Outcome of the Third Meeting of the HELCOM Expert Group on environmental risks of hazardous submerged objects (SUBMERGED 3-2015)

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Outcome of the Third Meeting of the HELCOM Expert Group on environmental risks of hazardous submerged objects (SUBMERGED 3-2015)

Introduction

0.1 In accordance with the decisions of RESPONSE 20-2015, HOD 48-2015 and subsequent correspondence between the host, Chairs and the Secretariat, the Third Meeting of the HELCOM SUBMERGED expert group (HELCOM SUBMERGED 3-2015) was held on 14-15 October 2015 in Gothenburg, Sweden.

0.2 The Meeting was attended by representatives from the Contracting Parties Estonia, Finland, Germany, Poland and Sweden, the Observer organization European Community Shipowners' Associations (ECSA) as well as invited guests from the back-to-back conference Wrecks of the World III. The List of Participants is contained in **Annex 1**.

0.3 The Third Meeting of SUBMERGED focused on the chapter on wrecks of the submerged hazardous objects assessment.

0.4 The Meeting was welcomed by Hanna Landquist on behalf of the host, Department of shipping and marine technology, Chalmers University of Technology, sending also greetings from docent Ida-Maja Hassellöv.

0.5 The Meeting was chaired by Mr. Jens Sternheim, Co-Chair, and Mr. Jorma Rytkönen, Vice-Chair of HELCOM SUBMERGED. Mr. Hermanni Backer, Professional Secretary, acted as Secretary of the Meeting.

1. Adoption of the Agenda

Documents: 1-1

1.1 The Meeting adopted the Agenda as contained in document 1-1.

2. Matters arising from other HELCOM meetings

Documents: 2-1

2.1 The Meeting recalled the outcome of the last meeting (HELCOM SUBMERGED 2-2015) as contained in document 2-1.

2.2 The Meeting took note of the outcomes of HELCOM processes and meetings of relevance to HELCOM SUBMERGED, as presented by the Secretariat.

- HOD 48-2015 took note of the outcome of the Second Meeting of SUBMERGED and that the SUBMERGED assessment work is progressing and invited the Contracting Parties to provide input particularly on the chapter on dumped waste/lost cargo.
- RESPONSE 20-2015 took note of the outcome of the Second Meeting of the SUBMERGED group.
- The Sixth Meeting of the HELCOM Group of Experts on Safety of Navigation (SAFE NAV 6-2015), held on 1 October 2015, requested that the progress of SUBMERGED expert group is presented at their next meeting (SAFE NAV 7-2016).

2.3 The Meeting recalled that the conference Wrecks of the World III: Shipwreck risk assessment was held in Gothenburg on 12-13 October 2015, back-to-back with SUBMERGED 3-2015. The Meeting took further note that presentations of the Wrecks of the World III conference will be available shortly also via the SUBMERGED workspace.

3. SUBMERGED Assessment current status

Documents: 3-1, 3-2, 3-3

3.1 The Meeting recalled the agreed outline of the SUBMERGED Assessment (Annex 2 of document 2-1) and the currently indicated chapter leads and agreed that the Secretariat could take over the lead regarding the dumped waste chapter.

3.2 The Meeting took note of an update regarding the overall status of material at the HELCOM SUBMERGED SharePoint workspace and took note of the possible use of the SUBMERGED workspace as a place where the most up-to-date assessment chapters are continuously available for download and editing. The Meeting noted that the HELCOM Secretariat can post updated files on behalf of those participants who have office security settings banning the use of SharePoint.

3.3 The Meeting took note of the status of the SUBMERGED Assessment chapter on warfare materials as drafted by the HELCOM SUBMERGED 2-2015 Meeting (document 3-2) and revised as contained in **Annex 2**.

3.4 The Meeting took note of the information submitted by Germany regarding munition dumping sites (document 3-1) and agreed that the SUMERGED report needs to include such a detailed description of individual sites as a separate more substantial Appendix/ supplementary information volume as well as GIS information.

3.5 The Meeting took note of the draft chapter on dumped waste and lost cargo (document 3-3) and agreed to use it as a basis of future work.

3.6 The Meeting agreed that, if needed, the response sub-divisions of the Baltic Sea (**Annex 3**) should be used in the SUBMERGED report.

4. Draft chapter on Wrecks

Documents: 4-1

4.1 The Meeting welcomed the oral information on experiences around drafting various US and global risk assessments on polluting wrecks by Ms. Dagmar Etkin, consultant, U.S.A (invited guest) including her general account of the steps involved in addressing polluting wrecks:

- Mapping presence of wrecks (based on wreck databases and in situ observations);
- Categorise wrecks to different main types (which might involve modelling probabilities of carrying hazardous cargo/fuel);
- Mapping sensitivity of the environment around wreck;
- Mapping socio-economic sensitivities;
- Detailed risk assessments and prioritising measures on wrecks;
- Resources on mitigation measures, including removal, should be reserved to the cases with highest risk categories.

