



UNITED
NATIONS

EP

UNEP(DEPI)/MED WG.439/Inf.11



UNITED NATIONS
ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

UNEP

12 May 2017
Original: English

Meeting of the MED POL Focal Points

Rome, Italy, 29-31 May 2017

Agenda item 9: Other Specific Issues

Emerging Chemicals in the Mediterranean Sea

For environmental and economic reasons, this document is printed in a limited number. Delegates are kindly requested to bring their copies to meetings and not to request additional copies.

UNEP/MAP
Athens, 2017

Table of Contents

INDEX	
1. INTRODUCTION AND BACKGROUND	
2. REGIONAL AND GLOBAL REGULATORY FRAMEWORKS ON CHEMICALS	
3. CURRENT RESEARCH ON EMERGING CHEMICALS IN THE MEDITERRANEAN AREA.	
4. COMPARISON OF TARGET CHEMICALS UNDER DIFFERENT REGIONAL SEAS CONVENTIONS.	
5. SETTING THE BARCELONA CONVENTION CANDIDATE CHEMICALS LIST.	
6. CONCLUSIONS AND RECOMMENDATIONS	
7. REFERENCES	
ANNEX I. The Stockholm Convention POPs list	
ANNEX II. The EU WFD Priority substances list under Directive 2013/39/	
ANNEX III. OSPAR List of Chemicals for Priority Action (Revised 2013)	
ANNEX IV. HELCOM List of Priority Hazardous Substances (2010)	
ANNEX V. The BARCELONA CONVENTION chemicals list (2000).	

1. INTRODUCTION AND BACKGROUND.

This document presents a follow up¹ of the priority environmental chemicals lists and the know-how to this regard in the Mediterranean Sea to allow to propose a candidate list of additional chemicals (mostly, synthetic organochlorinated compounds, phenols, pharmaceuticals, hormones and metals/elements) to be included in the Barcelona Convention in light of the evidences of their environmental occurrence in the marine environment. Therefore, the Barcelona Convention Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources (the LBS Protocol) and the Protocol for the Protection of the Mediterranean Sea against Pollution resulting from Exploration and Exploitation of the Continental Shelf and the Sea Bed and its Subsoil (the Offshore Protocol) require an update of the chemicals list. These chemicals should be targeted in the coming years under the MED POL monitoring and activities to gather scientific information to be able to propose measures for their reduction or elimination.

The aim of this document is to review the lists of priority contaminants to allow the selection of candidate chemicals to be included for the monitoring in the Mediterranean Sea under the MED POL Programme for the coming years. The sources of information to perform the selection of these substances are based mainly in available lists of chemicals of concern internationally, such as:

- OSPAR and HELCOM Regional Seas conventions Priority List of Chemicals and Substances of concern;
- The European Commission WFD and MSFD Directives and the list of priority substances and 'Watch list';
- The Stockholm, Rotterdam and Basel Conventions list;
- The US Environmental Protection Agency Lists;
- Other regional studies (e.g. California Biomonitoring)

These information sources above were contrasted with the availability of studies in the Mediterranean Sea and its ecoregions by performing a revision of the main bibliographic databases (ScienceDirect-ELSEVIER and Web of Science-Thomson Reuters). The last 20 years (1998-2017) with up to 10,000 references were investigated for the 'contamination and pollution in the Mediterranean' and 'marine' keywords, with the goal to identify gaps and priorities in the Mediterranean Area for further chemicals to be included in a candidate chemicals list.

The Barcelona Convention and its Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities (LBS Protocol) is the main legal reference regarding the reduction of pollutants within the Mediterranean region. According to its general provision (art.1), the Parties "*shall take all appropriate measures to prevent, abate, combat and eliminate to the fullest possible extent pollution of the Mediterranean Sea Area caused by discharges from rivers, coastal establishments or outfalls, or emanating from any other land-based sources and activities within their territories, giving priority to the phasing out of inputs of substances that are toxic, persistent and liable to bioaccumulate*".

To respond to the LBS Protocol of the Barcelona Convention, the Strategic Action Plan (SAP-MED) is the first and unique long term policy (2000-2025) focused on combatting pollution from land based sources and activities and their impact on marine and coastal environments. The SAP-MED is an action-oriented initiative to manage priority target categories of harmful substances and activities, to be eliminated or controlled by the Mediterranean countries through specific pollution reduction measures and interventions up to the year 2025. These actions are executed through plans and programmes, such as Sectoral Plans (SPs), National Actions Plans (NAPs), National Diagnostic Analyses (NDAs), National Baseline Budgets (NBBs) of emissions/releases, the MED POL Programme, and others (UNEP/MAP, 2015).

¹5th Meeting of the Ecosystem Approach Coordination Group. Rome, Italy, 14-15 September 2015. UNEP(DEPI)/MED WG.420/Inf.13

To this regard, the 18th Meeting of the Contracting Parties to the Barcelona Convention in 2013, mandated the update of the National Action Plans (NAPs) with the main objective to identify the necessary programmes of measures to meet the obligations under the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities (LBS Protocol), in line with the adopted routemap for the Ecosystem Approach (EcAp) and the Good Environmental Status (GES) overall target in the Mediterranean Sea. Later, the 19th Meeting of the Contracting Parties in 2016, adopted the Integrated Monitoring and Assessment Program of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP), which includes updated decisions with regard the IMAP Ecological Objective 9 (Contaminants cause no significant impact on coastal and marine ecosystems and human health). The focus of both actions, namely NAPs (ca. Programmes of Measures) and IMAP (ca. Integrated Monitoring), necessarily take into account a list of pollutants, emerging and priority contaminants, as well as the relevant industrial and economic sectors affecting to their input in the marine environment. In this way, a circular environmental management is established between the emissions/releases of harmful substances and their environmental monitoring (ca. MED POL Programme) under the SAP-MED, to enter in action.

The SAP MED (2000-2025) set the following targets with regard to chemical contaminants:

- Phase out inputs of 9 pesticides and PCBs by 2010 (Aldrin, DDT, Dieldrin, Endrin, Chlordane, Heptachlor, Mirex, Toxaphene, PCB/PCT) and reduce to the fullest possible extent hexachlorobenzene, dioxins and furans by 2010;
- Phase out to the fullest possible extent inputs of PAHs by 2025;
- Phase out to the fullest possible extent discharges and emissions and losses of heavy metals (mercury, cadmium and lead) by 2025;
- Reduce discharges, emissions and losses of zinc, copper and chromium by 2010 and eliminate by 2025;
- Phase out to the fullest possible extent discharges and emissions and losses of organotin compounds by 2010 (Butyltin compounds);
- Reduce discharges, emissions and losses of organohalogen compounds, such as Lindane, into the Mediterranean sea by 2010 and eliminate by 2025

Table 1. SAP-MED (2000-2025) priority substances related to industrial development.

Toxic, Persistent and Liable to Bioaccumulate (TPB)	Aldrine, DDT, Dieldrine, Endrine, Chlordane, Heptachlor, Mirex, Toxaphene, Hexachlorobenzene, Polychlorinated biphenyls (PCB), Polychlorinated dibenzo-p-dioxins/furans (PCDD/PCDF), Polycyclic Aromatic Hydrocarbons (PAH), Mercury, Cadmium, Lead, Organometallic compounds
Other heavy metals	Zinc, Copper, Chrome
Organohalogen compounds	Chlorinated solvents, Chlorinated paraffins, Chlorobenzenes, Polychlorinated naphthalenes (PCNs), Polybrominated diphenyl ethers (PBDE) and Polybrominated biphenyls (PBB), Chlorophenols, Lindane, Chlorophenoxy acids
Radioactive substances	-
Nutrients and suspended solids	BOD ₅ , Nutrients (Nitrogen, Phosphorous), Suspended Solids (SS)
Hazardous wastes	Obsolete chemicals, Used lubricating oils, Batteries

(Source: UNEP/MAP MED POL, 2015)

Consequently, further measures (see BOXPLOT 1) were elaborated and adopted in the framework of the implementation of Articles 5 (General Obligations) and 15 (Adoption of Action Plans, Programmes and Measures) of the LBS Protocol and in line with the SAP-MED targets. The origin of these measures can be traced back to the year 2008 when MED POL Focal Points agreed to establish a list of 'action' priority substances. The 'action' priority substances as regards chemical contaminants consist of Metals, Organic metallic compounds, Polychlorinated Biphenyls (PCBs), Polychlorinated dibenzodioxins (PCDDs), Polychlorinated dibenzofurans (PCDFs), Volatile Organic Compounds (VOCs) and POPs. In principle, it was agreed that in order to propose measures, the substance:

- Should be covered by regional and/or international instruments regulating its use, release or phasing out (e.g. under Stockholm Convention);
- Should have an Emission Limit Value (ELV) or its ELV is under development either at national or at regional levels;
- The substance and/or its high input could represent a risk to the marine environment or human health

Table 2. Level of achievement of SAP-MED targets based on 2003, 2008 and 2013 NBB data and E-PRTR 2013 data (Source: UNEP/MAP, 2015).

