OSPAR COMMISSION

Background document on lead

Hazardous Substances Series

2009

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”) was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Community and Spain.

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998.
La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l’Irlande, l’Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d’Irlande du Nord, la Suède et la Suisse et approuvée par la Communauté européenne et l’Espagne.

Acknowledgement

This Background Document has been prepared by Ms Elizabeth Fadum, Norwegian Pollution Control Authority, task manager for Norway as lead country.

Secretariat note

The Background Document was first adopted in 2002. A monitoring strategy for lead was added in 2004 (annex 2). The document was updated in 2009.

Contents

Executive summary

Lead is a naturally occurring heavy metal element. As such it cannot be degraded into less harmful substances. Lead is an acute toxic compound for mammals and aquatic organisms and can also cause blood-related diseases, damage to the immune system and is suspected to have carcinogenic properties. It is also toxic to reproductive processes. Studies have shown effects of lead in marine organisms such as accumulation in mussels and estrogenic effects on fish. Lead occurs in a number of compounds and in various chemical groups. Dissolved lead is considered the most hazardous form. Lead and organic lead compounds were included in 1998 in the OSPAR List of Chemicals for Priority Action.

The total production of lead in Europe in 2006 was 1.66 million tonnes. Half of this originated from primary production through mining and non-ferrous metal processing; the rest originated from recycling processes. Lead is used in a large number of applications as metallic lead in batteries and accumulators, lead shots, boat keels, building materials but also in products such as paint, leaded petrol, glass, electronic and electric equipment, plastic, ceramic products. Other sources that may adversely affect the environment are production processes such as non-ferrous metal production, mining, glass production and recycling processes, ceramics production, offshore industry and waste incineration and disposal. Major sources of discharges of lead to water in countries bordering the North Sea were zinc production, offshore oil and gas activities (natural component in barite used for drilling) and municipal waste water. Road transport is no longer a major source of emissions of lead to air in Europe due to significant decline in use of leaded petrol. Emissions from metals industry and combustion of fossil fuels still play an important role.

Monitoring of lead is carried out on a regular basis in OSPAR. In the period 1990 – 2006, total inputs of lead through rivers and direct discharges to the whole OSPAR maritime area have generally decreased with statistically confirmed downward trends of riverine inputs of 85% in Region I (Arctic Waters) and 50% in Region II (Greater North Sea). Direct discharges were the smaller and progressively diminishing component of overall inputs. Waterborne inputs of lead to Region II and Region III (Celtic Seas) were roughly of the same magnitude as atmospheric inputs of lead; in Region I, Region IV (Bay of Biscay/Iberian Coast) and Region V (Wider Atlantic) atmospheric deposition was the dominant pathway of lead to the sea. Lead concentrations in precipitation and air generally decreased in 1998 – 2006 in the OSPAR Regions.

Much of the decrease in waterborne and airborne inputs of lead occurred before 2000, since when changes in environmental concentrations have been relatively small as concentrations approach, but do not reach, background in large parts of the OSPAR area. In 2003 – 2007 concentrations of lead in sediments still gave rise to risk of pollution effects over large parts of the southern North Sea, both inshore and offshore, the Channel and the Irish Sea, and some scattered industrialised locations on the coast of Norway and northern Spain. Concentrations in fish and shellfish exceeding EU dietary limits are less widespread and the locations can generally be linked to urban and industrial activity, e.g. around Denmark, several UK estuaries and certain sites in southern Ireland, southern Norway and northern Spain.

Lead discharges and emissions have been regulated in several international forums, such as the UNECE Convention on Long Range Transboundary Air Pollution and the European Community. There are a large number of Council Directives regulating discharges and emissions of lead and use in products and fuels, etc. Lead is also on the list of priority substances of the Water Framework Directive 2000/60/EC and an Environmental Quality Standard for this substance has been adopted in Directive 2008/105/EC. All countries bordering the North Sea have achieved the 70% reduction target set by the North Sea Ministers for lead discharges and emissions in the period 1985 to 1999/2000.

Further progress in reduction is more difficult to achieve and is slowing down. More effort is needed to support further reductions in releases through improved technology for example in combustion processes. Some further restriction on the use of lead containing products are being implemented in the EU, but still lead containing products are expected to be on the market up to the target date 2020. Uses in products not yet regulated need to be further investigated to inform the need and scope for further action. The effective implementation of the obligations under the Water Framework Directive for lead is important to help moving towards the cessation target.

Récapitulatif

Le plomb est un métal lourd présent à l’état naturel. En tant que tel il ne peut pas se dégrader en substances moins dangereuses. Le plomb est un composé à toxicité aigüe pour les mammifères et les organismes aquatiques et peut également entraîner des maladies du sang, endommager les systèmes immunitaires et on le soupçonne de posséder des propriétés cancérigènes. Il est également toxique pour les systèmes reproducteurs. Des études montrent les effets du plomb sur les organismes marins, tels que l’accumulation dans la moule et les effets oestrogéniques sur le poisson. Le plomb se trouve dans un certain nombre de composés et dans divers groupes chimiques. On considère que le plomb dissout est le plus dangereux. Le plomb et ses composés organiques ont été inscrits dans la liste OSPAR des produits chimiques prioritaires en 1998.

La production totale de plomb en Europe s’élevait en 2006 à 1,66 millions de tonnes. La moitié provient de la production primaire, l’exploitation minière et le traitement de métaux non-ferreux; le reste provient des processus de recyclage. Le plomb est utilisé dans un grand nombre d’applications, en tant que métal dans les piles et les accumulateurs, les balles de plomb, les quilles de bateau, les matériaux de construction et les produits céramiques. D’autres sources risquant d’avoir un effet préjudiciable sur l’environnement sont les processus de production tels que la production de métaux non ferreux, l’exploitation minière, la production du verre et les processus de recyclage, la production céramique, l’industrie de l’offshore et l’incinération et l’élimination des déchets. La production du zinc, les activités pétrolières et gazières offshore (composante naturelle de la baryte utilisées dans le forage) et les eaux usées municipales constituent les sources principales de rejet de plomb dans l’eau dans les pays en bordure de la mer du Nord. Le transport routier ne représente plus la source principale d’émissions atmosphériques de plomb grâce au déclin de l’utilisation de l’essence plombée. Les émissions provenant de la métallurgie et de la combustion de combustibles fossiles jouent encore un rôle important.

OSPAR réalise une surveillance régulière du plomb. Entre 1990 et 2006, le total des apports de plomb provenant des fleuves et des rejets directs dans l’ensemble de la zone maritime OSPAR a baissé dans l’ensemble, on a relevé une tendance à la baisse confirmée statistiquement de 85% dans la Région I (eaux arctiques) et de 50% dans la Région II (mer du Nord au sens large). La contribution des rejets directs au total des rejets est la plus faible et en progressivement baisse. Les apports aquatiques de plomb dans la Région II et la Région III (mers celtiques) sont pratiquement équivalents aux apports atmosphériques de plomb, dans la Région I, la Région IV (golfe de Gascogne/côte ibérique) et la Région V (Atlantique au large) les retombées atmosphériques constituent la voie de pénétration dominante du plomb dans la mer. Les concentrations de plomb dans les précipitations et l’atmosphère ont dans l’ensemble baissé entre 1998 et 2006 dans les Régions OSPAR.