4.2 The Meeting welcomed the oral information on experiences around the drafting of the recent 2013 NOAA Risk Assessment for Potentially Polluting Wrecks in U.S. Waters by Ms. Lisa Symons, NOAA, U.S.A (invited guest) including the following specific points to the HELCOM SUBMERGED process on assessing the polluting wrecks:

- The approaches, structure and some of the content in the NOAA report could possibly be useful for the Baltic report.

- Socio-economic consequences and risks are in many cases more important than environmental risks for the public.
- Polluting wrecks can be included in contingency plans and recommendations/material for such inclusions are likely appreciated by pollution response authorities.
- In the US openness of unclassified wreck registers, if combined with awareness raising and education, is a way to encourage "citizen science" by recreational divers which helps to document wrecks and the status of nature around them.
- she can consider to offer to review SUBMERGED assessment draft text on potentially hazardous wrecks, if considered useful by the Group.

4.3 The Meeting considered a draft outline of the chapter on wrecks of the SUBMERGED Assessment (document 4-1) and developed it further as included in **Annex 4**.

5. Wrecks: Geographical distribution

Documents:

5.1 The Meeting exchanged available information on geographical distribution of submerged wrecks, including national wreck databases, as follows:

- Estonia has a wreck database http://195.80.112.238:8080/HIS/Avalik?REQUEST=Main openly available, the register was originally confidential but in the end it was opened in combination with awareness building among, and education of, recreational divers as an attempt to encourage submission of updated information on wrecks as well as to foster a sense of collective responsibility. A wreck register hosted by the national heritage board is also available in the address http://register.muinas.ee/public.php?menuID=wreckregistry. According to a rough estimation, perhaps 50 wrecks of the ca. 700 wrecks in the Estonian part of the Baltic Sea should be checked for environmental risks.
- Finland has a confidential wreck database hosted by SYKE but some commercial databases have wreck information available for the general public. Some information is also available via the Finnish national board of antiquities. Recreational divers uphold a site hylyt.net.
- Germany informed that BSH has a wreck register and that this information might be available also for the SUBMERGED assessment.
- Latvia and Lithuania have at least some public sites hosted by recreational divers.
- Poland has a national wreck database hosted by the National Hydrographic Office but it is difficult to get access permits even for Polish national administration. Other publicly available information and databases are also available even if less complete.
- Sweden has a national database on wrecks hosted by the Swedish Maritime Museum and has carried out considerable work in assessing and mapping wrecks.
- Denmark has provided data on their national database in Danish
- Wreck information included in nautical charts can be used as a rough proxy for areas/countries where no other information is available; sites like wrecksite.eu, uboat.net might also include some useful information.

5.2 The Meeting welcomed the ArcReader GIS dataset with the HELCOM SUBMERGED UXO database version 1.0 and the general information on the progress of the SUBMERGED GIS data collection, which currently covers particularly munitions and other objects, but which could be easily expanded to wrecks, as presented by Mr. Gunnar Möller, Sweden.

5.3 The Meeting agreed to create a joint wreck dataset including basic wreck information covering the entire Baltic Sea and as a starting point to include wrecks of vessels in the size class 100 GT or more and resulting from incidents on or after the year 1870.

5.4 The Meeting invited all Contracting Parties to make the wreck data available for this dataset and the assessment via the HELCOM Secretariat (hermanni.backer@helcom.fi) or Sweden (gunnar.moller@mil.se) and include information on the confidentiality level of the data. The Meeting highlighted that in case it is difficult to release wreck datasets to the general public as precise coordinates, one option might be to transform/ present the information in the form of a 1x1 km grid/raster without exact positions.

5.5 The Meeting recalled that wreck spills have been observed during aerial/satellite surveillance and took note that closer inspection of the results of laboratory testing of beached tarballs could give an indication if the tarball in question is formed from wreck oil or other spill (e.g. illegal operational discharge).

6. Wrecks: Environmental issues

Documents:

6.1 The Meeting welcomed the presentation by Ms. Deborah French McKay, consultant, U.S.A. (invited guest) on assessments of environmental risks of wrecks, particularly regarding the use of drift and other modelling in calculating potential risks of various toxic chemicals in wrecks (**Presentation 1**).

6.2 The Meeting was of the opinion that the HELCOM SUBMERGED report should result in advice to the regional (Baltic-wide) and sub-regional (sub-basin) wreck pollution incident preparedness and response.

6.3 The Meeting noted that in some cases wrecks seem to have a positive effect on local economies and to the marine environment, as artificial reefs attract fish as well as recreational divers.

7. Wrecks: Risk assessment

Documents:

7.1 The Meeting welcomed the presentation by Ms. Hanna Landquist, Chalmers University on the VRAKA risk assessment method (**Presentation 2**).