SAP-MED Category	Substance	SAP-MED target	Emission value (kg/year)			Trend 2013 vs 2003 ¹³
			2003	2008	2013 ¹⁴	
Nutrients and suspended solids	BOD5	Reduce 50% inputs of BOD by 2010	●	●	●	
POPs	Aldrin	Phase out inputs of 9 pesticides and PCBs and reduce to the fullest possible extent hexachloro benzene, dioxins and furans by 2010	-	133.1	127.1	-5% ¹⁵
	Dieldrin		-	69.59	124.23	79% ¹⁵
	Endrin		-	0.06	37.97	●
	Heptachlor		-	0.07	92.00	●
	Hexachloro-benzene		0.36	29.57	25.17	>100% ¹⁵
	PCB/PCT		5.2	14.93	7,289.15	>100% ¹⁵
	PCDD/PCDF		5.18	1,037.62	147,195.57	>100%
PAHs	PAH	Phase out to the fullest possible extent inputs of PAHs by 2010	512,331	421,053	12,434	-98%
Heavy metals (Hg, Cd, Pb) and organometallic compounds	Mercury	Phase out to the fullest possible extent discharges and emissions and losses of heavy metals by 2025	1,029,131	612,618	58,671	-94%
	Cadmium		21,057	11,347	38,506	83%
	Lead		1,760,068	1,245,723	342,117	-81%
Other heavy metals	Zinc	Reduce discharges, emissions and losses of zinc, copper and chrome by 2010	7,753,795	3,110,815	851,796	-89%
	Copper		107,641	226,923	10,520,102	>100%
	Chrome		●	8,516,046	1,602,495	-88%
Organohalogenated pesticides	Lindane	Reduce discharges, emissions and losses into the Mediterranean Sea by 2010	0.03	267.71	105.90	>100%

13. Current status (in %) has been calculated following the formula: (kg substance reported 2013/kg substance reported 2003)/kg substance reported 2003. Numbers in red mean a net increase from 2003 to 2008 while numbers in green mean a net reduction from 2003 to 2008.

14. 2013 values include NBB 2013 for Egypt, Lebanon, Israel, Montenegro and Turkey. E-PRTR 2013 for Cyprus, France, Italy, Greece, Malta, Slovenia and Spain

15. Current status calculated following: (kg substance reported 2013-kg substance reported 2008)/kg substance reported 2008.

As it could be observed in Table 2 some of the SAP-MED goals are progressing towards the targets set by 2025. For example, decreasing trends has been calculated for Aldrin, PAHs, Mercury, Lead, Zinc and Chromium. These information is confirmed by the latest analysis on levels and trends report in the Mediterranean Sea based on the MED POL Database on monitoring. On the other hand, some trends are presented with 5-year increments over a 100%, however caution should be taken to interpret these trends as the reported baseline data could contain some issues, such as for PCB/PCTs. Lindane (γ -HCH isomer) according to the assessment is far to reach the measure adopted for its phase out. Some of these compounds showing increasing trends have been banned by the Stockholm Convention and levels in the environment show low levels except for the known hotspots in Mediterranean coastal areas. In any case, the relevance of the chemicals selected should be in accordance with the data analysis of emissions/releases.

BOX PLOT 1. Legally binding measures adopted by Contracting Parties of the Barcelona Convention between 2009-2012 in relation to chemical contaminants.

- **Elimination of the POPs Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Mirex and Toxaphene (Decision IG.19/8, effective 2011 and 2012 for stock piles).**
- **Phasing out of DDT (Decision IG.19/9, effective 2011 and 2012 for stock piles).**
- **Reduction of inputs of Mercury (Decision IG.20/8).**
- **☒ Phasing out of the POPs hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether (Decision IG20/8, effective 2013)**
- **Phasing out of the POPs lindane and endosulphan (Decision IG20/8, effective 2013)**
- **Phasing out of the POPs perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride (Decision IG20/8, effective 2013)**
- **Elimination of the POPs alpha hexachlorocyclohexane, beta hexachlorocyclohexane, chlordecone, hexabromobiphenyl ether, pentachlorobenzene (Decision IG20/8, effective 2013)**

In any case, the chemicals of concern and ‘action’ chemicals should be linked to the known sources, as well as production and use. At present, not only industrial chemical substances should be considered (majorly, legacy pollutants), but other groups of chemical products in our daily live might have severe impact in the coastal environment as well, reaching the sea through waste water effluents. The Contracting Parties reported emissions by categories are shown in Figure 1.

The Figure compares the emissions reported between 2003, 2008 and 2013 under the LBS Protocol of the Barcelona Convention by Contracting Parties (averaged from hundreds to thousands of tonnes). These specific and compound categories are the precursors of harmful chemicals monitored in biota and sediments along the coastal and marine areas in the Mediterranean Sea.

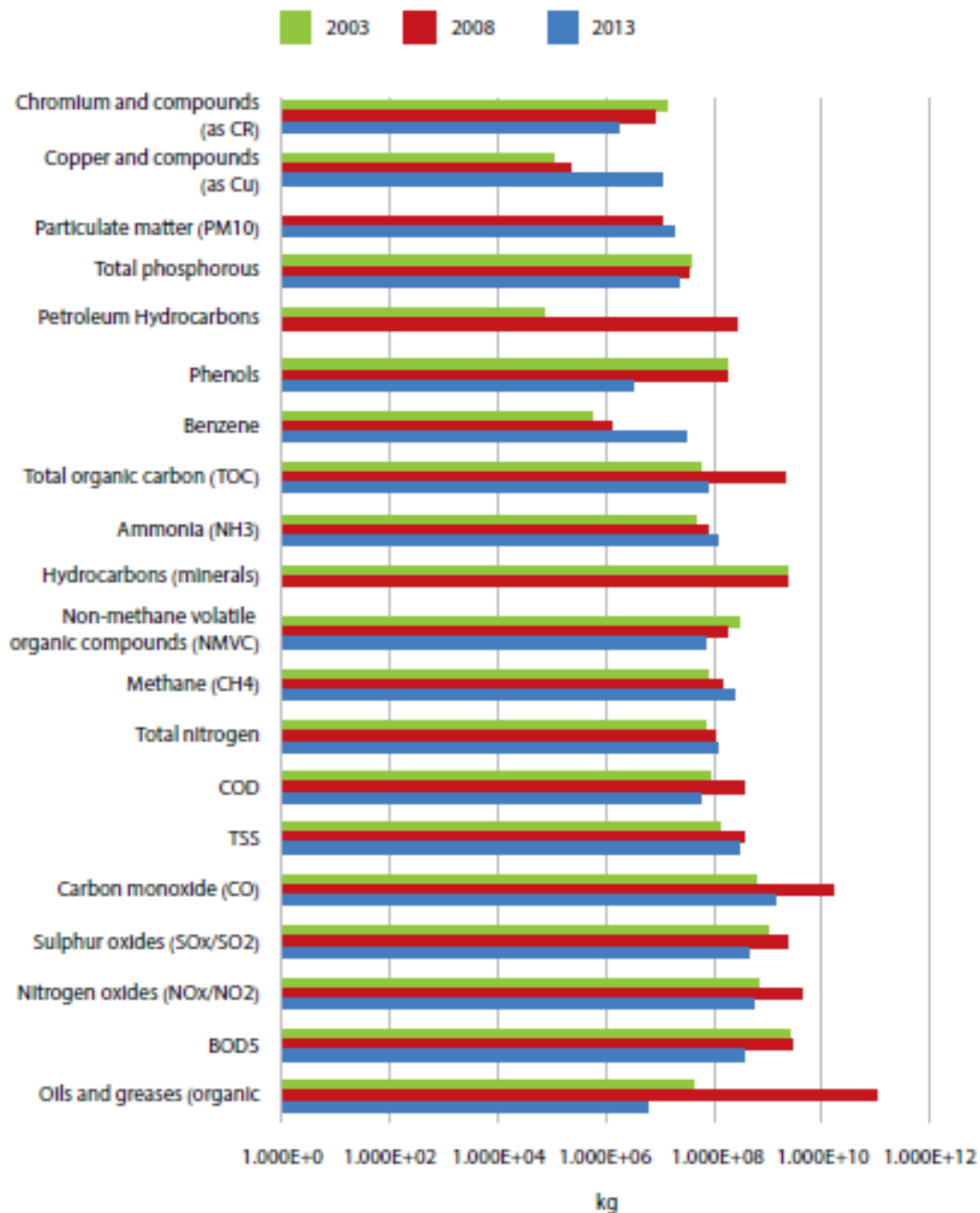


Figure 1. Top pollutants by emission values (NBB 2003, 2008 and 2013 NBB data and E-PRTR 2013 data).

2. REGIONAL AND GLOBAL REGULATORY FRAMEWORKS ON CHEMICALS

As pointed out earlier, discussions on harmful substances within the Mediterranean Sea, should be covered by regional and/or international instruments regulating its use, release or phasing out (e.g. Stockholm Convention). The boxplot below (BOX PLOT 2), show the main UN instruments to control the uses and trade of harmful chemicals worldwide. In the international sphere, the marine environment harmful substances are also covered by the Regional Seas Conventions, such as OSPAR and HELCOM, the European Union policy, as well as organisations, such as the US Environmental Protection Agency in the United States. These instruments and their list of substances are discussed below and presented in the Annexes.

BOX PLOT 2. United Nations International Regulatory Framework for chemicals.

The **Stockholm Convention** (<http://www.pops.int>) is a global treaty to protect human health and the environment from persistent organic pollutants that has been signed by 179 governments, which was adopted in 2001 and entered into force 2004. The governments will have to take measures to eliminate or reduce the release of POPs into the environment. Under the Convention, any Party can submit proposals for listing new chemicals, which may be added by decisions of the Conference of Parties (CoP) to Annex A for global elimination, Annex B for restriction, and/or Annex C as unintentionally produced products. To date the Stockholm Convention has listed 23 priority POPs to its three Annexes: the initial (and largely out of use) 12 POPs, and a further 11 POPs added in 2009 (9 chemicals), 2011 (1 chemical), 2013 (1 new chemical) and 2015 (3 new chemicals).