La plupart des diminutions d’apports aquatiques et atmosphériques de plomb se sont produites avant 2000, depuis lors les concentrations environnementales sont relativement faibles car elles sont proches des concentrations ambiantes dans de grandes parties de la zone OSPAR sans toutefois y être égales. De 2003 à 2007 les concentrations de plomb dans les sédiments risquaient encore d’entraîner des effets de pollution dans de grandes parties de la mer du Nord méridionale, aussi bien près des côtes qu’en haute mer, la Manche et la mer d’Irlande, et quelques sites industrialisés éparpillés le long de la côte de Norvège et de l’Espagne du Nord. Les concentrations dans le poisson et les mollusques et crustacés dépassant les limites alimentaires de l’UE sont moins répandues et leur emplacement peut généralement être lié à des activités urbaines et industrielles, par exemple près du Danemark, dans plusieurs estuaires du Royaume-Uni et certains sites d’Irlande du Nord, au Sud de la Norvège et au Nord de l’Espagne.

Les rejets et émissions de plomb sont réglementés au sein de plusieurs organisations internationales telles que la Convention sur la pollution atmosphérique transfrontière à longue distance de l'UNECE. Il existe un grand nombre de Directives du Conseil règlementant les rejets et émissions de plomb et son utilisation dans des produits et des combustibles, etc. Le plomb figure également dans la liste des substances prioritaires de la Directive cadre sur l'eau 2000/60/CE et une Norme de qualité environnementale pour cette substance a été adoptée dans la Directive 2008/105/CE. Tous les pays en bordure de la mer du Nord sont parvenus à l'objectif de réduction de 70% déterminé par les Ministres de la mer du Nord pour les rejets et émissions de plomb entre 1985 et 1999/2000.

Il est plus difficile de réaliser des progrès supplémentaires dans la réduction et ils ralentissent. Des efforts supplémentaires sont nécessaires à l'appui de nouvelles réductions des rejets en appliquant de meilleures technologies, par exemple dans les processus de combustion. Des restrictions supplémentaires de l'utilisation de produits contenant du plomb sont en cours de mise en oeuvre au sein de l'UE mais on pense que ces produits seront encore sur le marché jusqu'à la date cible de 2020. Il faut étudier plus avant son utilisation dans des produits pas encore réglementés afin de déterminer la nécessité et la portée d'actions supplémentaires. La mise en œuvre efficace des engagements dans le cadre de la Directive cadre sur l'eau pour le plomb est importante car elle permet d'avancer dans le sens de l'objectif de cessation.

1. Identification of all sources of lead and its pathways to the marine environment

1.1 Lead

Lead is a naturally occurring non-essential basic element. Lead is classified as a heavy metal and has a high toxicity to both man and biota. As an elementary substance, lead is persistent and cannot be degraded into harmless products. It will therefore be permanently recycled in the physical, chemical and biological processes in the environment.

The impact of lead on the environment is well known. Lead is an acute toxic compound for mammals and aquatic organisms and can also cause blood-related diseases, damage to the immune defence system and is suspected to have carcinogenic properties. All lead compounds are also classified as toxic to reproduction, category 1 according to Council Directive 67/548/EEC (classification and labelling of dangerous substances). Numerous studies have shown the effects of lead on marine organisms: *e.g.* accumulation in mussels, estrogenic effects on fish. The impact of lead is felt all over the world. Lead occurs in a number of compounds and in various chemical groups. Dissolved lead is thought to be the most bioavailable (hazardous) lead species. Acknowledging that lead can be part of different chemical groups, and form organic compounds, these will be referred to as lead in this document. This background document is not a risk assessment of lead or lead compounds, but is meant as a risk management tool.

1.2 Production

Today, lead is produced from the yield of ores and concentrates and/or from recycling in several countries. In 1990, world production of lead metal was 5.7 million tonnes, with slightly more than 50% from recycled materials (OECD, 1993). In that year, OECD countries accounted for 50% of the world's production of lead in ores and concentrates and about 64% of the world's metal production. World production in 1999 was 6.5 million tonnes, approximately 60% of which was from recycled material (IZLSG, 2008). Western world countries account for approximately 75 - 80% of refined lead production and mining. In 2000, Europe accounted for 12% of world ore production and 29% of world refined metal production. The figures quoted for OECD countries remained the same in 2000. Total production of refined lead in the EU in 1999 was 1.55 million tonnes, 652 000 tonnes of which was primary production and 904 000 tonnes was from recycling.

Lead production worldwide saw an increase by 14.5% in 2003 – 2006 with highest increase rates in Asia. Lead production in Europe has steadily been rising in the period 1998 – 2006 in response to increasing consumption. Consumption figures for Europe suggest a small average increase per annum (2.4%) since 2003. In 2006, production in Europe reached 1.66 million tonnes (up 4.6% since 2003). By 2006, 50% of the total lead production in Europe was from recycling (IZLSG, 2008)

Primary lead from mining is often produced as a by-product or co-product with other metals such as zinc, silver, copper and cadmium. In 1989, 155 mines in 35 countries produced 2.2 million tonnes of lead in concentrate with co-product output of copper, zinc and silver.

Lead is the most recycled non-ferrous metals in the world. Secondary production (from recycled materials) has risen steadily. It surpassed primary output for the first time in 1989. This growth reflects the favourable economic conditions associated with lead recycling and the fact that lead retains its physical and chemical properties when recycled. The steady growth of the amount of recycled lead is primarily due to its increased use in recyclable applications (in particular batteries) and a declining consumption for disperse uses. Also, general increases in the recycling rates of lead containing products such as vehicles and electrical and electronic equipment will result in increased secondary lead production.

Applications are being developed for lead and lead compounds in a number of new areas: microelectronics, superconductors, earthquake damping materials and radon gas shielding, and for retrievable storage or permanent disposal of nuclear waste, to name a few. Major new applications are also being developed for traditional uses, notably lead-acid batteries, which are increasingly being used for emergency power applications, for powering electric and hybrid-electric vehicles and for energy storage in remote areas without access to electricity mains.

1.3 Lead in the environment

Environmental releases of lead can occur naturally (for example, through crystal weathering, volcanism) or from anthropogenic sources related to industrial activity, power generation (coal and oil fired), traffic, fishing, municipal waste water, navigation and the use and disposal of consumer products.

Lead is a natural, very minor constituent of surface water and groundwater. Nriagu and Pacyna (1988) estimated, for 1983, inputs of 97 000 - 180 000 tonnes per year of lead to aquatic ecosystems world-wide from sources such as industrial wastes, effluents from mining, smelting, refining, manufacturing processes, atmospheric deposition, and dumping of sewage sludge. Atmospheric deposition was found to represent over half of the total. Since 1983 the situation has changed dramatically with the introduction of new cleaner production technologies and more stringent emission limits. For example, between 1955 and 1985, emissions from lead production fell by 71% across the EU as a whole due to the phase-out of leaded petrol. Furthermore, it has been estimated that in the United Kingdom alone total emissions of lead from anthropogenic sources have declined from 7561 tonnes in 1970 to 1033 tonnes in 1998 - a reduction of 86% (DETR, 1998).

In Norway the national emissions/discharges of lead to the environment decreased from approximately 600 tonnes in 1995 to approx. 240 tonnes in 2005, a reduction of 60%. In the period 2000 – 2007 the Norwegian offshore discharges decreased from approximately 24 tonnes to approximately 2 tonnes. Lead in products used offshore on the Norwegian continental shelf declined from 90 kg in 2000 to 0.9 kg in 2007 due to implementation of the substitution principle in the offshore industry.