7.2 The Meeting agreed that developing and agreeing on joint risk assessment methods for polluting wrecks, or submerged hazardous objects in general, would be an important outcome of HELCOM SUBMERGED.

7.3 The Meeting recalled that within HELCOM MARITIME a risk assessment model and decision support tool / database on invasive species introductions via ballast water has been adopted and revised recently (LINK).

7.4 The Meeting recalled that socio-economic consequences and risks are often even more important than environmental risks for the public and was of the opinion that these issues should be highlighted in the report in general.

7.5 The Meeting welcomed the presentation by Mr. Kari Rinne, ECSA/ Alfons Håkans, on the main steps in observing and addressing polluting wrecks (http://www.alfonshakans.fi/pollution-recovery/) including observation, identification, risk assessment and oil removal.

8. Work plan and future meetings

Documents: 8-1

8.1 The Meeting considered and updated the work plan of the Group as contained in **Annex 5**.

8.2 The Meeting took note of the currently valid list of nominated members of SUBMERGED (document 8-1) as contained in **Annex 6**.

8.3 With reference to the decisions by SUBMERGED 2-2015, the Meeting confirmed to organise the Fourth Meeting of HELCOM SUBMERGED as an online meeting in December 2015 (exact time and date to be confirmed by the Secretariat) and welcomed the confirmation by Estonia that they are prepared to host SUBMERGED 5-2016 on 12-13 April (12-14 April, if needed) 2016 in Tallinn, Estonia.

8.4 The Meeting requested that the SUBMERGED assessment is covered in the agenda of the HELCOM RESPONSE 21-2016 meeting (15-17 March 2016, Sweden) and agreed that the available draft of the whole report will be compiled in February 2016 and sent to the HELCOM RESPONSE meeting for commenting, provision of additional information and in order to consider prolonging the current deadline of the SUBMERGED activity (ready report by the end of 2016).

8.5 The Meeting highlighted the importance of participation from all Contracting Parties, especially Poland, Latvia, Lithuania, Russia and Denmark, in the work of the Group.

8.6 The Meeting noted that an International Oil Spill Conference will take place in May 2017 in the U.S. and has abstract submission 12-18 months prior to the event and that the SUBMERGED assessment could be an interesting topic for the Conference participants.

8.7 The Meeting thanked Sweden and the Chalmers University of Technology for the excellent facilities and hosting of the Meeting.

9. Outcome of the Meeting

Documents: 9-1

9.1 The Meeting edited and adopted the draft Outcome of the Meeting (document 9-1). The final Outcome, including the Annexes, will be prepared by the Secretariat in consultation with the Chairs of the Meeting and made available in the HELCOM Meeting Portal.

Annex 1

List of Participants

Name	Representing	Organization	E-mail
Chairs			
Jens Sternheim	Germany	Ministry of Energy, Agriculture, the Environment and Rural Areas of Schleswig-Holstein	jens.sternheim@melur.landsh.de
Jorma Rytkönen	Finland	Finnish Environment Institute (SYKE)	jorma.rytkonen@ymparisto.fi
Contracting Parties			
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Marit Mätik	Estonia	Estonian Ministry of the Interior, Border Guard Policy Department	marit.matik@siseministeerium.ee
Ivar Treffner	Estonia	Estonian Police and Border Guard	ivar.treffner@politsei.ee
Kirsi Kentta	Finland	Ministry of the Environment	kirsi.kentta@ymparisto.fi
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Tobias Knobloch	Germany	Umweltbundesamt / Federal Environment Agency	tobias.knobloch@uba.de
Benedykt Hac	Poland	Maritime Institute in Gdańsk	mkubacka@im.gda.pl
Gunnar Möller	Sweden	Swedish Armed Forces	gunnar.moller@mil.se
Hanna Landquist	Sweden	Chalmers Technical University	hanna.landquist@chalmers.se
Fredrik Lindgren	Sweden	Chalmers Technical University	
Anders Östin	Sweden	FOI - Swedish Defence Research Agency	
Observers			
Kari Rinne	ECSA	ECSA - European Community Shipowners' Association	kari.rinne@alfonshakans.fi
Invited guests			
Lisa Symons	USA	NOAA – National Oceanic and Atmospheric Administration	lisa.symons@noaa.gov
Dagmar Etkin	USA	Consultant-ESC	etkin@environmental-research.com
Deborah French McKay	USA	Consultant-RPS	DfrenchMcCay@rpsgroup.com
HELCOM Secretariat			
Hermanni Backer	Professional Secretary	HELCOM Secretariat	hermanni.backer@helcom.fi

Annex 2

Draft chapter on Warfare materials of HELCOM SUBMERGED Assessment

(wording of individual section headings subject to future refinement)

Introduction

Munitions in the Baltic Sea

Marine waters around the Baltic Sea contain munitions. Among others, fishermen, divers, offshore wind farm constructors and beachgoers may face serious risks by working on the sea bed or collecting objects in the surf. Every year people get hurt severely after having collected warfare material unintentionally.