The **Rotterdam Convention** (<http://www.pic.int>) is a global treaty to promote shared responsibility for chemicals, through cooperative efforts among Parties in the international trade of certain hazardous chemicals and to contribute to the environmentally sound use of those hazardous chemicals. It has 154 Parties in 2015. While the chemicals listed in the Rotterdam Convention are not banned, they represent priority chemicals that are known to cause unacceptable health and/or environmental effects in more than two regions, and have been banned or severely restricted by national governments for this reason. The Convention provides for a Prior Informed Consent procedure for imports of chemicals listed in its Annex III, a total of 47 pesticides and industrial chemicals.

The **Basel Convention** (<http://www.basel.int>) was adopted in 1989 with the aims of reducing hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal; restricting transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management; and establishing a regulatory system for cases where transboundary movements are permissible. It has 181 Parties in 2015. Annex I identifies 18 waste streams (e.g. clinical wastes, manufacturing or waste disposal operations), and 27 waste constituents (see Annex 2). Annex III lists 14 Hazard Characteristics; while two additional lists were added in 1998 which identify waste types that are (Annex VIII, List A) and are not (Annex IX, List B) covered by the convention.

The **Strategic Approach to International Chemicals Management** (SAICM) (<http://www.saicm.org/>), was adopted by the International Conference on Chemicals Management (ICCM) in 2006 and is a policy framework to foster the sound management of chemicals. SAICM was developed by a multi-stakeholder and multi-sectoral Preparatory Committee and supports the achievement of the goal agreed at the 2002 Johannesburg World Summit on Sustainable Development of ensuring that, by the year 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health.

European Union and United States Environmental Chemicals Policy

The European Commission has established since 2000 diverse policy mechanisms to control and manage the continental and marine surface waters, namely, the Water framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD) (European Union, 2000, 2008a and 2008a). With regard to the latter, the MSFD requirements require to Member States (including those European countries with shoreline in the Mediterranean Sea), to take into consideration the relevant provisions of the WFD in territorial and/or coastal waters to ensure proper coordination of the implementation of the two legal frameworks. The WFD include an amended list of priority chemicals and environmental criteria (45 compounds and their environmental quality standards, EQS). Twelve priority substances were added to the initial list of 33 substances of their Annex X (European Union, 2013) in order to be monitored in all European countries (mainly river basins). The MSFD recommends the same list of substances, with the exception of those which are not relevant to the marine environment, to be monitored in the marine ecosystems. The MSFD has an Ecosystem Approach criteria for their evaluation based on 11 Descriptors of Good Environmental Status (GES), where Descriptors 8 and 9 concern to the occurrence of harmful chemicals in the marine ecosystem. The Annex II present the list of substances under the WFD and can be found also:

http://ec.europa.eu/environment/water/water-dangersub/lib_pri_substances.htm

In 2015, according to Directive 2008/105/EC as amended by Directive 2013/39/EU (the Environmental Quality Standards Directive, EQSD), a new mechanism was needed to provide high-quality monitoring on the concentrations of potentially polluting substances in the aquatic environment across the EU (JRC, 2015a). The mechanism, aimed at emerging chemicals, consist in the elaboration of a short-list of 10 chemicals to be included in a list for a limited period of time (a dynamic 'Watch list'), with the purpose of monitoring them for 4 years, and thus, better inform the determination of suitable risk reduction measures (Figure 2). The selection mechanism to identify a short-list of substances is based on the suspected risk to or via the aquatic environment (organisms toxicity and potential hazards to human health), and the unavailability of sufficient monitoring data or data of sufficient quality to identify the risk posed by those substances, as well as reliable analytical methods and no immediate ban on production or use in the EU to be foreseen. Therefore, information on these aspects should be gathered from a number sources, such as revisions of the list of the WFD, research projects, stakeholders recommendations, results of monitoring programmes and information on production volumes, chemical properties and environmental concentrations and effects. Further, secondary criteria has also been taken into account for prioritising substances (JRC, 2015a)

1. Diclofenac
2. 17-Beta-estradiol (E2), Estrone (E1)
3. Alpha-ethinylestradiol (EE2)
4. Oxadiazon
5. Tri-allate
6. Methiocarb
7. 2, 6-ditert-butyl-4-methylphenol
8. Neonicotinoid insecticides as a group: Imidacloprid, Thiacloprid, Thiamethoxam, Clothianidin, Acetamiprid
9. Macrolide antibiotics: Erythromycin Clarithromycin, Azithromycin
10. 2-Ethylhexyl 4-methoxycinnamate

Figure 2.. Current chemicals included in the European Union Water Framework Directive ‘Watch List’ to be monitored in continental and coastal marine waters.

This final 1st Watch List (Figure 2) discarded substances, such as Bisphenol A, Carbamazepine, Ibuprofen, Zinc and its compounds, Cyanide – free (HCN and CN-), Phenanthrene and Malathion; however, these might be included straightforward to the next revision of the Annex X of the WFD. Musk xylene was also discarded because a ban has been imposed on its use in Europe. The justification of the selection process can be found in the Joint Research Center (JRC) Report (JRC, 2015a and reference there in). The original proposals of chemicals were searched in three databases, including NORMAN Database (Network of reference laboratories, research centres and related organisations for monitoring of emerging environmental substances <http://www-norman-network.net>). In terms of effects (toxicology), an assessment of PEC and PNEC (JRC, 2015) was undertaken for the initial list of substances before those were short-listed for the Watch list.

As mentioned above, with regard to the MSFD, the reference list of substances at EU level is provided by the WFD. More, the MSFD provisions foresee the consideration of contaminants that are not covered by the WFD, but entail a significant risk to, or via, the marine environment. Beyond the traditional pollutant land-based sources into the coastal marine environment, the threat posed by sea-based sources of chemicals in coastal and marine areas has been reviewed recently by the European Commission JRC (JRC, 2015b). The resulting lists are a compendium that should support the selection of relevant substances. The sea-based sources of contaminants are mainly originate from offshore oil and gas industry followed by shipping, mariculture, dredging and dumping activities, offshore renewable energy devices, shipwrecks and seabed mining.

To this regard, the offshore oil industry (exploration and exploitation of oil resources) is the major contributor to sea-based sources of contaminants. Produced waters and drilling muds generated during the extraction of oil by means of offshore installations are one of the main contributors for a number of toxic chemical compounds to be released. Some chemical substances are included already in the lists of the regional sea conventions (RSCs), such as Phenols/Alkylphenols (methylphenols, nonylphenols, octylphenols, etc.) and Polycyclic Aromatic Hydrocarbons (PAHs), whilst other categories should be included (viscosifiers, shale inhibitors, surfactants, lubricants, antifoams, flocculants and metals/metalloids to mention few) (JRC, 2015b).

In the European Union context, the REACH Regulation is another policy instrument for the chemicals industry (Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals-REACH), which establishes the European Chemicals Agency (ECHA), overall aiming to improve the protection of human health and the environment from the risks that can be posed by chemicals, while enhancing the competitiveness of the EU chemicals industry. Since 2006, the combination of this policy with the environmental policy directives allow a better control, prevention or ban of the harmful chemicals. The ECHA receives and evaluates individual registrations for their compliance, and the EU Member States evaluate selected substances to clarify initial concerns for human health or for the environment. Authorities and ECHA scientific committees assess whether the risks of substances can be managed, otherwise, decide on restrictions or bans. The EU ECHA website for substances included in the REACH candidate list can be found:

<http://echa.europa.eu/web/guest/candidate-list-table>

Similarly to the European Union, it is worth to mention here other international chemicals lists in the framework of the management and control of chemical pollutants, for example, in the United States.

The US Environmental Protection Agency (US EPA) reports on a Contaminant Candidate List (CCL), which is a list of contaminants that are currently not subject to any proposed or promulgated national primary drinking water regulations, but are known or anticipated to occur in public water systems, and therefore require to be investigated to gather information. The contaminants listed on the CCL may require future regulation under the Safe Drinking Water Act (SDWA). The most recent list, CCL 4, announced by US EPA, was in November 2016. With regard the marine environment the list contains some chemicals also targeted by different RSCs, such as Nonylphenols (OSPAR) or under the European Water Framework Directive 'Watch List', such as hormones (e.g. E1, E2 and EE1). The CCL-4 List (USEPA) can be found:

<https://www.epa.gov/ccl/chemical-contaminants-ccl-4>

In parallel, the US EPA also establish a list of no more than 30 compounds to be monitored during a period of time, called the Monitoring Unregulated Drinking Water Contaminants List, similarly to the 'Watch List' of the European Union, in order to gather information as a basis for future regulatory actions to protect public health. The most recent list, UCMR 4, announced by US EPA, was in December 2016 (chemicals to be monitored between 2018 and 2020):

<https://www.epa.gov/dwucmr/fourth-unregulated-contaminant-monitoring-rule>

Regional Seas Conventions (RSCs) in the European Area

Two main regional seas conventions in the European context have published and update lists of chemicals for priority action; for the North Atlantic Area (OSPAR Convention) and the Baltic Sea (HELCOM). In the case of the OSPAR List (OSPAR, 2013), background documents are prepared for each chemical substance (the Part A list of the Priority Action Chemicals List). The background documents assess the situation for the substance and conclude on what actions are necessary to move towards the cessation target. They are reviewed periodically, resulting in review statements or revised background documents, depending on whether the new information available affects the risk evaluation and the recommended actions. Each of these chemicals also has a monitoring strategy. The selection and prioritisation of substances, is now performed based on the evaluation of chemicals and their properties covered by EU legislation. With respect the substances of possible concern, OSPAR is relying on progress on the evaluation of substances under the REACH Regulation and on the prioritisation of substances under the Water Framework Directive (see above).

Additionally, the OSPAR List of Substances of Possible Concern (LSPC) it is a dynamic working list and is regularly revised as new information becomes available which can result in substances either being removed from the list or added to the List of Chemicals for Priority Action. In the light of developments in the chemicals sector in the European Community, namely developments under the Water Framework Directive and the REACH regulation, OSPAR work on the selection and prioritisation of substances has been put on hold. Instead, OSPAR collaborates with the EC on these issues.

