3 Area Gas Monitor (4 channel + PID) - 5 Multi RAE lite - 3 Multi RAE Plus gas monitor - 21 Personal (4 Channel) gas monitor - 3 Gas Detection Tubes - 3 Air Monitor Microdust Pro Other possible costs: - Oil Spill Modelling - Personnel

Source: OSRL. (2016). Retrieved from: https://www.oilspillresponse.com/

APPENDIX 6 - APPENDIX TO PART 3

1.1 Original list of alternative service models from the Terms of Reference

Below is the original list of alternative models proposed in the Terms of Reference for this study. The actual list of service models proposed for comparison differs following discussions with EMSA and refining of the models. Options for chartering under Models 2 and 3 were particularly further explored, and Model 4 was not explored as a separate model.

Figure 55 Original list of alternative service models from the Terms of Reference

1. **Model 1:** EMSA improved service model. Currently EMSA contracts companies that own or charter vessels and owns the equipment, but some improvements are to be proposed by the contractor;
2. **Model 2:** EMSA financing 100% of the building of dedicated specialised pollution response vessels, which could be operated by EMSA or by a charterer;
3. **Model 3:** EMSA financing 100% of the building of multi-purpose response vessels, to be operated by EMSA or by a charterer;
4. **Model 4:** EMSA co-financing the EU Member States in the construction of new vessels and/or the chartering of existing vessels suitable for pollution response;
5. **Model 5:** EMSA outsourcing in full stand-by and mobilisation services provided by external service providers (e.g. OSRL, MSRC membership, NOFO, lease of service from providers such as equipment

1.2 Figures for Models 1.5, 1.6 and 1.7

The figures below present a detailed view on each region in which a reduction of EMSA presence in considered (under models 1.5, 1.6 and 1.7 under Part 3), in order to highlight national capacities in terms of vessels over 700 m^3, EMSA's vessels theoretical 24 hour range from home base and the economic area of activity of the EMSA vessels.

Figure 56: Detailed illustration of the 24 hour range of the vessels from home base and area of economic activity in the Eastern approach to the channel

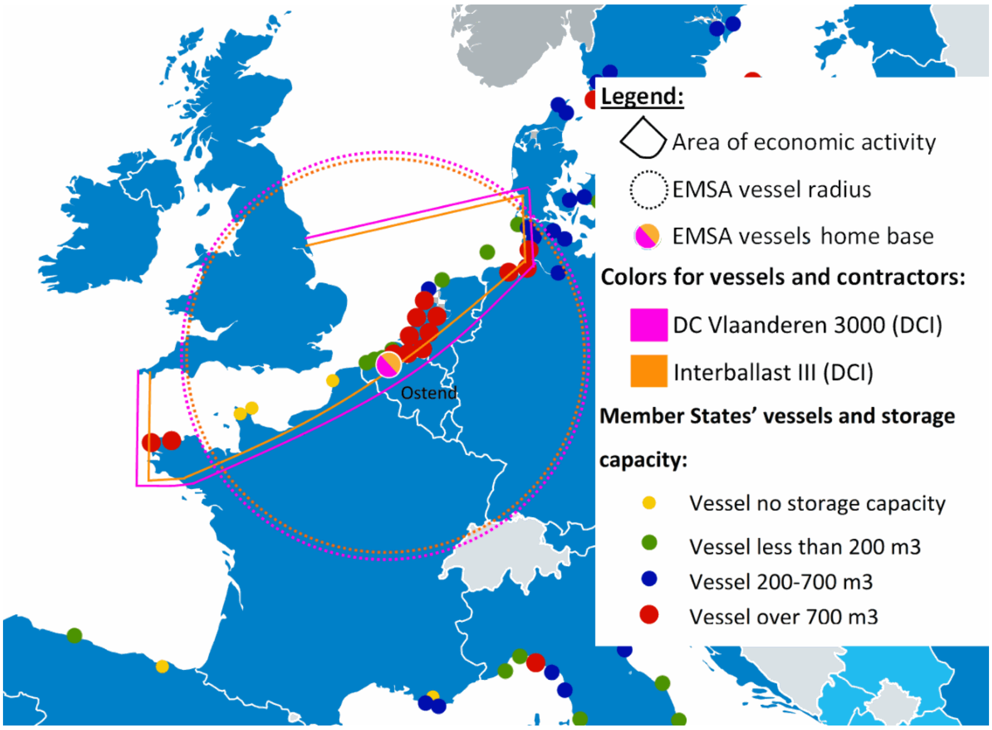


Figure 57: Detailed illustration of the 24 hour range of the vessels from home base and area of economic activity in the South Atlantic Region