Current technology to detect underwater munitions is depending on the metal coating of the objects such as bombs, sea mines and artillery shells. With time, corrosion takes away more and more of the metal and consequently eliminates the chance to find and remediate these point sources of contamination, especially considering that some munitions have been introduced more than 100 years ago.

Initially driven by institutes and organizations (GO as well as NGO) in the most affected areas, relevant measures were undertaken to support the knowledge base with regard to sea-dumped munitions and their effects on human populations and marine eco-systems. Without cross-border co-ordination duplications will take place in the near future and obvious synergies will most likely not be realized.

As results of local, regional and national or international scientific research, knowledge is growing and multiple recommendations are published that are both directly and indirectly relevant to sea-dumped munitions and their effects upon humans and marine ecosystems. That would open up the possibility for the decision makers to ensure they are able to deal with all aspects of sea dumped munitions from identification, monitoring and elimination of threats in a more systematic and coordinated manner.

Introduction:

- Former battlefield
- Former dumping ground
- Today new demands for usages: trafficking, fishery, aqua farming, (blue growth), offshore wind farms, pipelines, recreation, etc.

Definition of conventional and chemical munitions (infobox on special terminology: warfare materials, UXO, chemical weapons [CWC], status of white phosphorus)

Scope of contamination (relation of amounts: conventional vs. chemical munitions)

Short overview of types of munitions and/or containers (bombs, grenades, sea mines, torpedoes, etc.; max. double page infobox)

Former reports

Regarding managerial activities and investigations, i.a.:

CHEMU, MUNI (short description)

Differences to this report (widened scope): conventional munitions => to be found throughout the Baltic with many known hotspots and designated former dumping grounds, introductions stemming from numerous activities, also en route dumping and mine-laying operations

National activities

Grouped according to MS: Managerial activities (e.g. MSFD) and investigations

Germany

- Expert group on munitions in German marine waters (BLANO Expertenkreis Munition im Meer), i.a. responsible for preparing annual update reports on developments and progress in the field
- MukaSH & KIS
- RoBEMM (01.10.2015-30.09.2018)
- UDEMM (pending)

International activities

managerial activities and investigations, i.a.:

- International Mine Action Standard 9.60:
  - UNMAS – United Nations Mine Action Service – http://www.un.org/en/peacekeeping/issues/mineaction.shtml
  - IMAS – International Mine Action Standard – http://www.mineactionstandards.org/about/draft-imas or http://www.mineactionstandards.org/fileadmin/MAS/documents/imas-international-standards/english/series-09/IMAS_09.60_Underwater_Survey_and_Clearance_of_Explosive_Ordnance__EO_.pdf
- Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI Oceans):
  - http://www.jpi-oceans.eu/news-events/news/jpi-oceans-workshop-munition-sea
- description of CHEMSEA & most important results (single page infobox)
- description of MODUM & preliminary results (single page infobox)

(results of CHEMSEA and MODUM will be described in more detail in the subsequent chapters)

Geographic distribution

Limits and quality of information

Description of how the presented data was collated

especially: 'Disclaimer' regarding incomplete data basis and uncertainties associated with currently available historic information