The Helsinki Commission (HELCOM, 2010) has developed a similar approach to protect the Baltic Sea from the environmental harmful effects of chemical substance and to prevent pollution by continuously reducing discharges, emissions and losses of hazardous substances; with the ultimate aim to achieve concentrations in the environment near background values for naturally occurring substances and close to zero for man-made synthetic substances. An updated list of priority substances

was released in HELCOM Recommendation 31E/1 and adopted in 2010 in the framework of the Baltic Sea Action Plan. The list will be updated regularly based on monitoring data and other scientific data.

3. CURRENT RESEARCH ON EMERGING CHEMICALS IN THE MEDITERRANEAN AREA.

Based on bibliographic research performed in the main databases (Elsevier and Thomson Reuters), Figure 2 show the distribution of contributions in terms of research papers, books, conference proceedings and other formats for the Barcelona Convention Contracting Parties to the topic of marine pollution in the Mediterranean Sea. Both Figures (2a and 2b, based on Elsevier and Thomson and Reuters databases, respectively) indicates that nine Contracting Parties, namely Morocco, Israel, Tunisia, Turkey, Egypt, Greece, Italy, France and Spain lead the research and monitoring inputs with regard to chemical pollution in the Mediterranean. The latest three countries, Italy, France and Spain, show the highest percentages of contribution in both databases.

In light of these information, it is clear that more research investigations and environmental monitoring is necessary in the Mediterranean Area to be able to produce information on the chemical occurrence of legacy and emerging pollutants. Figure 6, shows the distribution of contributions by Mediterranean ecoregions, reflecting a domination of studies undertaken in the Adriatic Sea area. However, taking into account the number of research contributions contributions by countries these geographical distributions (ecoregions) might not be fully accurate, and respond to the methodology and indexed keywords in order to retrieve the information from those databases. Therefore, the comparison of databases is of high importance (Figure 2a and 2b).

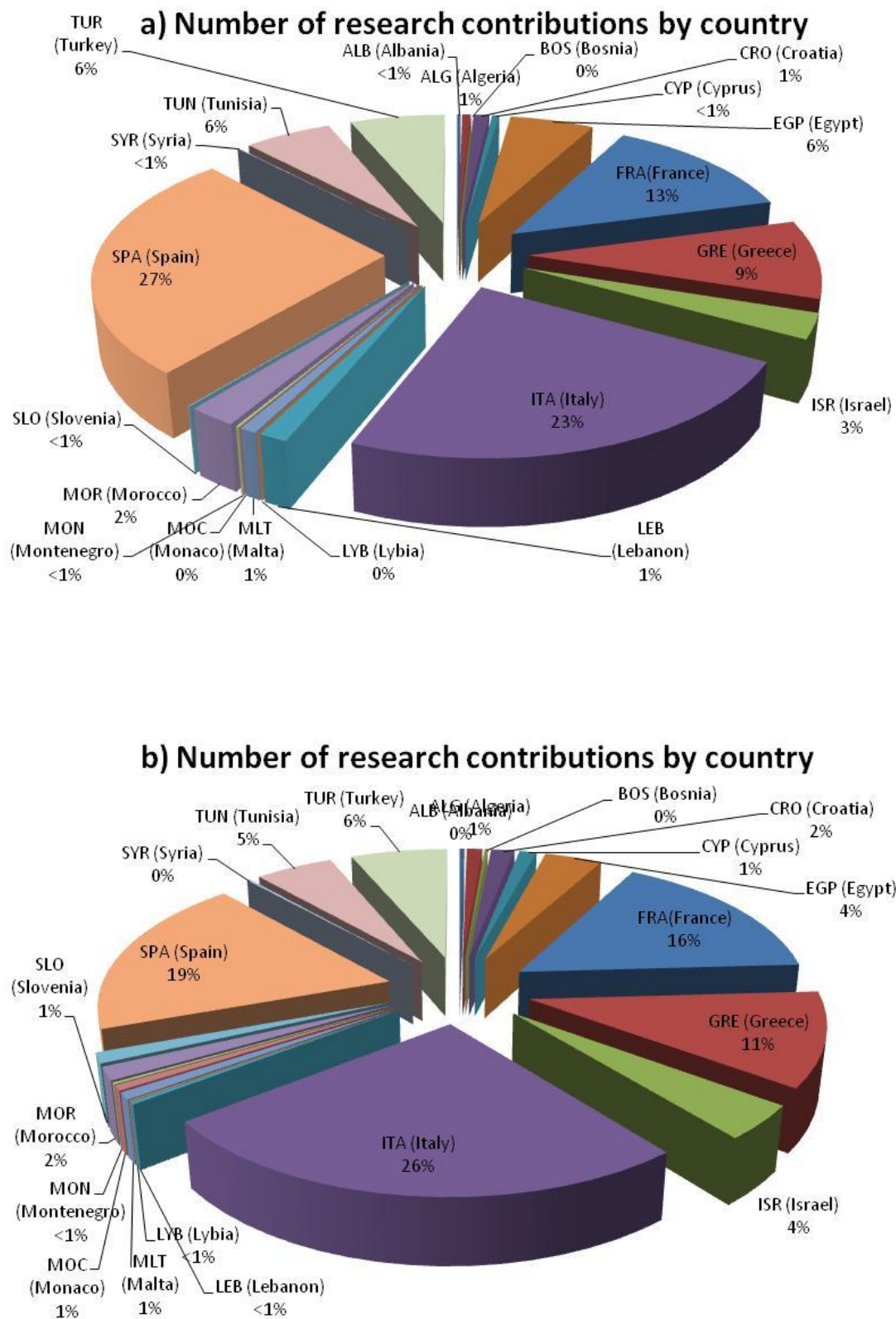


Figure 2. Percentages of the research contributions from two different databases on pollution research for common priority chemicals lists from OSPAR, HELCOM and Barcelona Convention targets in the Mediterranean Sea. (a) ELSEVIER, ScienceDirect, b) THOMSON AND REUTERS, Web of Science.

To note, that the majority of investigations and monitoring survey for chemical pollution under the LBS Protocol of the Barcelona Convention and published in scientific journals has been performed in the coastal environments (mussel chemical monitoring, and lately, sediment sampling), and rarely in other locations in the marine ecosystems, such as the open sea or the seabed, which could be considered under the Offshore Protocol of the Barcelona Convention in the future years.

Number of research contributions by Mediterranean ecoregion

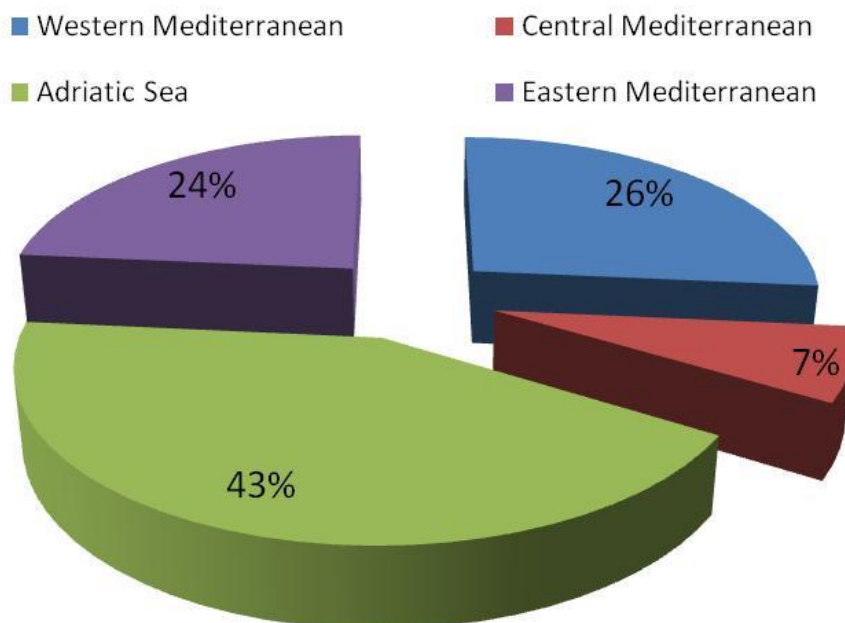


Figure 3. Percentages of the research contributions on common priority and action chemicals list from OSPAR, HELCOM and Barcelona Convention in the Mediterranean Sea (number of contributions grouped by ecoregions (keywords) from Elsevier databases search, January 2017).

4. COMPARISON OF TARGET CHEMICALS UNDER DIFFERENT REGIONAL SEAS CONVENTIONS.

The adoption in 1996 of the amended Protocol against Pollution from Land-Based Sources (LBS Protocol) followed by the Strategic Action Plan (2000-2025) in the Mediterranean Sea under the Barcelona Convention, have proposed lists of chemicals of concern (by different categories) which are presented in the table below (Table 3) and compared to the listed priority chemicals under other Regional Seas Conventions (namely, OSPAR and HELCOM). These lists of chemicals under the Barcelona Convention, have included the main categories of the Regional Seas Conventions since 2000, with the exception of perfluorinated compounds (PFCs) and environmental phenols (e.g. Perfluorooctanyl sulphonic acid (PFOS), nonylphenols/octylphenols and their ethoxylates (NP/NPE, OP/OPE) and Endosulfan (organohalogen pesticide)).

Table 3. Comparison of common groups of chemicals under Regional Seas Conventions (note: only chemicals and categories which are listed by two or more RSCs are shown).