According to EMEP data the lead emission in OSPAR countries decreased from approx. 14 700 tonnes in 1990 to approximately 1000 tonnes in 2006 which indicates a considerable emission reduction (more than 90%) in this period. Much of the reduction has been achieved before 2000, since when progress in reductions has slowed.

In this context, it is considered that the total annual input of lead to aquatic ecosystems has declined since 1983, given the reduction that has occurred in lead emissions from mobile sources. It is important to emphasise that point sources of discharge, although not necessarily of great world-wide importance, may have large local impacts. In contrast, the globally important atmospheric deposition is spread over vast areas of ocean and may have less local impact.

Lead entering a river is rather rapidly transported to the sea. In the course of downstream dispersion, some lead may be removed by transfer to sediments on the river bed. During periods of high flow, some of this deposited lead may become resuspended and enter the water in suspended solids. Water in lakes and reservoirs is not usually subject to such energetic processes, and transfer is likely to be more solely related to the water column.

For marine waters, inputs from rivers, direct discharges from land-based sources to the sea, discharges of produced water from the offshore oil and gas industry, and atmospheric deposition are dispersed and diluted by mixing with cleaner seawater from deep ocean areas. Lead also tends to precipitate in the rather alkaline waters of the sea, and will deposit into sediments on the seabed. In estuarine zones, enhanced precipitation of lead into estuarine sediments, or occasionally removal of sediment to the sea, may occur.

In general, lead decreases in concentration from rainwater (generally acidic (pH<5.5); about 20 µg/l) to fresh water (generally neutral (pH=7); about 5 µg/l) to seawater (alkaline (pH>8.2); below 1 µg/l). In the course of this decreasing concentration gradient, lead is removed to bottom sediments. This can either be a long-term sink, or a source of secondary release if it is re-mobilised, *e.g.* through intake by bottom dwelling organisms.

Concentrations of lead in rivers are mainly dependent upon local source inputs, as residence times are short. The local geochemistry may also be important. In areas of lead mineralisation, rivers can contain lead concentrations as much as ten times higher than in unmineralised areas. In areas without lead mineralisation, background levels of lead in the water tend to be very low, and normally well below 10 µg/l. When point source inputs of lead enter a river, downstream concentrations may be appreciably elevated.

1.4 Identified sources

Several comprehensive reports on lead have been published which review the various sources of lead (OECD, 1993; US Department of Health and Human Services, 1992; Swedish National Chemicals Inspectorate, 1994; UNEP, 2006: Interim review of scientific information on lead).

Lead is used/occurs in a number of industrial processes and is contained in numerous products. Some main identified areas and sources of use are:

- Metallic lead:
  - batteries and accumulators;
  - lead shots;
  - boat keels;
  - weights in fishing nets, sinkers/lures, vehicle wheels;
  - building materials (*e.g.* radiation protection in hospitals, lead roofing materials, flashing/weathering);
  - curtain hems;
  - mantles in high voltage ground/sea electric cables;
  - alloys;
- Lead in products:
  - paint;
  - leaded gasoline;
  - glass (*e.g.* TV and computer screens);
  - electronic and electric equipment;
  - fertilisers;
  - additive to plastics (*e.g.* PVC);
  - solder material (*e.g.* in water pipes);
  - glazes and enamels on ceramic products;
- Lead from production processes and energy production:
  - mine drainage;

- metal production (*e.g.* zinc production);
- glass production and recycling processes;
- ceramics production;
- offshore platforms (produced water, drilling fluids and drill cuttings);
- municipal waste incineration;
- hazardous waste incineration;
- industrial discharges from smelters.

Lead and its compounds may enter the environment at any stage in the lead-life cycle, *inter alia*, during mining, smelting, processing, use, recycling or disposal. By far the largest use of lead is in batteries, which represented approximately 75% of the consumption in the western world in 1999 and approximately 80% in 2003 - 2008. Other major applications areas are lead compounds other than those used in batteries (8% of total), lead sheets (6%), ammunition (3%), alloys (2%) and cable sheathing (1%) (ILZSG, 2008). The most significant change in the use pattern during the period 1970 to 2008 is that batteries account for an increasing part of the total, whereas cable sheathing and petrol additives have decreased due to substitution.

It has been estimated that the total global anthropogenic atmospheric emission of lead in the mid-1990s was 120 000 tonnes, of which 89 000 tonnes originated from the use of petrol additives. The global consumption of lead for manufacturing of petrol additives decreased from 31 500 tonnes in 1998 to 14 400 tonnes in 2003. In June 2006 only two countries worldwide used leaded petrol while 26 countries, most of them in Asia-Pacific region, used both leaded and unleaded petrol.

Areas in the vicinity of lead mines and smelters are subject to high-levels of air emissions, however the earlier EU ambient limit lead in air limit, 1.0 $\mu g/m^3$, was in 2005 reduced to 0.5 $\mu g/m^3$. Indeed, virtually all plants in Europe already achieve levels well below 1.0 $\mu g/m^3$.

As many primary pollutant sources are regulated, the need to also assess secondary sources increases. In this context contaminated sediments and sea shore hazardous waste sites are especially important. Norwegian studies have shown that these can be important long-term sources.

2. Monitoring data, quantification of sources and assessment of the extent of the problem

2.1 Monitoring

Lead is subject to several monitoring programmes and surveys describing transport of lead in the environment, including water, air and dredged materials.

The following work has been carried out by OSPAR under the Joint Assessment and Monitoring Programme (JAMP):

- Monitoring strategy for lead with periodic data and information collection (see Annex 2);
- Lead is regularly monitored and assessed as part of the OSPAR monitoring programmes:
    - Comprehensive Study on Riverine Inputs and Direct Discharges (RID);
    - Comprehensive Atmospheric Monitoring Programme (CAMP);
    - Co-ordinated Environmental Monitoring Programme (CEMP);
- JAMP monitoring guidelines and environmental assessment criteria.

In the OSPAR Quality Status Report (QSR 2000) it was concluded that, in general, loads of heavy metals from rivers and direct discharges generally decreased. Waterborne inputs decreased between 1990 and 1996 in Region I (Arctic Waters), Region III (Celtic Seas) and Region IV (Bay of Biscay and the Iberian Coast); input levels remained fairly stable in Region II (Greater North Sea). Data still showed elevated concentrations of metals including lead in sediments close to coastal sources. In mussels, however the trend is more marked with significant decreases in mussels from Germany, Spain, Norway and the Dogger Bank (OSPAR, 2000).

Lead is monitored and reported under the OSPAR monitoring programmes annually. Latest trend and status assessments for waterborne inputs (OSPAR, 2009a), airborne inputs (including quantification of main emission sources and contributors) (OSPAR 2009b), and concentrations in the marine environment (OSPAR, 2009c) were published in 2009.

The Heavy Metal Protocol of the UN-ECE Convention on Long-range Transboundary Air Pollution (LRTAP) gives the countries an obligation to report on emissions of lead. The countries should make contributions to the ongoing programme EMEP in order to monitor atmospheric transport of lead. An emission inventory is part of the programme and reporting on air emissions will in future take place in the UN-ECE framework every year for three heavy metals (Cd, Pb and Hg) as well as for sixteen persistent organic pollutants (POPs).