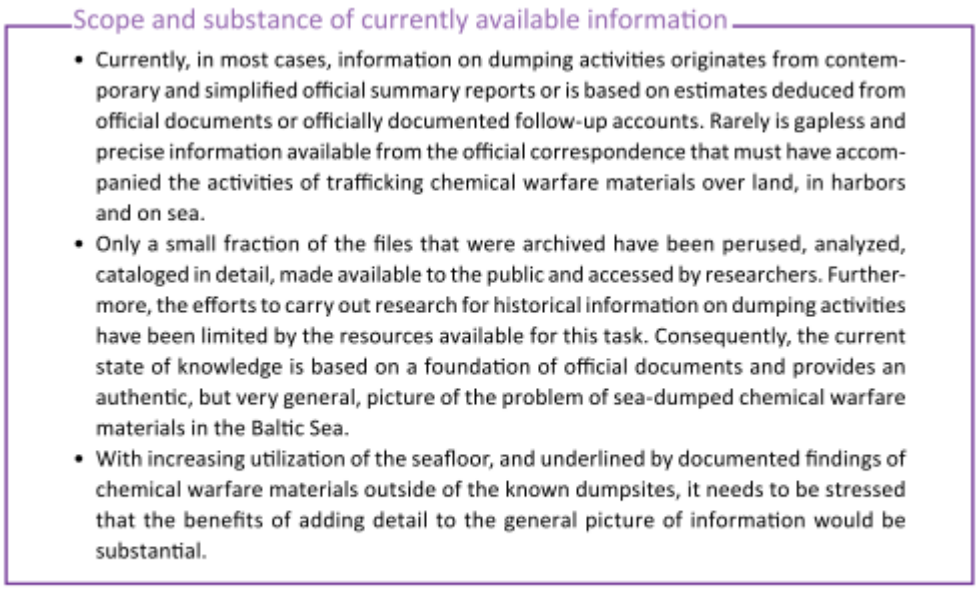


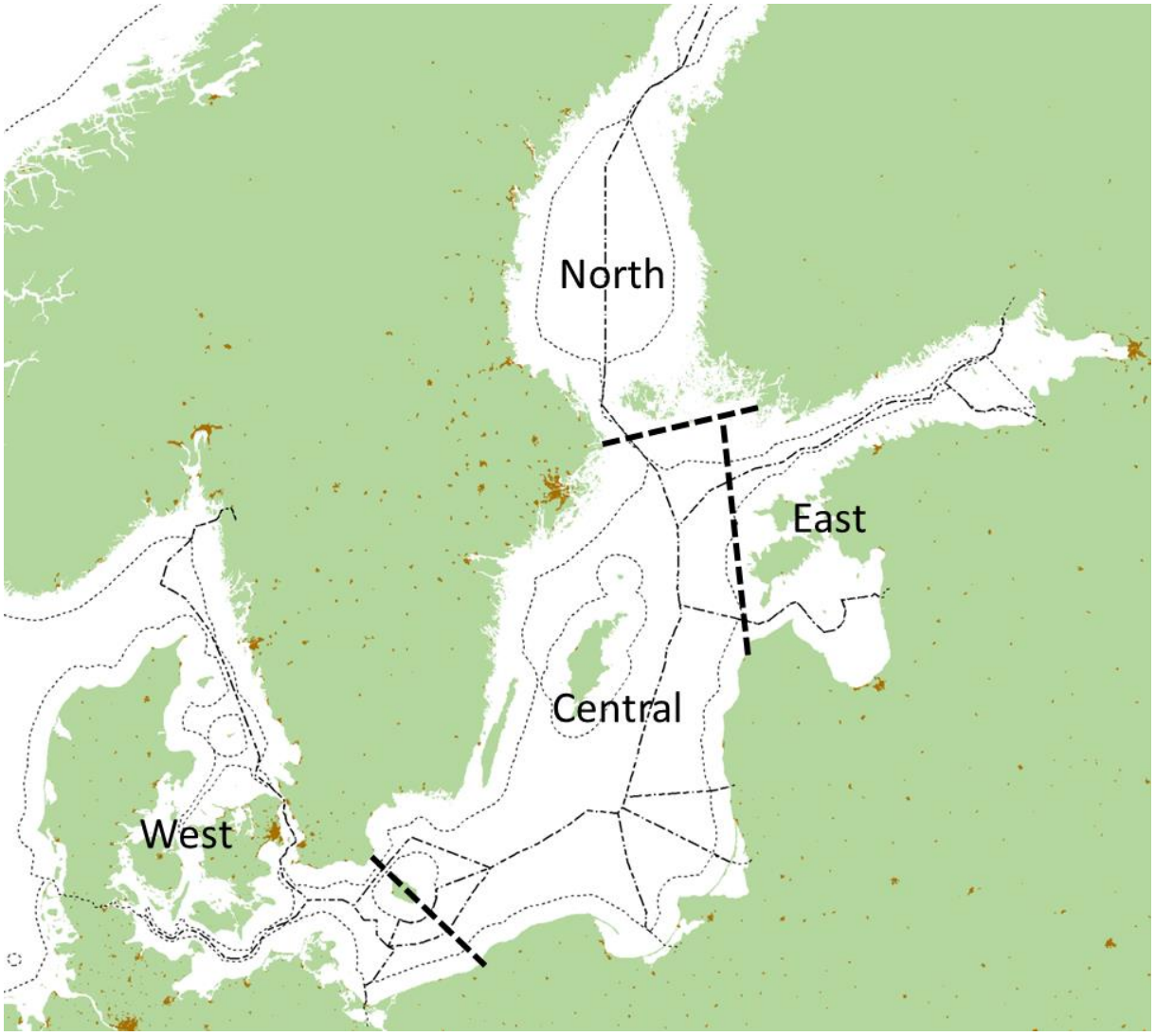
Figure 12: The current state of knowledge and quality of sources.

Introduction of munitions into the Baltic Sea

General description of different pathways of introduction: military activities (exercise, battles), dumping activities (officially designated and unofficial), accidents (emergency dumping, aircrafts, ships) etc.