Categories and/or chemical compounds	LBS Protocol (1996)	SAP-MED (2000)	HELCOM (2010)	OSPAR (2013)
Metallic compounds				
Cadmium	x	x	x	x
Lead and organic lead compounds	x	x		x
Mercury and organic mercury compounds	x	x	x	x
Organometallic compounds				
Organic tin compounds	x	x	x	x
Organohalogenated compounds				
Perfluorooctanyl sulphonic acid (PFOS)			x	x
Brominated flame retardants (PBDEs)		x	x	x
Polychlorinated biphenyls (PCBs)	x	x	x	x
Polychlorinated dibenzodioxins (PCDDs)	x	x	x	x
Polychlorinated dibenzofurans (PCDFs)	x	x	x	x
Short chain chlorinated paraffins (SCCP)		x	x	x
Endosulfan			x	x
Hexachlorocyclohexane isomers (HCH)	x	x		x
Pentachlorophenol (PCP)		x		x
Nonylphenol/ethoxylates (NP/NPEs)			x	x
Octylphenol/ethoxylates (OP/OPEs)			x	x
Polychlorinated naphthalenes (PCNs)		x		x
Polycyclic aromatic compounds				
Polycyclic aromatic hydrocarbons (PAHs)	x	x		x

Despite the most relevant categories and compounds have been listed under the Barcelona Convention for 14 categories (which included individual metallic an/or organometallic compounds) the information on different groups of chemicals still very limited for the majority of them, which the majority correspond to newer synthetic compounds. Further, in depth formal toxicological studies

and/or risk-based approaches have not been undertaken recently. In Table 3, it can be observed that the OSPAR Convention is the most complete with regard priority chemicals for action in the marine environment (list not complete, a summary list of Priority Chemicals and further information can be found in Annex III). On the other hand, the HELCOM Priority list from 2010 do not include some of the most relevant substances of concern in the marine environment such as Lead and Polyaromatic Hydrocarbons, as priority substances.

The complete list of legacy pollutants under the Barcelona Convention LBS Protocol contain more substances than those presented in Table 3, such as pesticides (Aldrin, Endrin, Mirex, HCB, Lindane or DDTs) and metallic compounds (Chrome, Copper and Zinc), which are not regarded as priority compounds by OSPAR and HELCOM. Some of these substances have been de-selected from RSCs due to their ban at European level or based in monitoring evidences of no occurrence and/or under a risk-based approaches.

In the next page, Figures 4 and 5, shown the percentages of studies conducted in the Mediterranean area searching by contaminant name or acronym (keywords) in the major reference database (Elsevier). Figure 3 show the percentages corresponding to the full list of chemicals and groups of chemicals under a combined matched-list of the relevant chemicals included in all 3 RSCs. It can be observed that less than a 10% conforms the total information with regard the majority of the emerging chemicals (such as brominated flame retardants, dioxins and furans, chlorinated paraffins, etc.) in the Mediterranean, including few legacy pollutants for which there is not an extensive information of their occurrence in the marine environment in the Mediterranean area (e.g. hexachlorocyclohexane isomers, HCHs). Further, there are some chemicals listed under OSPAR Priority List (Part A), for which there are no bibliographic references (not shown in Figure 3) in the Mediterranean Sea, such as organohalogenes (Dicofol, Trifluralin) or emerging groups such as pharmaceuticals, phenols and synthetic musks (e.g. clorotrimazole, 2, 4, 6-tri-tert-butylphenol and musk xylene, respectively); and similarly, for the majority of the substances in Part B and C of OSPAR List (see Annex III).

With regard new chemical compounds included in diverse categories under current research (such as pharmaceuticals, personal care products, hormones/endocrine system disruptors, musks, environmental phenols, phthalates, etc), the proposed Watch List under the WFD (JRC, 2015a) and the recent review evaluation of the sea-based sources of chemicals into the marine environment (JRC, 2015b) should be considered. These are applicable to the purpose of the present document in relation to the LBS and Offshore Protocols under the Barcelona Convention. In the 2015 JRC Report, the chemicals from sea-based sources are listed depending on their sources (e.g. oil and gas industry, mariculture, dredging, seabed mining, etc.) and by categories. The majority of these categories are new and related to industrial processes and applications in different sectors, such as viscosifiers, emulsifiers, surfactants in the oil and gas industry, alternative anti-fouling agents (e.g. chromium trioxide, Irgarol 1051) in shipping; or antibiotics (e.g. amoxicilin, oxytetracycline) in mariculture. Some categories, such as mixtures of phenols originated in produced waters are of high concern in the offshore oil industry. Other categories are already included in the Barcelona Convention Chemicals List, and therefore, some of these categories are enlarged with additional compounds like the metals/metalloids (e.g. Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel, Zinc, Mercury, Molybdenum, Nickel and Vanadium). These substances of concern from sea-based sources should be included under the Barcelona Convention lists to allow targeting these compounds for which there are no large set of bibliographic information in terms of their occurrence, transport, fate, toxicity; despite some are suspected to pose a threat to the marine ecosystems for many years.

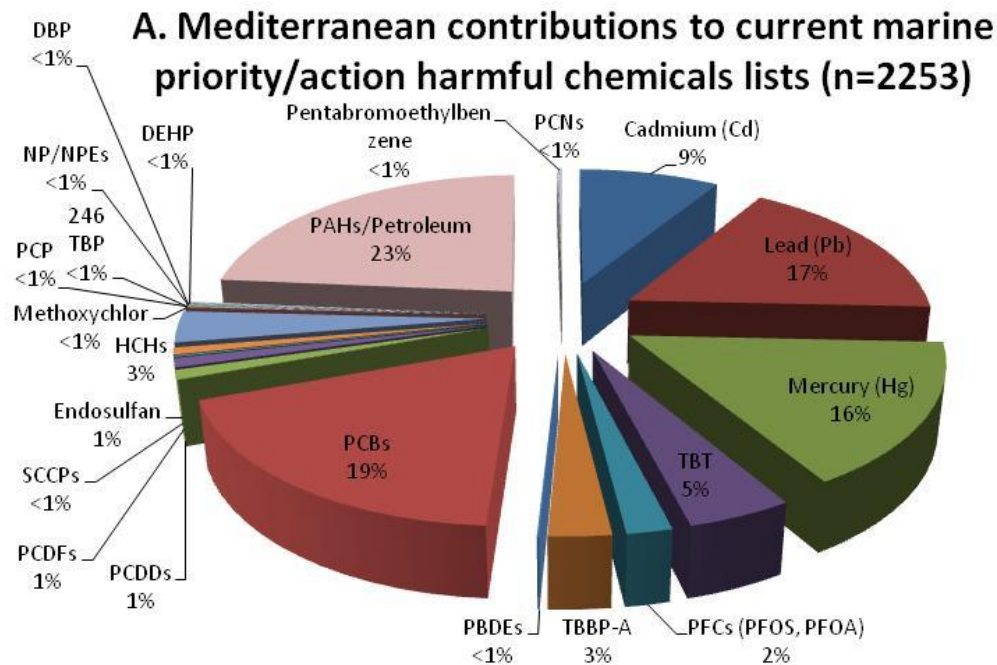


Figure 4. Percentages of the research contributions on common priority and action chemicals list from OSPAR, HELCOM and Barcelona Convention in the Mediterranean Sea.

B. Other organohalogenated compounds and metals under the Barcelona Convention-LBS Protocol (n=725)

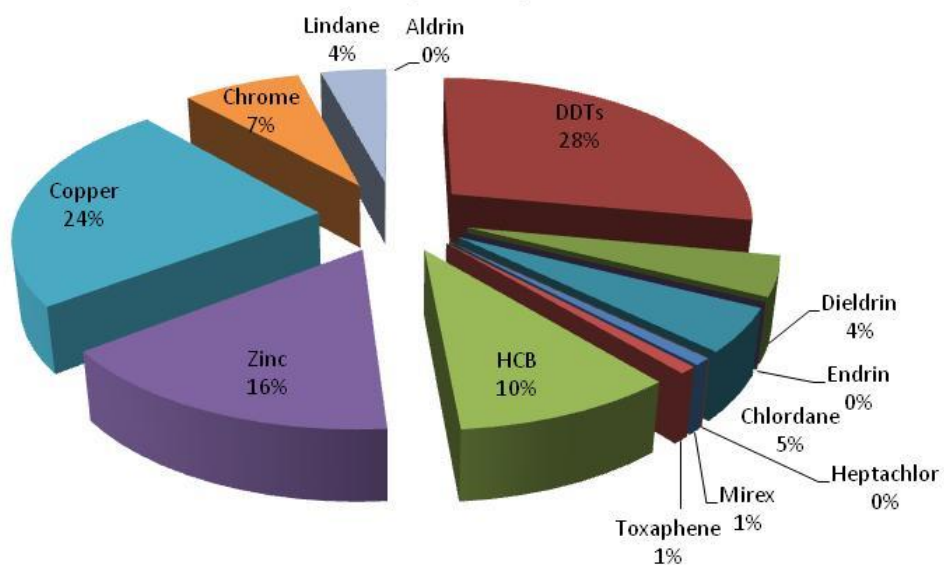


Figure 5. Percentages of the research contributions on common priority and action chemicals list from OSPAR, HELCOM and Barcelona Convention in the Mediterranean Sea.