North Sea Ministerial Conferences have designated lead as a hazardous substance, the reduction of which was given priority. According to The Hague and Esbjerg Declarations, a total of 70% reduction in emissions to air and discharges to water should have been achieved in the period 1985 - 2000.

2.2 Quantification of sources

According to the Progress Report to the 5th North Sea Conference, all North Sea States achieved a 70% reduction of lead discharges to water and emissions to air in the period 1985 to 1999/2000.

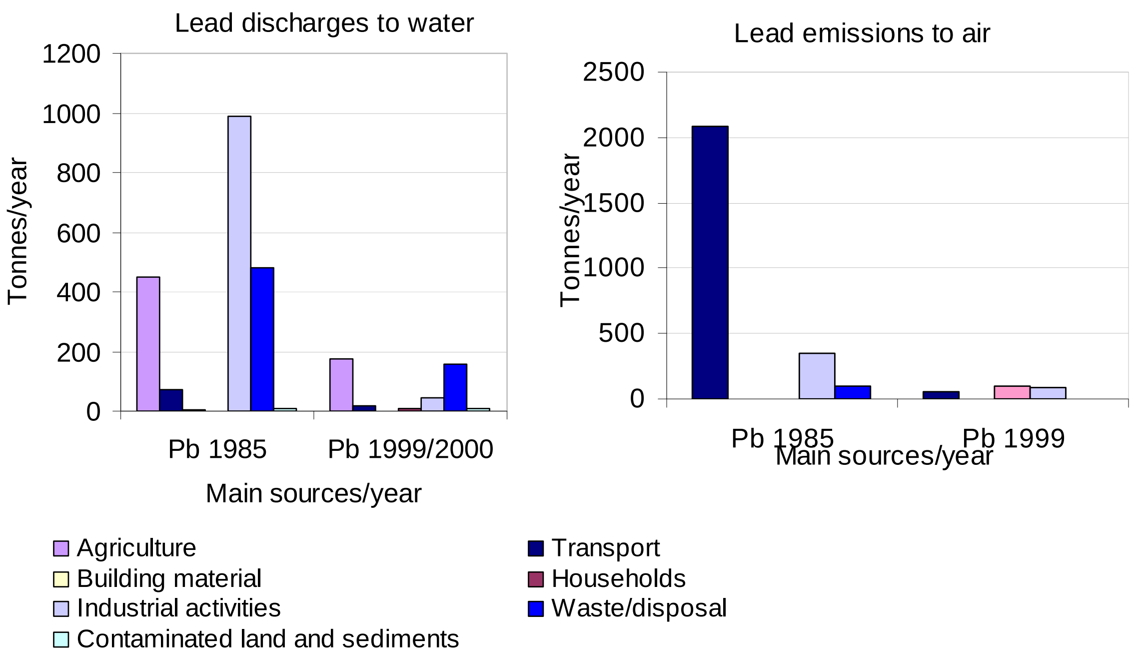

Figure 1: *Main groups of sources (cf. HARP-HAZ prototype, SFT, 2001) of discharges/releases to water and emissions to air of lead (Pb) in 1985 and 1999/2000. Source: Progress report to the 5th North Sea Conference (MD, 2002). (See Tables 1 and 2 below).*

The main group of sources reported by North Sea States to the 5th NSC Progress Report (2002) for lead, on the basis of the 'Source Oriented Approach' is shown in the above graph. Both data for 1985 and 1999 are included. It should be noted that data presented in this figure are not based on reports from all North Sea States (see also footnote 1). Data on discharges to water cover data reported by Denmark, Germany, Norway, the Netherlands and Sweden and data on emissions to air cover data from Denmark, Norway, the Netherlands and Sweden.

Figure 1 indicates that the source profile and the importance of individual sources for lead have changed between 1985 and 1999/2000. In 1985, 'transport' and 'industrial activities' were major sources, but due to the large reductions achieved especially as regards discharges/releases to water from various industry sectors, other sources now seem to be of greater importance. The major reduction in lead emissions to air is not surprisingly connected to the transport sector due to the decline in the use of leaded petrol. Considerable decreases are also recorded in the total emissions to air from waste incineration included in 'waste disposal'. Still industrial activities, *i.e.* industry covered by the IPPC Directive, and Small and medium-sized enterprises (SMEs) remain an important source of lead emissions to air.

'Agricultural activities' are a dominating main source of lead discharges to water in 1999/2000 for the countries shown in the graph. This is due to the reported amounts of lead discharges from groundwater[1] and the sub-source 'fishing equipment', which is included in this main source.

It should be noted that no country included data for the offshore activities in this part of the reporting to the 5th NSC Progress Report.

An overview over total amounts reported for sources ('Source Oriented approach' (SOA)) is given in Tables 1 and 2 below. It becomes clear in the overview that countries have not reported on the same sources.

Table 1: *Reported air emissions for lead in 1985 and 1999/2000 to 5th North Sea Conference*

Transport and infrastructure			
1985 Denmark, Sweden, Norway, Switzerland, The Netherlands	*Sum:*	*2 087 702*	*kg/year*
1999 Norway, Denmark, Belgium, Switzerland, The Netherlands	*Sum:*	*57 329*	*kg/year*
Households			
1985 Switzerland, The Netherlands, Norway	*Sum:*	*2318*	*kg/year*
1999 Switzerland, The Netherlands	*Sum:*	*2612*	*kg/year*
Small and medium-sized enterprises (SMEs)			
1985 The Netherlands	*Sum:*	*60*	*kg/year*
1999 Belgium, Norway, The Netherlands	*Sum:*	*99 170*	*kg/year*
Industrial activities (Covered by the IPPC-Directive 96/61/EC.)			
1985 The Netherlands, Denmark, Norway, Sweden, Switzerland	*Sum:*	*344 841*	*kg/year*
1999 Norway, The Netherlands, Denmark, Sweden, Switzerland	*Sum:*	*85 981*	*kg/year*
Waste / Disposal (incl. incineration of wastes and sludges)			
1985 Denmark, Norway, Sweden, The Netherlands	*Sum:*	*101 300*	*kg/year*
1999 Norway, Belgium, Denmark, The Netherlands	*Sum:*	*4065*	*kg/year*

[1] This sub-source was only reported by Germany and was included to reflect the rise in lead transport from groundwater due to anthropogenic activities.

Table 2: *Reported discharges to water for lead in 1985 and 1999/2000 to 5th North Sea Conference*

Agricultural activities (incl. processes specific to fishing and hunting)	
1985 Germany, Belgium, Denmark, Norway, The Netherlands	*Sum: 448 066 kg/year*
1999 Belgium, Germany, Switzerland, The Netherlands, Denmark	*Sum: 177 079 kg/year*
Transport and infrastructure	
1985 Germany, The Netherlands	*Sum: 73 262 kg/year*
1999 Germany, The Netherlands, Belgium, Switzerland	*Sum: 18 798 kg/year*
Building materials	
1985 The Netherlands	*Sum: 2661 kg/year*
1999 The Netherlands	*Sum: 1314 kg/year*
Households	
1985 The Netherlands	*Sum: 433 kg/year*
1999 The Netherlands, Belgium	*Sum: 8964 kg/year*
Industrial activities (Covered by the IPPC-Directive 96/61/EC.)	
1985 Norway, The Netherlands, Germany, Sweden, Switzerland	*Sum: 990 821 kg/year*
1999 Norway, The Netherlands, Belgium, Denmark, Germany, Sweden, Switzerland	*Sum: 44 329 kg/year*
Waste / Disposal (incl. Waste water treatment)	
1985 The Netherlands, Denmark, Germany, Norway, Sweden, Switzerland	*Sum: 479 770 kg/year*
1999 The Netherlands, Denmark, Germany, Norway, Sweden, Switzerland	*Sum: 155 167 kg/year*
Contaminated land and sediments	
1985 Norway, The Netherlands, Germany	*Sum: 7997 kg/year*
1999 Norway, The Netherlands, Germany	*Sum: 6849 kg/year*

The emissions to air from the glass industry in 1990 from OSPAR countries were estimated at 96,6 tonnes/year according to the ‘European Emission Inventory of Heavy Metals and Persistent Organic Pollutants for 1990’.