Resulting in: Scattered munitions vs. munitions contained in wrecks (both aircrafts and ships)

Short description of the Baltic Sea's geography having influenced distribution of munitions introduction (see map below)



Relocation

Post-introduction processes affecting distribution of underwater munitions (and constituents)

Areas of concern

Maps & profiles for special areas of interest (historic context), i.a.:

- thematic map on chemical munitions
- but also maps and descriptions showing overlap of conventional and chemical munitions distribution and historical context

full list of areas will likely be suitable for placing in the annex

Environmental issues

(applicable hazards should be described in this chapter => description of likelihood and resulting risk will be addressed under 'risk assessment')

Hazards of intact munitions

To keep in mind that munitions are inherently dangerous, i.a.:

detonation: Shockwave, shrapnel, etc.

Deterioration of munitions casings and constituents

(general description)

Corrosion

Ageing of munitions constituents, e.g.:

- increased instability of aged explosive formulations
- formation of sulfur mustard lumps

Transformation & degradation

Spreading of munitions constituents

(also recalling relocation as a process promoting subsequent large-scale spreading)

General considerations on leaking & spreading (compound-specific considerations to be addressed in the subsequent section), i.a.:

- Dissolved compounds vs. particles/lumps

Hazards of munitions constituents

Focus on conventional munitions: explosives and white phosphorus

Concise description of CWA (refer to MUNI report for more comprehensive information)

Risk assessment

(making use of incident descriptions throughout to explain the basis for likelihood estimation)

With regard to humans

Divided according to different user groups (see MUNI report), i.a.: fishermen, construction workers, beach visitors

With regard to the environment

(also taking the introduction of energy [detonation] into consideration)

With regard to maritime infrastructure

i.a. cables, pipelines, offshore wind farms

shortly address risks to humans and the environment ensuing from this

Remediation/salvage measures

Principal considerations

(also discussing mitigation measures, e.g. with regard to marine mammals)

Techniques

i.a. action by divers, ROV and other recovery systems

Lessons learned

(From past measures)

Conclusions and recommendations

General

Consider this report as a step in an on-going process and to establish a working process for periodical updates after significant new information becomes available.

Update sea charts to reflect the extensions of areas contaminated with munitions and ensure that no information is lost on nautical charts when the transition to Electronic Nautical Charts is made.

Historical and technical research

Provide the required resources for analysing existing archival information about the locations as well as the types and amounts of dumped warfare materials.

Archives of the former allied forces, who supervised a large part of the dumping operations, need to be incorporated into this effort as much as possible.

Investigate in detail any presence of potential warfare material objects below the sea surface, discovered in the course of targeted studies or by chance.

Assess whether a systematic location survey for submerged warfare materials should be carried out in territorial waters and, as appropriate, which prioritisation and methods should be used.

Inspection and monitoring of environmental impacts

Develop appropriate methods for assessing and monitoring submerged munitions-contaminated areas, since necessity demands an improvement of the current status of knowledge regarding the environmental impacts of submerged warfare materials. Focus on the study and evaluation of the hazard potential of the nearshore areas as well as the most heavily munitions-contaminated areas.

Carry out additional investigations to support assessments of the overall situation, which so far have been based on isolated finds. Furthermore, investigations on the susceptibility of different types of munitions to corrosion should be carried out to provide robust information about the corrosion-dependent release of warfare material-type compounds into water and sediments.

Decide on the need for further action based on the inspection and evaluation of munitions-contaminated areas (vide supra), taking into account ecological, economic and technical aspects. The overriding question for every assessment is whether an immediate danger exists that needs to be averted. Further options can be considered on the basis of the recommendations, all the way up to a remediation.

Handling of hazardous situations

Review and, if necessary, develop guidance documents and rules of conduct for particularly dangerous activities involving direct or indirect contact with the sea floor, and assure the public availability of the relevant information.

Expand the range of options available for warfare material disposal (explosive ordnance disposal) continuously with new, alternative procedures that integrate up-to-date technological developments.

Channels for reporting and documentation

Advance the development of reporting channels and reporting systems in the Baltic Sea area: Create a central registration office to which all incidents occurring in the Baltic Sea are reported for documentation.

In order to simplify this process, existing systems should be taken into consideration as a basis, e.g., those established in Germany.

Annex 3

Proposed HELCOM response sub-regions

(cf. Outcome of RESPONSE 20-2015, Annex 2)

Annex 4

Draft outline of chapter on Wrecks of HELCOM SUBMERGED Assessment

Introduction

- **Wrecks in the Baltic Sea**
  - A general introduction, i.a.:
    - Definition of wrecks (ship wrecks, aircraft wrecks, other structures?)
    - Scope of contamination (fuel, cargo+++)
    - National wreck registers
- **Former reports**
  - Regarding managerial activities and investigations, i.a.:
    - Wreck mapping activities in the Baltic
    - Relevant wreck studies made elsewhere – Lessons Learned
    - Differences to this report (widened scope)
- **National activities**
  - Grouped according to MS:
  - Databases development
- **International activities**
  - managerial activities and investigations, i.a.:
    - IMO conventions – Nairobi Convention