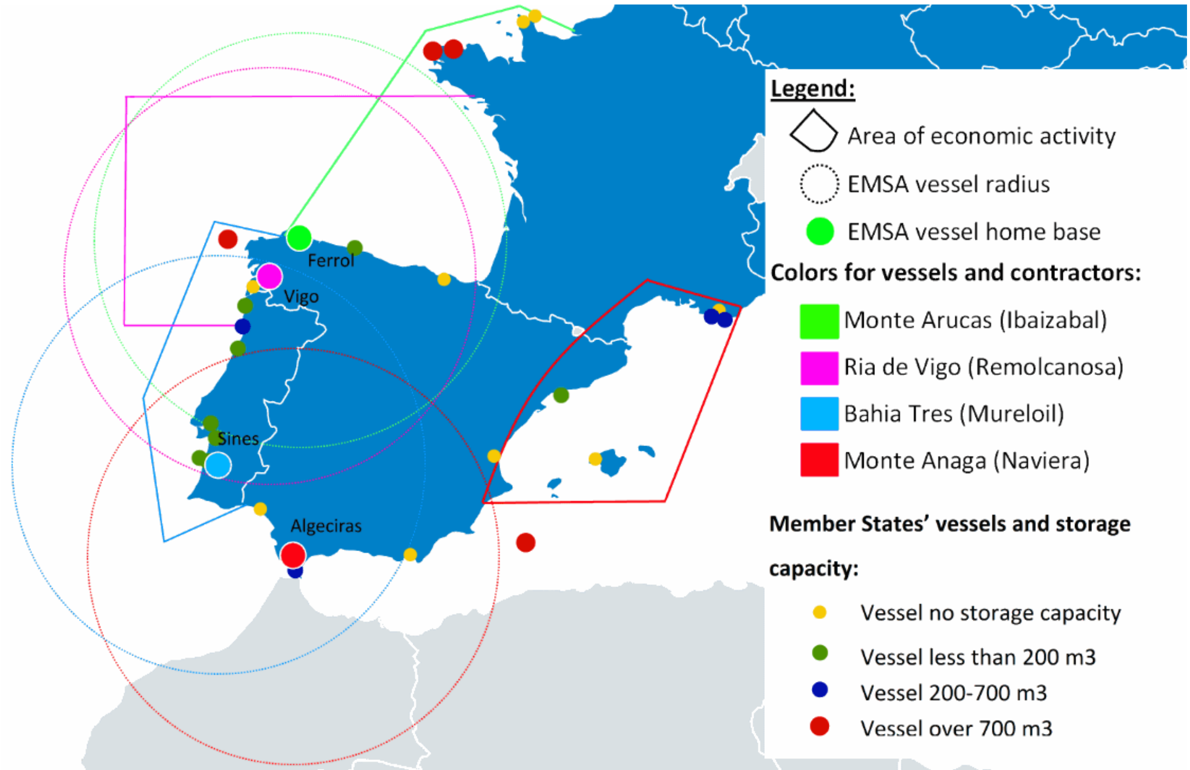
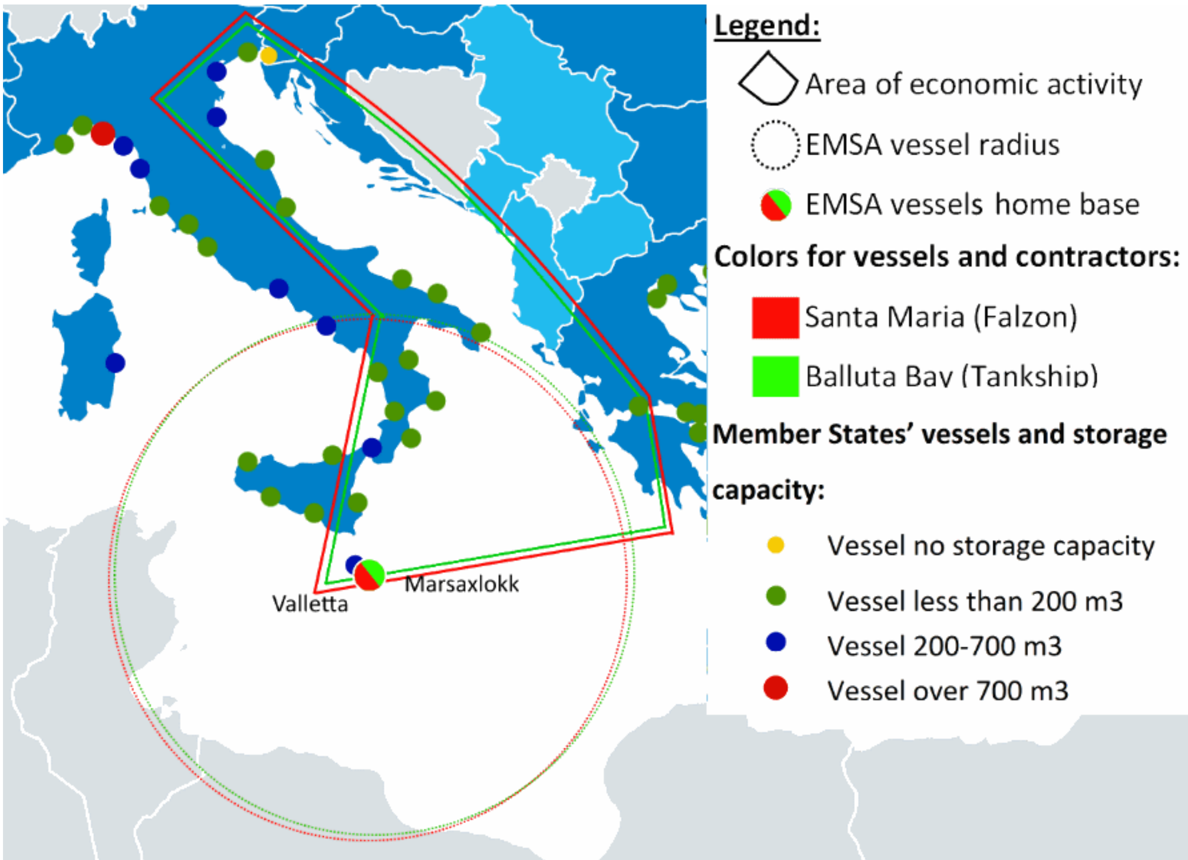