A more comprehensive overview of lead sources and sub-sources can be found in Annex 1. The tables also indicate roughly the relative importance of these sources with respect to discharges to water and emissions to air. Many of these sources are regulated (see Chapter 4). Lead in products will be incorporated in the waste source category in the list, or if relevant, the production category.

It should be noted that the offshore industry was considered as a major source. The sources of lead discharges from the offshore industry are produced water and barite in drilling fluids. From the Norwegian offshore industry in 2006, the discharges of lead from produced water were 350 kg. Discharges from drilling, where barite is used as weight material, was 6.7 tonnes in 1999 and increased to 24 tonnes in 2000 due to a higher level of lead contamination in the barite, but in 2006 the discharge of lead was reduced to approx. 2.3 tonnes.

Contaminated sediments are considered as a source of medium importance. OSPAR Contracting Parties routinely reports on lead measured in dredged material dumped in the OSPAR maritime area. According to the annual report for 2005, the loads were Belgium – 558 tonnes, France – 842 tonnes, Germany – 379 tonnes, Ireland – 25 tonnes, the Netherlands – 488 tonnes, Spain – 93 tonnes and the United Kingdom – 1219 tonnes.(OSPAR, 2007).

Data from the European Pollutant Emission Register (EPER) indicate that there was a decline in lead discharges to water in the OSPAR Contracting Parties from 2001 to 2004. The total discharges of lead reported by Contracting Parties to EPER under their commitments under the IPPC Directive in 2001 and 2004 are 93.6 and 82.2 tonnes respectively. The discharges reported relate mainly to the metal industry, the pulp and paper industry, the basic organic chemicals industry and basic inorganic chemicals or fertilisers. While uncertainties in the exact discharge figures exist due to inconsistencies in reporting and do not allow conclusions on trends, the discharge data still give a rough indication that discharges from these heavily regulated point sources still continue.

In the period 1990 – 2006, total direct and riverine inputs of lead through rivers and direct discharges to the OSPAR maritime area have generally decreased with statistically confirmed downward trends of riverine inputs of 85% in Region I (Arctic Waters) and 50% in Region II (Greater North Sea) (OSPAR, 2009a). Direct discharges were the smaller and progressively diminishing component of overall inputs. Waterborne inputs of lead to Region II and Region III (Celtic Seas) were roughly of the same magnitude as atmospheric inputs of lead. In Region I, Region IV (Bay of Biscay/Iberian Coast) and Region V (Wider Atlantic) atmospheric deposition was the dominant pathway of lead to the sea (OSPAR, 2009b).

The total air emissions reported by OSPAR Contracting Parties under their commitments under the Convention on Long-Range Transboundary Transport of Pollutants to EMEP amounted to 1076 metric tonnes in 2005. The figures held by EMEP suggest that about half of the emissions are accounted for together by Spain (mainly from combustion and industrial processes) and Portugal (mainly from road transport and aviation). In1998 – 2005, lead emissions reported by Contracting Parties decreased by more than two thirds. The most significant reduction (more than 90%) was achieved in emissions from road transport, reflecting the phase-out of leaded petrol in the OSPAR Convention Area. While in 1998 the transport sector (below 1000 m) contributed two thirds to the total lead emissions in the Convention area, it still accounted for one forth of the total emissions in 2005 and was the second largest emission source after combustion in power plants and industry and before industrial processes.

In the same period the emissions from air transport (above 1000 m) increased by one third. Reductions in emissions from main sources in 2001 – 2005 were less pronounced for industrial processes (15%) and combustion in power plants and industry (18%) but reached 31% for commercial, residential and other stationary combustion. The picture for the individual manufacturing industries is inconsistent. In 2001 – 2005 overall emissions from the non-ferrous metal manufacture halved but the trend was less clear for iron and steel (down 6%); yet emissions remained stable or even increased for some Contracting Parties. With the emission reductions achieved for the two largest single manufacture emission sources, emissions from ‘other manufacturing industries’ (including furnaces and the manufacture of glass, ceramics, tiles etc.) as a group have become the biggest manufacture emission source with no clear trend in emissions in 1998 – 2005.

Emissions from combustion in power plants and in industry and industrial process were the main contributors (76%) to total atmospheric deposition of lead to the OSPAR maritime area in 2005.(OSPAR, 2009b). Transport is the second largest emission source contributing to lead depositions (17%). EMEP model results estimate the net anthropogenic input load to the OSPAR maritime area in 2006 to amount to more than 2200 tonnes (compared to total deposition including resuspension of more than 4400 tonnes). Deposition rate is highest in Regions II and IV along the coasts. Atmospheric net deposition of lead showed a statistically significant decrease in Region II (down 30%) in 1998 – 2006 but an increase in Region V (up 20%). The changes of atmospheric inputs in the other Regions were not statistically significant. Decreasing trends in concentrations of lead in air and precipitation were also observed for some CAMP stations especially in Region II (down 8%).

Table 3 shows total air emissions of lead reported to EMEP for the period 2000 - 2006 in tonnes/year. While there are uncertainties in data there is indication that emissions show a diffuse picture with a clear decrease for some countries while emission levels have stagnated or even slightly increased for other Contracting Parties.

Table 3: *Officially reported air emission data to EMEP 2000 - 2006. Tonnes/year of lead. Source:* emep.emissions@umweltbundesamt.at and www.umweltbundesamt.at. 2008.

	2000	2001	2002	2003	2004	2005	2006
Belgium	117	102	72	63	81	77	76
Denmark	7	6	5	5	5	6	6
Finland	36	38	40	34	28	24	25
France	252	214	208	156	142	138	128
Germany	102	105	106	105	106	107	108
Iceland	-	-	-	-	-	-	-
Ireland	30	17	17	16	16	17	16
Luxembourg	-	-	-	-	-	-	-
Netherlands	37	41	45	41	43	37	39
Norway	9	8	9	9	10	8	-
Portugal	150	170	168	171	173	163	158
Spain	626	408	275	271	267	273	275
Sweden	26	23	20	19	18	15	14
Switzerland	36	33	29	26	25	24	24
United Kingdom	163	155	142	129	134	117	106

2.3 Recycling and waste management

Battery recycling rates are high in many countries, sometimes exceeding 90%. However, it has become apparent that the weakest link in the recycling chain is usually the consumer who retains or discards a used battery rather than returning it for recycling. In a number of countries, authorities are working with industry to increase recycling by focusing on the battery life cycle and encouraging consumers to return used batteries.