C. Pharmaceuticals and Hormones studies contributions in the Mediterranean (n=27)

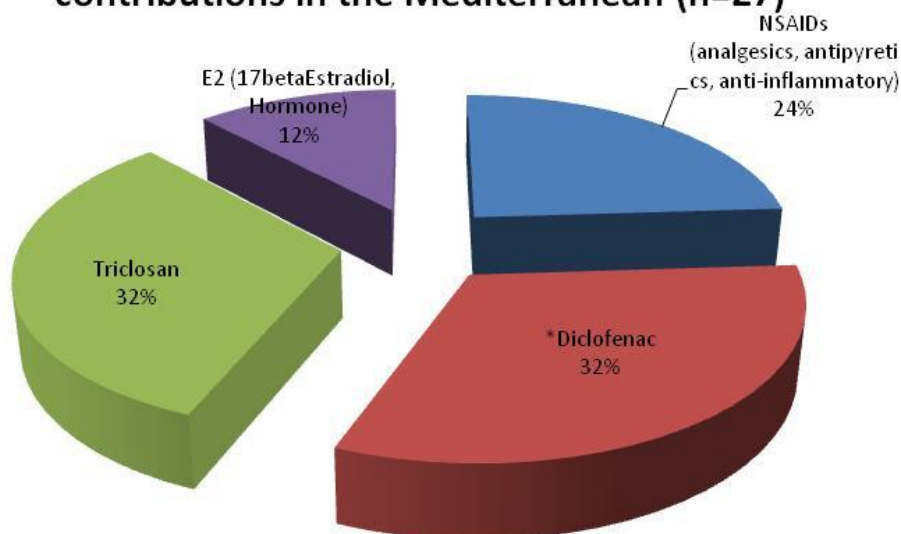


Figure 6. Percentages of the research contributions on common priority and action chemicals list from OSPAR, HELCOM and Barcelona Convention in the Mediterranean Sea.

Finally, Figure 6 shows the distribution percentages between some chemicals under the WFD Watch List (e.g. hormone 17- β -Estradiol), as well as a number of relevant pharmaceutical compounds (e.g. bactericide Triclosan) or NSAIDs (nonsteroidal anti-inflammatory drugs). It could be observed that the number of investigations are very low in the Mediterranean Sea to be able to implement programmes of measures and restrictions.

5. SETTING THE BARCELONA CONVENTION CANDIDATE CHEMICALS LIST.

The advancement of the methods and extraction techniques in environmental analytical chemistry in the latest two decades as favored the detection and quantification of hundreds of new chemicals in the environment. In this context, the Regional Seas Conventions (OSPAR, HELCOM, Black Sea Commission), the European Commission and other international conventions and organizations are also evaluating periodically these lists of harmful substances on a risk-based approaches for both the environment and human health protection. The lists include a number of priority chemicals for action and substances of concern or candidate chemicals to be followed up.

At an international level much effort has been directed towards the monitoring of these new chemicals in different compartments of the marine environment. The most coherent approach, has been to perform a screening of the new chemical target in the already existing network coastal stations under the framework of the Mussel Watch Program. This has been tested in the US and Asia-Pacific regions (Nakata et al., 2012; Richardson, B., 2012; Bricker et al., 2014; Maruya et al. 2014) and including initial studies in Europe (Picot et al., 2014). An interesting study on PFCs (both PFOS and PFOA compounds) in NW Mediterranean sediments is also of reference (Sánchez-Vidal et al., 2015).

Table 4. The Barcelona Convention Candidate Chemicals List (2017)

Categories	Substances (and primary target matrices)	Origins/Regulation
Organohalogenated compounds	Perfluorooctanesulfonate (PFOS) – b, s	USEPA; OSPAR, 2013; HELCOM, 2010
	Perfluorooctanoic acid (PFOA) – b, s	USEPA; OSPAR, 2013; HELCOM, 2010
	Perperfluorobutanoic acid (PFBA) – b, s	USA (Richarson and Kimura, 2016)
	Perfluorobutanesulfonate (PFBS) – b, s	USA (Richarson and Kimura, 2016)
	Tetrabromobisphenol (TBBP-A) – b, s	OSPAR, 2013
	Dicofol (pesticide) – b, s	OSPAR, 2013
	Hexabromocyclododecanes (HCDs) – b, s	HELCOM, 2010; Asia-Pacific (Tanabe et al., 2012); US (Dodder et al., 2014)
	Endosulfan (pesticide) – b, s	OSPAR, 2013; HELCOM, 2010
	Hexachlorocyclohexane isomers (HCHs) – b, s	OSPAR, 2013
	Methoxychlor (pesticide) – b, s	OSPAR, 2013
	Pentachlorophenol (PCP) (pesticide) – b, s	OSPAR, 2013
	Trifluralin (pesticide) – b, s	OSPAR, 2013
Organic nitrogen compounds	4-(dimethylbutylamino)dyphenilamin (6PPD) – b, s	OSPAR, 2013
Organic ester	Neodecanoic acid, ethenyl ester – w, b, s	OSPAR, 2013
Environmental phenols	Nonylphenol/Ethoxylates (NPs/NPEs) – w, s	USEPA; OSPAR, 2013; HELCOM, 2010
	Octylphenol/Ethoxylates (Ops/OPEs) – w, s	USEPA; OSPAR, 2013; HELCOM, 2010
	2, 4, 6-tri-tert-butylphenol – w, s	OSPAR, 2013
Pharmaceuticals	Clotrimazole – w	OSPAR, 2013
	Triclosan (phenol) and by-products – w, b	USA (California), 2015
	NSAIDs (e.g. Diclofenac) – w, b	EU-WFD Watch List, 2015
	Other antibiotics, bactericides, etc. – w, b, s	Sea-based sources (JRC, 2015)
Hormones	Estrone (E1) – w	EU-WFD Watch List, 2015
	17 β Estradiol (E2) – w	EU-WFD Watch List, 2015
	17 α Ethylinestradiol (EE1) – w	EU-WFD Watch List, 2015
Phtalate esters	Dibutylphthalate (DBP) - s	OSPAR, 2013
	Diethylhexylphthalate (DEHP) – s	OSPAR, 2013
Synthetic musks	Musk xylene	OSPAR, 2013
	Tonalide (AHTN) - w, b, s	USA/Asia (Nakata et al., 2012)
	Galaxolide (HHCB) – w, b, s	US/Asia (Nakata et al., 2012)
Plastic additives (BVUSs)	Benzotriazoles (e.g. UV-P, UV-320, UV-326, UV-327, UV-328) – b, s	USA/Asia (Nakata et al., 2012; EU (Picot et al., 2014)
Metals/Elements	Arsenic – b, s	Sea-based sources (JRC, 2015)
	Barium – b, s	Sea-based sources (JRC, 2015)
	Iron – b, s	Sea-based sources (JRC, 2015)

	Manganese – b, s	Sea-based sources (JRC, 2015)
	Molybdenum – b, s	Sea-based sources (JRC, 2015)
	Nickel – w, b, s	Sea-based sources (JRC, 2015)
	Vanadium – w, b, s	Sea-based sources (JRC, 2015)
Organometallic compounds	Organic mercury (e.g. methylmercury) – b (fish)	WHO (World Health Organisation)

Note: w-seawater, b-biota and s-sediment

A necessary performance-based quality assurance/quality control (QA/QC) approach was developed to ensure a high degree of data quality, consistency and comparability (Richardson, B., 2012; Bricker et al., 2014).

For the selection of the candidate substances the following points have been considered:

- Recommendation as per other RSCs and relevant organisations,
- Research studies pointing to potential threat to the marine environment,,
- Public health importance,
- Budget of production, uses and/or emissions,
- Analytical Quality Assurance frameworks,
- Laboratory (analytical methods) considerations,
- Target mussel and sediment matrices (current MED POL monitoring strategies)

6. CONCLUSIONS AND RECOMMENDATIONS

1. A candidate chemical list has been proposed as a complementary target to be monitored under the Barcelona Convention.
2. Some of the proposed chemicals are under the lists of different Regional Seas Conventions and relevant environmental organisations worldwide.
3. The majority of the proposed substances could be determined with low to medium input into current analytical procedures, and/or improve the current ones
4. In parallel to the analytical determination of new chemicals, quality assurance and standardized methodologies for sampling, sample processing, determination and quantification should be observed.
5. The inclusion of these substances in monitoring programmes should provide with further environmental information of the threats posed in the marine environment.
6. The availability of information, including toxicity, will allow to take action on programmes of measures for their control and/or ban.

Future improvements:

Despite most of the proposed chemicals could be included in the current analytical protocols almost straightforward, due to restricted availability of funding for sampling and analytical determinations in most Contracting Parties a further short-list of the Barcelona Convention candidate chemicals list might be performed taking into consideration the main biota sampled in the Mediterranean Sea (bivalve sp.). In this way, the harmonisation of data between contracting parties, as well as in terms of QA/QC, will be achieved.