Figure 58: Detailed illustration of the 24 hour range of the vessels from home base and area of economic activity in the Central Mediterranean



1.3 Cash flow analysis of spending under the baseline scenario

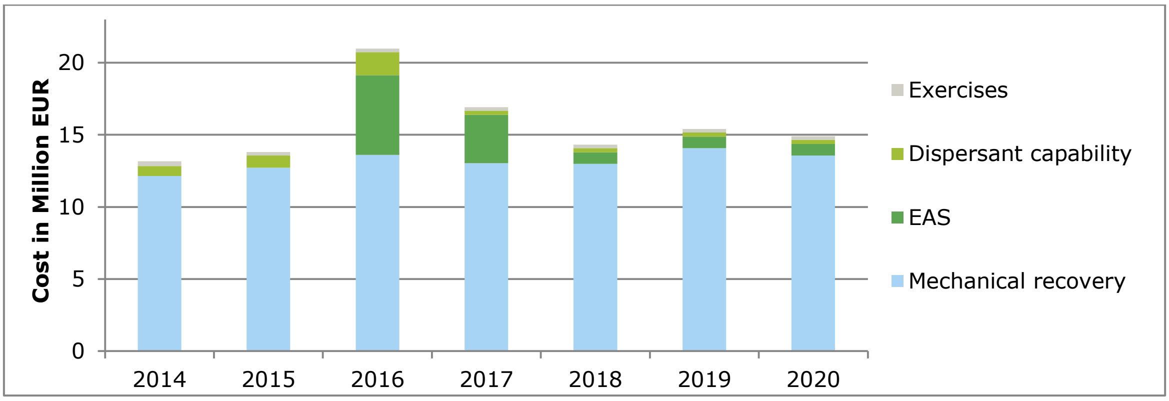
Similarly to the exercise conducted in Part 2 (see section 3.3), we present below the results of the baseline model in terms of cash flow. It shows how the model developed predicts EMSA's spending for the OPR service over the period 2014-2020. Cash flow from the year 2017 onwards is calculated based on expected spending for those years. Prior to 2017, the expenditure corresponds to historical data of EMSA's expenditure (i.e. identical to the results in Part 2).

Figure 59: Cash flow on all parts of services, 2014-2020

	2014	2015	2016	2017	2018	2019	2020
Mechanical recovery	12,136,620	12,717,580	13,601,908	13,032,416	12,987,328	14,078,731	13,575,473
EAS	0	0	5,537,730	3,362,609	799,468	799,468	799,468
Dispersant capability	702,265	839,345	1,603,557	286,274	286,274	286,274	286,274
Exercises	337,832	251,012	237,420	243,718	243,718	243,718	243,718
Total cost in year	**13,176,717**	**13,807,937**	**20,980,616**	**16,925,017**	**14,316,789**	**15,408,191**	**14,904,934**

Note: 2015-prices

Table 90: Cash flow on all parts of services, 2014-2020



Note: 2015-prices

1.4 Additional information regarding selected multi-purpose vessels

The multi-purpose vessels (MPVs) proposed under Model 3 are of two types: the "Neptune Series" built by Zamakona Yards for SASEMAR, and the MPV 8116 built by Damen for the Swedish Coast Guard. In Figure 60 and Figure 62 below are some specifications and costs for these two types of MPVs.