Geographic distribution

- **Limits and quality of information**
  - Description of how the presented data was collated
  - especially: 'Disclaimer' regarding incomplete data basis and uncertainties associated with currently available historic information
- **Introduction of wrecks into the Baltic Sea**
  - Short general description of shipping history and other historical periods from which wrecks originate
  - General description to different wreck types and eras (accidental wrecks, battle wrecks)
- **Areas of concern**
  - Maps & profiles for special areas of interest (including historic context), i.a.:
    - thematic map on number of wrecks sites
    - but also maps and descriptions showing overlap of other
  - List of main known wrecks will likely be suitable for placing in the annex

Environmental issues

- Threat of oil pollution
- (applicable hazards should be described in this chapter => description of likelihood and resulting risk will be addressed under 'risk assessment')
- **Hazards related to fuel and cargo oils**
  - To
- **Other hazards related to wrecks – not to be handled in this context ?**

- ?

[Draft based on NOAA wreck assessment and other material to be provided by Estonia Triin Vokk after the SUBMERGED 3 meeting and to be uploaded to the workspace.]

Socio-Economic issues

Socioeconomic considerations and their inclusion to risk assessment.

[Draft based on NOAA wreck assessment and other material to be provided by Estonia Triin Vokk after the SUBMERGED 3 meeting and to be uploaded to the workspace.]

Risk assessment

- (Wreck prioritization/ risk assessment)

[Draft based on NOAA wreck assessment and other material to be provided by Estonia Triin Vokk after the SUBMERGED 3 meeting and to be uploaded to the workspace.]

Remediation/salvage measures (oil removal)

Introduction

Lessons learned have of the proved the water depth being the main parameter affecting whether or not oil has been removed from the wreck, or not. Most part of the successful oil removal operations have been conducted in the water depth less than 100 meter.

Often wrecks lying close to the coastal waters have more significant impact for the area with the gradual oil leakage. There are no reports on the sudden blow up type of oil plume based on submerged ship or wreck. The general tendency for oil leakage out of the sunken wrecks is usually a continuous oil spill outflow where the magnitude of oil remains small, but has peak values following closely on the hydrodynamic changes close to the wreck. In the Baltic Sea area, i.e. in the water depths of 50….80 m the most dominant factor is the water temperature close to the bottom, which usually reach the maximum value in the late Summer up to early Autumn. This has also been the time window when usually observations have been made having the mysterious origin, later confirmed to have the origin as a submerged object.

- Nationality, type, size and structure of the wreck;
- Condition/corrosion of the wreck;
- Water depth, temperature and current:
- Need for debris removal & munitions;
- Location, identification; tank/oil quality;

During the oil removal operation planning phase following factors should be taken into consideration:

- Marking penetration points to the hulls
- Vessel, Oiling and Ecological and Socio-economic risk assessment
- Underwater visualization
- Oil removal plans
  - Operation organization
  - Oil removal
  - Time schedule
  - Operation vessel(s)
  - Work method plan
  - Underwater working plan
  - Technology plan
  - Oil storage and disposal plan
  - Action plan in case of oil leakages

- Mobilization plan
- Demobilization plan
- Operation risk analysis.

Techniques

Due to the rapid development of the underwater technology there are a set of new technologies available assisting the authorities to locate an submerged object. Location of the underwater object is nowadays easier than it was 20..30 years ago. Identification of the object is also easier and cost saving with the modern technology. Modern ROV technology also allows response operations in deeper sea areas, thus wrecks which were out of the operations earlier can now be studied, and status checked with lower costs.

Underwater visualization

Wrecks condition and position is determined by means of side scan sonar, Multi Beam Echo Sounder or underwater 3D scanning. At different types of sonars it is possible to get an estimation of wrecks position and condition in general. Higher sonar frequencies yield better resolution but less range.

Water depth, temperature, current in situ

Water depth is measured by echo sounder. Water temperature is measured by thermometer at site. Water temperature has direct effect on oil viscosity and features. Strong currents may set limitations in usage of ROVs due their limited propulsion and working stability. For measuring currencies at longer periods of time a Recording Doppler Current Profiler may be used. Tidal range in the area must be investigated and reported.

Clearing and/or dredging

For clearing the operation area, support vessels winches, cranes and other special equipment, may be used. With divers and ROVs assisting. Mammouth pumps are often used to remove silt and other debris covering the target.

Cleaning of tank outer surface

For hull surface cleaning prior hot tapping operations, high water pressure can be used as well as mechanical scrubbing and brushing by divers or ROVs.

Corrosion of the wreck

Visual check by diver or ROV. Cleaning of surfaces and material thickness measuring with ultra-sonic thickness gauges.