If lead-containing industrial solid wastes and post-consumer products are not recycled or reused, they are generally sent to landfills for disposal or they are incinerated. The composition and volume of wastes destined for final disposal, as well as management methods, vary according to country and region depending on factors such as use patterns, recycling rates and population density.

Some countries have estimated that batteries and consumer electronic products account for most of the lead in municipal solid waste. Others have identified lead in soldered food cans as the main source of lead in domestic waste. It has been observed in some countries that the volume of lead in municipal waste is declining. Soldered food cans were once a major source of lead in municipal waste. However the application has been discontinued in most developed countries, and in many developing countries too, and very little lead from this source will now find its way into domestic waste. Studies have shown that health concerns are minimal for properly managed landfills with controls for run-off and leachate water, and that lead emissions from incinerators can be controlled, with proper technology, to 99% reduction or greater efficiency. While much of the atmospheric emissions of lead from incineration can be eliminated, lead captured by emission control devices and the lead remaining in ashes must be disposed of properly, usually in landfills, as the lead has become very mobile due to incineration.

Lead materials that can be recycled vary from industrial and consumer scrap to remediation and abatement wastes. Post-consumer product scrap constitutes more than 80% of the scrap supply for recycling, with batteries accounting for up to 90% in a given year.

2.4 Environmental contamination

Much of the decrease in waterborne and airborne inputs of lead occurred before 2000, since when changes in environmental concentrations have been relatively small as concentrations approach, but do not reach, background in large parts of the OSPAR area (OSPAR, 2009c). In 2003 – 2007 concentrations of lead in sediments still gave rise to risk of pollution effects over large parts of the southern North Sea, both inshore and offshore, the Channel and the Irish Sea, and some scattered industrialised locations on the coast of Norway and northern Spain. Concentrations in fish and shellfish exceeding EU dietary limits are less widespread and the locations can generally be linked to urban and industrial activity, e.g. around Denmark, several UK estuaries and certain sites in southern Ireland, southern Norway and northern Spain.

3. Desired reduction

The OSPAR objective with regard to hazardous substances is to prevent pollution of the maritime area by continuously reducing discharges, emissions and losses of hazardous substances. The ultimate aim is to achieve concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances. Every endeavour will be made to move towards the target of cessation of discharges, emissions and losses of hazardous substances of concern by the year 2020.

As lead is toxic and persistent, it is imperative that discharges, emissions and losses which reach the marine environment in significant amounts be prevented or reduced as soon as possible, and at the latest by 2020. Ideally, reductions should take place progressively.

In order to meet the targets specified in the OSPAR objective and timeframe, it is necessary to:

- assess the need for further reductions from the various sources and the practicability of such reductions;
- review existing regulations and controls in the light of the need for further reductions;
- decide which organisation is responsible and/or best placed for carrying out detailed assessments and/or implementing controls;
- inform the relevant organisation (if not OSPAR) of the OSPAR ministerial commitments with regard to hazardous substances and the need for action to address OSPAR concerns;
- set up mechanisms for monitoring the compliance with measures adopted in the relevant forum;
- set up mechanisms to monitor inputs to the marine environment;
- review progress (quantify inputs and assess concentrations in the marine environment and biota) and identify the need for further action.

Substantial reductions have been achieved in the period 1998 – 2005. Yet, overall there is currently no clear move towards the cessation target.

4. Identification of regulations and possible measures

4.1 Regulations

Lead discharges and emissions from stationary and mobile sources have been regulated by a number of initiatives, directives and agreements. They cover lead releases from transport, industry and from the use of lead as metal and lead compounds in products.

Within the Heavy Metal Protocol of UN-ECE LRTAP there are several BAT requirements that include lead.

Within OSPAR, several PARCOM and OSPAR Decisions and Recommendations contain BAT and BEP requirements to reduce lead emissions from various industrial processes:

- PARCOM Recommendation 90/1 on the Definition of the Best Available Technology for Secondary Iron and Steel Plants.
- PARCOM Recommendation 91/2 on the Definition of the Best Available Technology in the Primary Iron and Steel Industry.
- PARCOM Recommendation 95/5 concerning Best Available Technology in the Pharmaceutical Manufacturing Industry.
- PARCOM Recommendation 94/5 Concerning Best Available Techniques and Best Environmental Practice for Wet Processes in the Textile Processing Industry
- PARCOM Recommendation 97/1 Concerning Reference Values for Effluent Discharges from Wet Processes in the Textile Processing Industry
- PARCOM Recommendation 97/2 on Measures to be Taken to Prevent or Reduce Emissions of Heavy Metals and Persistent Organic Pollutants Due to Large Combustion Plants ($\geq$ 50 MWth)
- OSPAR Recommendation 98/1 concerning Best Available Techniques and Best Environmental Practice for the Primary Non-Ferrous Metal Industry (Zinc, Copper, Lead and Nickel Works)

Within the European Union several EC Directives include regulations for lead. This is a list of some EU regulations concerning lead emissions:

- Council Directive 96/61/EC on integrated pollution prevention and control (IPPC) demands that for (usually medium-sized and larger) plants in numerous industrial sectors permits should be issued that contain emission limit values based on best available techniques (BAT). To this end, the EC has established BAT reference documents (BREFS). This might also result in the reduction of lead emissions from relevant sources in the medium-term by promoting the use of BAT associated performance by 2007 at the latest. However, specific emission limit values for lead have so far not yet been set at Community level. Sometimes, lead is included in a sum parameter for several heavy metals in specific EC Directives.

- Council Directive 76/769/EEC and the amending Directive 89/677/EEC limits the marketing of carcinogenic, mutagenic, reproductive substances to the public and bans the use of lead chromate and lead sulphate in paints.
- Council Directive 86/278/EEC restrict the lead content in sewage sludge used in agriculture on land to prevent leaching of lead to soil, groundwater and runoff water.
- Council Directives 85/210/EEC and 98/70/EC set limit values for the concentration of lead in gasoline.
- Council Directives 99/30/EC set limit values for lead (among others) for ambient air (limit value: 0,5 $\mu g/m^3$).
- Council Directive 2000/53/EC on end-of life vehicles bans lead containing materials other than in specified components and restricts the lead content in alloys.
- Directive 2000/60/EC, (the Water Framework Directive), sets out a combined approach, both for the setting of environmental quality objectives and for the requirement and implementation of control measures on emissions and products. According to Decision No 2455/2001/EC lead is on the list of priority substances.
- Council Directive 2000/76/EC regulates lead emissions (among others) from incineration of waste, hazardous as well as municipal.
- Regulation EC) No 178/2002 of the European Parliament and the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety
- Council Directive 2002/95/EC (the RoHS Directive) on restrictions of the use of hazardous substances in electrical and electronic equipment bans, with some exceptions, the use of lead in new such equipments.
- Council Directive 2002/96/EC on the waste electrical and electronic equipment (the WEEE Directive)
- Council Directive 2006/66/EC restrict the use of lead in batteries and accumulators and handling of waste batteries and accumulators.
- Council Directive 2008/105/EC sets out Environmental Quality Standards in the field of water policy for prioritised substances including lead, which is set to 7,2 $\mu g.l^{-1}$ for transitional and coastal waters. According to this directive, lead is on the list of priority substances but not identified as a hazardous substance.

In addition several OSPAR countries have further legislation regulating lead emissions.