7. REFERENCES

- Bricker et al., 2014. NOAA's Mussel Watch Program: Incorporating contaminants of emerging concern (CECs) into a long-term monitoring program. *Marine Pollution Bulletin* 81, 289–290.
- Dodder et al., 2014. Occurrence of contaminants of emerging concern in mussels (*Mytilus* spp.) along the California coast and the influence of land use, storm water discharge, and treated wastewater effluent. *Marine Pollution Bulletin* 81, 340-346.
- European Union, 2000. Directive 2000/60/EC of the European parliament and of the council of 23 October 2000 establishing a framework for Community action in the field of water policy (WFD). <http://eur-lex.europa.eu/>
- European Union, 2008a. Directive 2008/105/EC of the European parliament on environmental quality standards in the field of water policy, and amending Directive 2000/60/EC. <http://eur-lex.europa.eu/>
- European Union, 2008b. Directive 2008/56/EC of the European parliament and of the council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). <http://eur-lex.europa.eu/>
- European Union, 2013. Directive 2013/39/EU of the European parliament and of the council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy. <http://eur-lex.europa.eu/>
- HELCOM, 2010. HELCOM RECOMMENDATION 31E/1. Implementing HELCOM's objective for hazardous substances. HELSINKI COMMISSION - Baltic Marine Environment Protection Commission. <http://www.helcom.fi>
- JRC, 2015a. Development of the first Watch List under the Environmental Quality Standardss Directive. European Commission, Joint Research Centre (JRC), ISPRA, Italy.
- JRC, 2015b. Identification of marine chemical contaminants released from sea-based sources. review focusing on regulatory aspects. Eds. V. Tornero and G. Hanke. European Commission, Joint Research Centre (JRC), ISPRA, Italy.
- Maruya et al., 2014. Refocusing Mussel Watch on contaminants of emerging concern (CECs): The California pilot study (2009–10). *Marine Pollution Bulletin* 81, 334 - 339.
- Nakata et al., 2012. Asia–Pacific mussel watch for emerging pollutants: Distribution of marine mussels from Portuguese coast by QuEChERS extraction and GC–MS/MS. *Sci. Total Environ.*, 493, 162–169.
- Richardson, B., 2012. Monitoring temporal and spatial trends of legacy and emerging contaminants in marine environment: Results from the environmental specimen bank (es-BANK) of Ehime University, Japan. *Marine Pollution Bulletin* 64, 1459–1474.
- Richardson and Kimura, 2016. Water Analysis: Emerging Contaminants and Current Issues. *Anal. Chem.*, 88, 546–582.
- Sanchez-Vidal et al., 2015. Delivery of unprecedented amounts of perfluoroalkyl substances towards the deep-sea. *Sci. Total Environ.*, 526, 41–48
- UNEP/MAP, 2015. Strategic Action Programme to Address Pollution from Land Based Activities in the Mediterranean region (SAP-MED) and National Action Plans' (NAP) implementation 2000 – 2015, UNEP/MAP, Athens, 2015.
- Nakata et al., 2012. Asia–Pacific mussel watch for emerging pollutants: Distribution of synthetic musks and benzotriazole UV stabilizers in Asian and US coastal waters. *Marine Pollution Bulletin* 64, 2211–2218.
- OSPAR, 2013. Chemicals for Priority Action List. <http://www.ospar.org>
- Picot et al., 2014. Detection of emerging contaminants (UV filters, UV stabilizers and musks) inmarine mussels from Portuguese coast by QuEChERSextraction and GC–MS/MS. *Sci Total Environ.*, 493, 162-169.

ANNEX I. The Stockholm Convention POPs list.

The following table present the persistent organic pollutants (POPs) considered under the Stockholm Convention.

For more

information: <http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx>

Listed POPs	Entry into force, Annex (es)
Aldrin	2004, A
Alpha hexachlorocyclohexane	2010, A
Beta hexachlorocyclohexane	2010, A
Chlordane	2004, A
Chlordecone	2010, A
DDT	2004, B
Dieldrin	2004, A
Endrin	2004, A
Heptachlor	2004, A
Hexachlorobenzene (HCB)	2004, A and C
Hexabromocyclodecane	2014, A
Hexabromobiphenyl	2010, A
Hexabromodiphenyl ether and heptabromodiphenyl ether (commercial octabromodiphenyl ether)	2010, A
Lindane	2010, A
Mirex	2004, A
Pentachlorobenzene	2010, A and C
Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride	2010, B
Polychlorinated biphenyls (PCB)	2004, A and C
Polychlorinated dibenzo-p-dioxins (PCDD)	2004, C
Polychlorinated dibenzofurans (PCDF)	2004, C
Technical endosulfan and its related isomers	2012, A
Toxaphene	2004, A
Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial pentabromodiphenyl ether)	2010, A
Hexachlorobutadiene	2016, A
Polychlorinated naphthalenes	2016, A and C
Pentachlorophenol and its salts and esters	2016, A

ANNEX II. The EU WFD Priority substances list under Directive 2013/39/EC

The table below presents the current priority chemicals listed under Directive 2013/39/EC, amending the Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.

For more information:

<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013L0039&from=EN>

Number	CAS number ⁽¹⁾	EU number ⁽²⁾	Name of priority substance ⁽³⁾	Identified as priority hazardous substance
(1)	15972-60-8	240-110-8	Alachlor	
(2)	120-12-7	204-371-1	Anthracene	X
(3)	1912-24-9	217-617-8	Atrazine	
(4)	71-43-2	200-753-7	Benzene	
(5)	not applicable	not applicable	Brominated diphenylethers	X ⁽⁴⁾
(6)	7440-43-9	231-152-8	Cadmium and its compounds	X
(7)	85535-84-8	287-476-5	Chloroalkanes, C 10-13	X
(8)	470-90-6	207-432-0	Chlorfenvinphos	
(9)	2921-88-2	220-864-4	Chlorpyrifos (Chlorpyrifos-ethyl)	
(10)	107-06-2	203-458-1	1,2-dichloroethane	
(11)	75-09-2	200-838-9	Dichloromethane	
(12)	117-81-7	204-211-0	Di(2-ethylhexyl)phthalate (DEHP)	X

(13)	330-54-1	206-354-4	Diuron	
(14)	115-29-7	204-079-4	Endosulfan	X
(15)	206-44-0	205-912-4	Fluoranthene	
(16)	118-74-1	204-273-9	Hexachlorobenzene	X
(17)	87-68-3	201-765-5	Hexachlorobutadiene	X
(18)	608-73-1	210-168-9	Hexachlorocyclohexane	X
(19)	34123-59-6	251-835-4	Isoprothuron	
(20)	7439-92-1	231-100-4	Lead and its compounds	
(21)	7439-97-6	231-106-7	Mercury and its compounds	X
(22)	91-20-3	202-049-5	Naphthalene	
(23)	7440-02-0	231-111-4	Nickel and its compounds	
(24)	not applicable	not applicable	Nonylphenols	X ⁽⁵⁾
(25)	not applicable	not applicable	Octylphenols ⁽⁶⁾	

(26)	608-93-5	210-172-0	Pentachlorobenzene	X
(27)	87-86-5	201-778-6	Pentachlorophenol	
(28)	not applicable	not applicable	Polyaromatic hydrocarbons (PAH) ⁽¹⁾	X
(29)	122-34-9	204-535-2	Simazine	
(30)	not applicable	not applicable	Tributyltin compounds	X ⁽⁸⁾
(31)	12002-48-1	234-413-4	Trichlorobenzenes	
(32)	67-66-3	200-663-8	Trichloromethane (chloroform)	
(33)	1582-09-8	216-428-8	Trifluralin	X
(34)	115-32-2	204-082-0	Dicofol	X
(35)	1763-23-1	217-179-8	Perfluorooctane sulfonic acid and its derivatives (PFOS)	X
(36)	124495-18-7	not applicable	Quinoxifen	X
(37)	not applicable	not applicable	Dioxins and dioxin-like compounds	X ⁽⁹⁾
(38)	74070-46-5	277-704-1	Aclonifan	
(39)	42576-02-3	255-894-7	Bifanox	
(40)	28159-98-0	248-872-3	Cybutryne	
(41)	52315-07-8	257-842-9	Cypermethrin ⁽⁶⁾	
(42)	62-73-7	200-547-7	Dichlorvos	
(43)	not applicable	not applicable	Hexabromocyclododecanes (HBCDD)	X ⁽¹⁰⁾
(44)	76-44-8/	200-962-3/	Heptachlor and heptachlor epoxide	X
(45)	886-50-0	212-950-5	Terbutryn	

(1) CAS: Chemical Abstracts Service.

(2) EU-number: European Inventory of Existing Commercial Substances (EINECS) or European List of Notified Chemical Substances (ELINCS).

(3) Where groups of substances have been selected, unless explicitly noted, typical individual representatives are defined in the context of the setting of environmental quality standards.

(4) Only Tetra, Penta, Hexa and Heptabromodiphenylether (CAS -numbers 40088-47-9, 32534-81-9, 36483-60-0, 68928-80-3, respectively).

(5) Nonylphenol (CAS 25154-52-3, EU 246-672-0) including isomers 4-nonylphenol (CAS 104-40-5, EU 203-199-4) and 4- nonylphenol (branched) (CAS 84852-15-3, EU 284-325-5).

(6) Octylphenol (CAS 1806-26-4, EU 217-302-5) including isomer 4-(1,1',3,3'-tetramethylbutyl)-phenol (CAS 140-66-9, EU 205-426-2).

(7) Including benzo(a)pyrene (CAS 50-32-8, EU 200-028-5), benzo(b)fluoranthene (CAS 205-99-2, EU 205-911-9), benzo(g,h,i)perylene (CAS 191-24-2, EU 205-883-8), benzo(k)fluoranthene (CAS 207-08-9, EU 205-916-6), indeno(1,2,3-cd)pyrene (CAS 193-39-5, EU 205-893-2) and excluding anthracene, fluoranthene and naphthalene, which are listed separately.

(8) Including tributyltin-cation (CAS 36643-28-4).