Marking penetration points to the tank

Penetrating points in tanks are planned in desktop study phase. Then these are measured and located carefully and marked clearly before penetration, Figure zz. The entry marking is normally done with magnets or waterproof drawing by hand/ ROV's manipulator.

Figure zz.

Tank specific quantity and quality of oil

Determining oil amount through hull without causing unwanted leakage is desirable. Neutron Back Scattering (NBS) has potential in solving problem how to determining oil amount in tank, but so far field testing has not shown promising results. Technical limitations are at determining oil/water boundary surface, since method has limitations to separate oil from water without being at exact boundary surface. Other limitation is measuring length through steel. Through 20 mm of steel plate scanner measures only about 30 -40 mm deep inside of tank. (Sjöfartsverket 2014, Undersökningsmetoder och miljöaspekter Dnr: 1399-14-01942-6) Until more reliable method is available best solution is to estimate amount of oil through available material of ships log books and other material from witch oil amount may be calculated.

Oil sample can be taken from spilled oil, or through purposely drilled hole, that is fitted with valve or sealed plug afterwards.

Oil Removal

Ease of pumping also depends on the tank dimensions. A wide, shallow tank with the same volume behaves differently to one which is narrow and tall. Heating oil need to be carried out to change the viscosity of the fluid. In certain cases chemicals to modify flow characters can be used. Methods chosen are result of combination with parameters tank dimension, oil quality, quantity and temperature.

Pumps and transfer hoses

There are numerous types of pumps. For oil removal applications three types of pumps are more commonly in use. They are: Centrifugal pump. Archimedes screw pump and Screw pump. Vacuum pumps are also used in oil transferring.

Oil viscosity control

Viscosity is adjusted by temperature and/or chemicals. Temperature is normally raised with steam or electrically operated heat exchangers. Depending on the age of the wreck and fuel type used the range of viscosity varies a lot. Usually the fuel oil stays rather fresh in submerged fuel tanks. Lessons learned have pointed out the fact the older oil types have been more soluble due to the existence of lighter hydrocarbon. Due to the improvement of the oil cracking methods in oil refineries bunker oils close to the modern time have been more viscous and having even pseudoplastic character instead of the Newtonian fluid in colder bottom temperatures. Heavy fuel oils usually form the challenge for the heating and pumping systems onboard the recovery fleet.

Vessels for the operation

Operational vessels are chosen by conditions and characteristics of an operating area. Seashore and shallow waters at archipelago areas have other requirements than open and deep seas. Anchoring and positioning vessel between group of islands at shallow and non-flowing water is less demanding than positioning support vessel at high flowing heavy currents or in deep waters where anchoring is practically impossible.

Oil storage and recycling plan

Oil disposal is planned together with local recycling authorities. Logistics and processes are agreed and estimation of removed oil quantity and quality is given. Water contamination in oil may need special attention. Water/oil separators may be used if water contamination is greater than acceptable amount. Acceptable amount of water in oil is agreed with oil recycling authorities while making disposal contract.

(Conclusions and recommendations)

- (Likely to be placed at the end of the complete SUBMERGED report)
  screening the national registers using selected risk assessment tool (VRAKA)
  selecting the “hot spots” using the unified risk matrix with preselected parameters
  screening up the locations of the objects with the HELCOM sensitivity maps
  selecting an appropriate amounts of objects for further measures
  conducting hydrodynamic studies and additional measures to validate the studies carried out and to get justification for the original analyses
  selecting the hot spots and transfer data to the proper GIS database /HELCOM ?
  creating programme to follow up the selected objects (additional satellite images in August – November, etc…)

Annex 5

Work plan of HELCOM SUBMERGED

Deadline	Task
December 2015 (date tbc) HELCOM SUBMERGED 4-2015 Online meeting	Considering available drafts of the three chapters. Considering overall progress and further work needed
First half of February 2016 Submission to RESPONSE	Available draft of the whole report will be compiled and sent to the RESPONSE meeting by the Secretariat
15-17 March 2016, Sweden HELCOM RESPONSE 21-2016 meeting	HELCOM RESPONSE meeting to comment, provide additional information and to consider timeframe of the SUBMERGED activity (ready report by the end of 2016).
12-13/12-14 April 2016, Tallinn HELCOM SUBMERGED 5-2016	Completion of the draft report for circulation to HELCOM RESPONSE Contacts.
April-May 2016	Circulation and gathering comments from HELCOM CPs
Summer 2016	Incorporating comments and input
29 September 2016, Copenhagen HELCOM SAFE NAV 7-2016	Presentation of revised draft document to SAFE NAV 7 and gathering further comments and input
Autumn 2016 HELCOM RESPONSE 22-2016	Endorsement of final assessment report
December 2016 HELCOM HOD	Approval of final assessment report for publishing

Annex 6

Nominated Members of HELCOM SUBMERGED

Representing	Name	Organisation	E-mail address
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