Denmark has in November 2000, implemented a broad ban on lead products. The limit of lead in products is 100 mg/kg. It contains a general ban – with delayed bans and exemptions – for lead substances. For metallic lead specified products are banned. The legislation on lead includes a ban on the import, sale and production of lead and lead containing products. This ban has been updated in 2007.

In Denmark, the Netherlands, Spain, Sweden and the UK, the use of lead shots is banned for use in wetland areas (duck hunting). In Norway lead shots related to all hunting is banned since 2005. Sweden has notified a new regulation concerning all ammunition containing lead. The Swedish Sport Shooting Association has already, on a voluntary basis, introduced a ban on lead shot used in national events for clay pigeon shooting.

In Spain and Switzerland the use of lead in bottle closures for alcoholic beverages was banned in 1995.

Currently there is under development a new amendment as a Proposal for a Regulation (EC) No …/… of the European Parliament and of the Council concerning the general rules on the definition, description and presentation of aromatized wines, aromatized wine-based drinks and aromatized wine-product cocktails (Recast)

As a consequence of the classification of lead compounds as toxic, the use of leaded paints is restricted to professional purposes (*i.e.* for restoration and maintenance of works of art and historical buildings), and sales to private consumers are not allowed. Switzerland has prohibited the marketing and use of lead in paints as well as articles treated with such paints from 1 August 2005.

Lead fishing weighs are banned in the UK, and in Denmark from late 2002. Several countries are considering the substitution of lead as weight material with iron based substances in fishing equipment.

The phasing out of leaded petrol (Directives 85/210/EEC and 98/70/EC) has, on average, more than halved atmospheric emissions of lead in the EU between 1990 and 1996 (EEA-State of the Environment – 1998). Further reductions have occurred, when more of the vehicle fleet has been converted to cars with catalytic converters, which use unleaded petrol. In Norway lead emission from road traffic decreased with approx. 99 % in the period 1995 to 2006.

There are several important initiatives undertaken by industry for lead, *inter alia*:

- The Non-ferrous Metals Sustainable Development Forum puts efforts into the development of sustainable production, use and disposal of lead, within. This forum is a multi-national body which includes governments, industry, NGOs and international research groups (http://www.nfmsd.org/default.html);
- The international lead industry has undertaken a voluntary risk assessment of lead, using the EC Existing Substances Regulations' protocols; (http://www.ila-lead.org/documents/FS_VRAL.pdf) The risk assessment is under review by EU's Independent Scientific Committee on Health and Environmental Risks (SCHER) . Comments from SCHER can be found on this web-site.

  http://ec.europa.eu/health/ph_risk/committees/09_scher/scher_opinions_en.htm#2
- The voluntary commitment of the PVC Industry (25 October 2001) in EU-15 sets the following reduction targets for replacing lead stabilisers on the basis of 2000 consumption levels: 15% in 2005, 50% in 2010 and 100% in 2015 (committed by ESPA and EuPC). The commitment of 100 % phase out in 2015 was extended to EU-27 in 2007. According to VINYL Progress Report 2008 lead replacement in the period 2000 – 2007 was 34 % in EU-15.

4.2 Possible measures

Lead is one of the environmental contaminants that are heavily regulated. Implementation of the measures already agreed is very important to reduce the lead burden to the marine environment.

To reduce the losses of lead from the use of lead as metal, it would be important to focus on the areas where the use causes releases into the environment, as is the case for lead in ammunition and fishing equipment. For both of these use areas, suitable substitutes exist (based on iron compounds). A voluntary risk assessment for restricting the uses of lead in ammunition and fishing sinkers is still under development in the EU.

To reduce lead emission from products, lead should be substituted where appropriate. However, a detailed investigation of the use of lead in such products, including the effectiveness and safety of proposed substitutes and an appraisal of the advantages and disadvantages of carrying out specific substitutions will need to be carried out in order to assess the practicability of phasing out lead in products. A phase-out of lead is possible in a number of products as:

- PVC;
- paints;
- electronic equipment;
- glass;
- lead shots;
- ceramics;
- fishing sinkers.

In addition, products which contain lead should be replaced by products with a lower lead content, or by products without lead.

Two OSPAR background documents, “Possibilities of Reducing Lead in PVC” and “Possibilities of Reducing Lead in Paints” were published by OSPAR 2003 and brought to the attention of the European Commission including a request to consider product-related action.

The European Commission has conducted a study (Cowi, 2004) on the advantages and drawbacks of potential marketing and use restrictions on the use of lead in ammunition and fishing sinkers, which may be considered under Council Directive 76/769/EEC.

Contaminated sediments and landfills in the close proximity of the shoreline are a likely source of the secondary release of pollutants in the coastal zone. Up to now this source has received limited attention in most countries. This is especially true for the waste sites, as there is normally no conflict of groundwater interests for drinking water purposes for these sites and therefore they tend not to be given priority for remedial action. Norwegian studies have shown that these sites can be a long-term contributor to local pollution for *e.g.* lead.

Moreover, cuttings piles near offshore installations for oil and gas production may contain barite, which may cause secondary release of lead if disturbed.

In 2005, the main industrial sources for lead releases to the environment have been regulated. Combustion and industrial processes remain the main sources for lead emissions to air. The use of leaded petrol has been banned for automobiles but its use still continues for some small aircraft. Some of the diffuse sources of lead from products are regulated through use restrictions in EU-legislation. However major use areas such as lead-acid batteries, ammunition and fishing equipment are still not regulated in most Contracting Parties.

There are still releases of lead to air and water. Overall trends are mainly pointing down. For some sources, emissions and discharges are mainly related to total activities within a sector and not to the implementation of BAT or emission limit values and will show activity dependent trends. Emissions for some specific activities and countries do not follow the general downward trend but have stagnated or even increased over the last years.

5. Choice for action

Substantial reductions have been achieved in discharges, emissions and losses of lead to the marine environment, especially through the removal of lead from petrol. The identification of lead as a priority substance under the EC Water Framework Directive also focuses activities on further controls in the aquatic and marine environment. Nevertheless, substantial amounts are still reaching the marine environment. Work to substitute other, safer materials for lead should be intensified, since this is the only action that will cease lead inputs. Such work should focus on plastic articles and equipment containing metallic lead and lead compounds. Deliberations on the appropriate forums to take action should be addressed in this work. Further, to avoid duplication of work, it is necessary to obtain an overview of existing and planned measures in other international forums.

The effective implementation of the obligations under the Water Framework Directive for lead is important to help moving towards the cessation target.

Further progress in reduction of lead from point sources is more difficult to achieve and has been slowing down. More effort is needed to support further reductions in releases through improved technology; for example in combustion processes.

As many primary pollutant sources have now been brought under control, there is also an increasing need to assess the secondary sources. Sediments and coastal waste-disposal sites are important in this context. Further information regarding the aquatic compartment in the environment is necessary in order to adequately characterise the risks to sediment compartments at regional level.

Some further restrictions on the use of lead containing products are being implemented in the EU, but still lead containing products are expected to be on the market by 2020. Uses in products not yet regulated need to be further investigated to inform the need and scope for further action.