(9) This refers to the following compounds: 7 polychlorinated dibenzo-p-dioxins (PCDDs): 2,3,7,8-T4CDD (CAS 1746-01-6), 1,2,3,7,8-P5CDD (CAS 40321-76-4), 1,2,3,4,7,8- H6CDD (CAS 39227-28-6), 1,2,3,6,7,8-H6CDD (CAS 57653-85-7), 1,2,3,7,8,9-H6CDD (CAS 19408-74-3), 1,2,3,4,6,7,8-H7CDD (CAS 35822-46-9), 1,2,3,4,6,7,8,9-O8CDD (CAS 3268-87-9) 10 polychlorinated dibenzofurans (PCDFs): 2,3,7,8-T4CDF (CAS 51207-31-9), 1,2,3,7,8-P5CDF (CAS 57117-41-6), 2,3,4,7,8-P5CDF (CAS 57117-31-4), 1,2,3,4,7,8-H6CDF (CAS 70648-26-9), 1,2,3,6,7,8-H6CDF (CAS 57117-44-9), 1,2,3,7,8,9-H6CDF (CAS 72918- 21-9), 2,3,4,6,7,8-H6CDF (CAS 60851-34-5),

1,2,3,4,6,7,8-H7CDF (CAS 67562-39-4), 1,2,3,4,7,8,9-H7CDF (CAS 55673-89-7), 1,2,3,4,6,7,8,9-O8CDF (CAS 39001-02-0) 12 dioxin-like polychlorinated biphenyls (PCB-DL): 3,3',4,4'-T4CB (PCB 77, CAS 32598-13-3), 3,3',4',5'-T4CB (PCB 81, CAS 70362-50-4), 2,3,3',4,4'-P5CB (PCB 105, CAS 32598-14-4), 2,3,4,4',5'-P5CB (PCB 114, CAS 74472-37-0), 2,3',4,4',5'-P5CB (PCB 118, CAS 31508-00-6), 2,3',4,4',5'-P5CB (PCB 123, CAS 65510-44-3), 3,3',4,4',5'-P5CB (PCB 126, CAS 57465-28-8), 2,3,3',4,4',5'-H6CB (PCB 156, CAS 38380-08-4), 2,3,3',4,4',5'-H6CB (PCB 157, CAS 69782-90-7), 2,3',4,4',5,5'-H6CB (PCB 167, CAS 52663-72-6), 3,3',4,4',5,5'-H6CB (PCB 169, CAS 32774-16-6), 2,3,3',4,4',5,5'-H7CB (PCB 189, CAS 39635-31-9).

(10) CAS 52315-07-8 refers to an isomer mixture of cypermethrin, alpha-cypermethrin (CAS 67375-30-8), beta-cypermethrin (CAS 65731-84-2), theta-cypermethrin (CAS 71697-59-1) and zeta-cypermethrin (52315-07-8).

(11) This refers to 1,3,5,7,9,11-Hexabromocyclododecane (CAS 25637-99-4), 1,2,5,6,9,10-Hexabromocyclododecane (CAS 3194-55-6), α -Hexabromocyclododecane (CAS 134237-50-6), β -Hexabromocyclododecane (CAS 134237-51-7) and γ -Hexabromocyclododecane (CAS 134237-52-8).

ANNEX III The OSPAR List of Chemicals for Priority Action (Revised 2013)

In the context of the OSPAR Convention for the North Atlantic Area the substances for Priority Action are summarized below. The full detailed description for each individual compound and categories of both the Priority Action list and the Substances of Concern List could be found in the OSPAR website.

For more information: <http://www.ospar.org/work-areas/hasec/chemicals/priority-action>

Part A: CHEMICALS WHERE A BACKGROUND DOCUMENT HAS BEEN OR IS BEING PREPARED

CAS No	Group of substances / substances	Function
	cadmium	<i>Metallic compound</i>
.	lead and organic lead compounds	<i>Metal/organometallic compounds</i>
	mercury and organic mercury compounds	<i>Metal/organometallic compounds</i>
	organic tin compounds	<i>Organometallic compounds</i>
51000-52-3	neodecanoic acid, ethenyl ester	<i>Organic ester</i>
1763-23-1	perfluorooctanyl sulphonic acid and its salts (PFOS)	<i>Organohalogens</i>
79-94-7	tetrabromobisphenol A (TBBP-A)	<i>Organohalogens</i>
87-61-6	1,2,3-trichlorobenzene	<i>Organohalogens</i>
120-82-1	1,2,4-trichlorobenzene	<i>Organohalogens</i>
108-70-3	1,3,5-trichlorobenzene	<i>Organohalogens</i>
	brominated flame retardants	<i>Organohalogens</i>
	polychlorinated biphenyls (PCBs)	<i>Organohalogens</i>
	polychlorinated dibenzodioxins (PCDDs) polychlorinated dibenzofurans (PCDFs)	<i>Organohalogens</i>
	short chained chlorinated paraffins (SCCP)	<i>Organohalogens</i>
793-24-8	4-(dimethylbutylamino)diphenylamin (6PPD)	<i>Organic nitrogen compound</i>
115-32-2	dicofol	<i>Pesticides/Biocides/Organohalogens</i>
115-29-7	endosulfan	<i>Pesticides/Biocides/Organohalogens</i>

	hexachlorocyclohexane isomers (HCH)	<i>Pesticides/Biocides/Organohalogens</i>
72-43-5	methoxychlor	<i>Pesticides/Biocides/Organohalogens</i>
	pentachlorophenol (PCP)	<i>Pesticides/Biocides/Organohalogens</i>
1582-09-8	trifluralin	<i>Pesticides/Biocides/Organohalogens</i>
23593-75-1	clotrimazole	<i>Pharmaceutical</i>
732-26-3	2,4,6-tri-tert-butylphenol	<i>Phenols</i>
	nonylphenol/ethoxylates (NP/NPEs) and related substances	<i>Phenols</i>
140-66-9	octylphenol	<i>Phenols</i>
	certain phthalates: dibutylphthalate (DBP), diethylhexylphthalate (DEHP)	<i>Phthalate esters</i>
	polyaromatic hydrocarbons (PAHs)	<i>Polycyclic aromatic compounds</i>
	musk xylene	<i>Synthetic musk</i>

Part B: CHEMICALS WHERE A BACKGROUND DOCUMENT HAS BEEN OR IS BEING PREPARED

CAS No	Group of substances / substances	Type
4904-61-4	1,5,9 cyclododecatriene	<i>Aliphatic hydrocarbons</i>
294-62-2	cyclododecane	<i>Aliphatic hydrocarbons</i>

PART C: CHEMICALS WHERE NO BACKGROUND DOCUMENT IS BEING PREPARED BECAUSE THERE IS NO CURRENT PRODUCTION OR USE INTEREST

CAS No	Group of substances / substances	Type
59447-55-1	2-propenoic acid, (pentabromo)methyl ester	<i>Organohalogens</i>
36065-30-2	2,4,6-bromophenyl 1-2(2,3-dibromo-2-methylpropyl)	<i>Organohalogens</i>
85-22-3	pentabromoethylbenzene	<i>Organohalogens</i>
28680-45-7 2440-02-0	heptachloronorborene	<i>Organohalogens</i>
1825-21-4	pentachloroanisole	<i>Organohalogens</i>
	polychlorinated naphthalenes	<i>Organohalogens (cont.)</i>
1321-65-9	trichloronaphthalene	
1335-88-2	tetrachloronaphthalene	
1321-64-8	pentachloronaphthalene	
1335-87-1	hexachloronaphthalene	
32241-08-0	heptachloronaphthalene	

2234-13-1	octachloronaphthalene	
70776-03-3	naphthalene, chloro derivs.	
55525-54-7	3,3'-(ureylenedimethylene)bis(3,5,5-trimethylcyclohexyl) diisocyanate	<i>Organic nitrogen compound</i>
2104-64-5	ethyl O-(p-nitrophenyl) phenyl phosphonothionate (EPN)	<i>Pesticides/Biocides</i>
70124-77-5	flucythrinate	<i>Pesticides/Biocides</i>
465-73-6	isodrin	<i>Pesticides/Biocides</i>
2227-13-6	tetrasul	<i>Pesticides/Biocides</i>
512-04-9	diosgenin	<i>Pharmaceutical</i>

ANNEX IV. HELCOM List of Priority Hazardous Substances (2010)

In the context of the HELCOM Convention for the North Atlantic Area the Priority Substances are listed below.

For more information: <http://www.helcom.fi/Recommendations/Rec%2031E-1.pdf>

Appendix II

List of Priority Hazardous Substances

(to be updated)

1. Dioxins (PCDD), furans (PCDF) & dioxin-like polychlorinated biphenyls

- 2a. Tributyltin compounds (TBT)
- 2b. Triphenyltin compounds (TPHT)

- 3a. Pentabromodiphenyl ether (pentaBDE)
- 3b. Octabromodiphenyl ether (octaBDE)
- 3c. Decabromodiphenyl ether (decaBDE)

- 4a. Perfluorooctane sulfonate (PFOS)
- 4b. Perfluorooctanoic acid (PFOA)

5. Hexabromocyclododecane (HBCDD)

- 6a. Nonylphenols (NP)
- 6b. Nonylphenol ethoxylates (NPE)

- 7a. Octylphenols (OP)
- 7b. Octylphenol ethoxylates (OPE)

- 8a. Short-chain chlorinated paraffins (SCCP or chloroalkanes, C10-13)
- 8b. Medium-chain chlorinated paraffins (MCCP or chloroalkanes, C14-17)

9. Endosulfan

10. Mercury

11. Cadmium

ANNEX V. The BARCELONA CONVENTION chemicals list (2000).

Below the chemicals of concern under the Barcelona Convention LBS Protocol are listed combining the target chemicals from the updated LBS Protocol in 1996 and the Strategic Action Programme targets (2000).

A. Barcelona Convention Chemicals List (2000)

Categories	Substances
PBTs (Toxic, Persistent and Bioaccumulable substances)	Aldrine
	DDT
	Dieldrine
	Endrine
	Chlordane
	Heptachlor
	Mirex
	Toxaphene
	Hexachlorobenzene
	Polychlorinated biphenyls (PCBs)
	Polychlorinated dibenzo-p-dioxins/furans (PCDD/PCDF)
	Polycyclic aromatic hydrocarbons (PAHs)
	Mercury
	Cadmium
Lead	
Other metals	Zinc
	Copper
	Chromium
Other organohalogen compounds	Chlorinated solvents
	Chlorinated paraffins
	Chlorobenzenes
	Polychlorinated naphthalenes (PCNs)
	Polybrominated diphenyl eters (PBDEs)
	Polybrominated biphenyls (PBBs)
	Chlorophenols
	Lindane
Chlorophenoxy acids	