Figure 60 Specifications and costs of Neptune Series multi-purpose vessels.[284]

Model: "Neptune Series"[285]
Vessels: Don Inda, Clara Campoamor
Owned by: Salvamento Maritimo (SASEMAR)
Shipyard: Zamakona yards (Spain)
Vessel class: multi-purpose vessel
Functions: towing, salvage, diving, oil recovery and pollution control.
Heated recovered oil storage capacity: 1,700 m^3
OPR equipment:
Dispersant storage, dispersant spray system, skimmers (400m^3/h), fire-fighting water spray.
Speed: 17.5 knots

Figure 61 Photograph of the Don Inda and Clara Campoamor, owned by SASEMAR. Source: Zamakona Yards.[286]

Additional information: Two "Neptune Series" models were built in 2006 by Zamakona Yards for SASEMAR, the Spanish Maritime Safety and Rescue Society.

Building cost of a "Neptune Series" vessel: € 35,300,000.

[284] Data provided by BRS Brokers.
[285] Full specifications are available on Zamakona Yards' website: http://www.zamakonayards.com/en/portfolio/don-inda-2/
[286] http://www.zamakonayards.com/en/portfolio/don-inda-2/

Figure 62 Specifications and costs of MPV 8116 multi-purpose vessels.

Model: MPV 8116[287]
Vessels: KBV001, KBV002, KBV003[288]
Owned by: Kustbevakningen (Swedish Coast Guard)
Shipyard: Damen shipyards (Netherlands)
Vessel class: multi-purpose vessel
Functions: Fishery protection, oil pollution response, HNS recovery, traffic control, towing, fire-fighting, oil recovering, rescue/salvage, operations, remotely operated vehicle (ROV) support.
Heated recovered oil storage capacity: 1,100 m^3
OPR equipment:
2x Sweeping booms & in-built brush type
Skimmers: 1x 100 m^3/hr, 1x 20 m^3/hr, 1x10 m^3/hr
Speed: 16 knots

Figure 63 Photograph of the KBV001, owned by the Swedish Coast Guard. Source: DAMEN.[289]

Additional information: Three models of the MPV 8116 were built in 2010 by Damen for the Swedish Coast Guard. The KBV003 is the model with the largest oil storage tank of 1,100 m^3.

Building cost of the KBV003: SEK 504,800,000 (€ 53,408,000).

APPENDIX 7 - LIST OF INTERVIEWEES

Table 91: List of interviewed organisations for Parts 1 and 4

Organization
Black Sea Commission - Permanent Secretariat to The Commission on the Protection of the Black Sea Against Pollution
Bonn Agreement Secretariat (North Sea)
CEDRE
CEPPOL
Coast Guard, Ireland
Commercial Director, Oil Spill Response Limited
Deputy Head of Unit, DG MOVE
Finnish Environment Institute (SYKE), Marine Research Centre, Marine Pollution Response Section

[287] Full specifications are available on Damen Shipyards' website: http://products.damen.com/en/ranges/multi-purpose-vessel/multi-purpose-vessel-8116
[288] We use storage capacity and cost information for the KBV003 due to its slightly larger size: 1,100 ^{m3}. For operational expenditure, the costs for each vessel hover around € 900,000 per year, therefore we use this average.
[289] Retrieved from: http://products.damen.com/en/ranges/multi-purpose-vessel/multi-purpose-vessel-8116

FPS Health, Food Chain Safety & Environment, Belgium
International Oil Pollution Compensation Funds (IOPC Funds)
Marine Environment Protection Directorate; Hellenic Coast Guard; Ministry of Maritime Affairs & Insular Policy
Marine Operations | Incident Response Unit, Malta
Ministry of Environment, Italy
Ministry of National Defence, Lithuanian Navy, MRCC Klaipeda
MRCC Cartagena, Spain, Dirección de Operaciones, Sociedad de Salvamento y Seguridad Marítima Ministerio de Fomento
NOFO
Norwegian Coastal Administration, Department for Emergency Response
Police and Border Guard Board, Estonia
Policy Officer, DG ECHO
Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC)
Rijkswaterstaat, Ministry of Infrastructure and Environment, The Nethelands,
Romanian Naval Authority, Maritime Co-Ordination Centre
Section Head, Plans and Policy Section, NOFO

Table 92: List of organisations who contributed to Part 3

Organization
BRS Brokers
Damen Shipyards
Ibaizabal
Mavi Deniz
OljOla
Swedish Coast Guard
Environmental administration of Finland
Tor Marine
Finnish Environment Institute (SYKE)

APPENDIX 8 - INTERVIEW QUESTIONS (PART 1 AND PART 4)

<See separate document attached>

APPENDIX 9 - BIBLIOGRAPHY

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