- PVC. The phasing out of the use of lead in the production of PVC is already taking place to some extent. .
- Paint. Substitution of lead in paints is possible. Lead free alternatives exist for anti-corrosive paint (red lead), colouring pigments (*e.g.* lead chromates, lead molybdates) and siccatives.
- Ammunition and fishing sinkers and other products. Substitution of metallic lead is possible in several products/articles. This applies to lead shot used in hunting and clay pigeon shooting, fishing sinkers, curtain hems and roofing materials.
- Barite. The offshore oil and gas industry uses drilling fluid with barite as a weight material. Barite contains lead as a natural trace contaminant. The concentration of lead in barite is low, but the total amount of barite being discharged is considerable. However lead in barite appears as lead sulphite and other salts which are practically insoluble in water and past studies have shown that lead is not bioavailable. Other studies have shown that the discharge of barite may cause some effect on marine species, but which of the components in the barite caused this effect was not established. Barite is included in the PLONOR list, as with all PLONOR substances, discharges should be subject to expert judgement, according to the OSPAR offshore chemicals pre-screening scheme and the precautionary principle.

At OIC 2004 Norway presented a report on environmental effects of lead and other trace components in mineral weight materials (OIC 04/2/5). From available evidence compiled for OIC 2007 (OIC 07/3/10), Norway concluded that lead in barite did not pose an environmental threat to the marine environment, due to low bioavailability of lead in barite.

In order to provide a sound basis for future decisions and assessment of progress towards the OSPAR objectives, OSPAR should;

- ensure implementation of the monitoring strategy for lead and organic lead compounds as presented in Annex 2;
- ensure that the information in this background document can be considered in the context of other international agreements and EU measures which deal with hazardous substances.

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Annex 1

Table A1: *Indicative overview of important sources and sub-sources of lead and lead compounds (mainly based on HARP-HAZ Prototype, SFT, 2001)*

Sources	**Discharges to water**	**Air emissions**
Agricultural Activities		
Mineral fertilisers	minor	
Agricultural manure	minor	
Sewage Sludge/Compost	minor	
Transport and infrastructure		
Road transport		MAJOR
Road drainage		
Building materials		
Roofs, gutters	minor	
Paints	minor	
Households		
Wood, oil and coal combustion		MEDIUM
Batteries & other lead containing products	minor	
Waterpipes	minor	
Small and medium-sized industrial activities (SME)		
Car repair shops	MEDIUM	
Cables and other lead containing products	minor	
Laboratory activities	MEDIUM	
Professional and recreational navigation (grease from propeller shafts)	minor	
Industrial activities (IPPC)		
Primary and secondary lead prod.		MAJOR
Primary and secondary copper Production		MAJOR
Primary and secondary nickel Production		MAJOR
Zinc production	MAJOR	MAJOR
Public power, co-generation and district heating		MAJOR
Gray iron foundries		MEDIUM
Pig iron tapping		MEDIUM
Sinter plants		MEDIUM
Reheating furnaces steel and iron		MEDIUM

Sources	**Discharges to water**	**Air emissions**
Basic oxygen furnace steel plant		MEDIUM
Rolling mills		MEDIUM
Cement Production		MEDIUM
Electric furnace steel plant		MEDIUM
Calcium Carbide production	MEDIUM	
Mining	MEDIUM	
Industrial combustion		MEDIUM
Extraction and distribution of fossil fuels		MEDIUM
Production of fertilisers	minor	MEDIUM
Production of glass	minor	MEDIUM
Prod. of plastics containing lead		
Production of cables		
Titanium production	minor	
Ferro Alloy	minor	minor
Production of paint and enamel	minor	minor
Power prod. (oil, wood and coal)	minor	MAJOR
Offshore (prod. water, lead as natural contaminant in barite, pipe dope product add. and raw materials cont. lead)	MAJOR	
Municipal Wastewater		
Municipal wastewater	MAJOR	
Waste		
Landfill activities	MEDIUM	
Hazardous waste incineration	minor	MEDIUM
Municipal waste incineration	minor	MEDIUM
Sewage sludge	MEDIUM	
Contaminated land/sediments		
Contaminated sediments	MEDIUM	
Contaminated sites and soils	MEDIUM	
Other		
Hunting/fishing	MEDIUM	

Annex 2: Monitoring strategy for lead and organic lead compounds

As part of the Joint Assessment and Monitoring Programme (*reference number 2003-22*), OSPAR 2004 adopted an Agreement on monitoring strategies for OSPAR Chemicals for Priority Chemicals (*reference number 2004-15*) to implement the following monitoring for tracking progress towards the objectives of the OSPAR Hazardous Substances Strategy (*reference number 2003-21*) with regard to lead and organic lead compounds. The Monitoring Strategy for lead and organic lead compounds will be updated as and when necessary, and redirected in the light of subsequent experience.

The releases of lead to both air and water from metals industry and coal combustion are still significant and monitoring of levels in the marine environment are relevant in order to check progress towards OSPAR's objectives. Lead is currently well covered in the OSPAR monitoring programmes in the environment (CAMP; CEMP; RID).

There are a number of relevant controls (*e.g.* regulations, directives, recommendations and decisions) on a) marketing and/or use, b) emissions and/or discharges of lead which have been agreed by Contracting Parties both in OSPAR and in other international forums and have been highlighted as important measures for achieving the OSPAR Hazardous Substances objective with respect to lead in the "choice for actions" chapter of the Background Document. Evidence from reports on the implementation of such measures will be used to make an initial judgement of the extent to which the amounts of these substances emitted or discharged are reduced.

For air emissions OSPAR will seek to make best use of data reported in other forums. The yearly reporting of releases to air in the context of UNECE LRTAP (EMEP) should in principle provide data for lead for all significant sources to air. OSPAR will examine and assess these data to determine whether emissions trends are decreasing. In addition, OSPAR will also examine the data reported by Contracting Parties to the EPER database on emissions from sources subject to IPPC.

For discharges to water, OSPAR will examine and assess the data on IPPC sources reported to the EPER database. For other significant sources there is no managed emission inventory. As an additional voluntary monitoring activity national data for discharges for non-IPPC could be collected at regular intervals. However, not all Contracting Parties have the resources to contribute to such reporting so it should be considered as an additional voluntary monitoring activity. The list of indicative sources at Annex 1 of the Background Document for lead should be taken into account in any initiative to collect this information. The outcome of a pilot study carried out by a WFD group (IMPRESS) on river catchments and discharge sources, may also be useful in the identification of important sources. Contracting Parties carrying out such additional monitoring are urged to co-ordinate their activities. Sources not covered by EPER include: agricultural activities; transport and infrastructure; building materials; households; small and medium-sized enterprises (SME); offshore activities (produced water, lead in barite, pipe dope add., raw materials containing lead); waste/disposal (incl. wastewater); contaminated land and sediments; other direct diffuse sources (incl. products used in hunting and fishing).

As pointed out in the OSPAR Background Document, there is a need to assess the importance of secondary sources. Coastal waste disposal sites may be of importance in this context. On-going work on the identification of pressures and impacts as part of the national implementation of the Water Framework Directive, should in principle also cover these sources. On a national level, the requirements in the new EC Landfill Directive will also cover coastal waste disposal sites.

Information about production/sales/use of lead and organic lead compounds will be updated on a regular basis as part of the regular review of the Background Document taking account *inter alia* of information from ECHA (European Chemicals Agency), use/sales statistics from industry and registrations in Nordic or other (national) product registers. For some types of products where diffuse releases are relevant, sales or use figures might be reported on a national basis as a part of the quantitative data for some sources (households, buildings, small and medium-sized industry) in the proposed voluntarily additional reporting for discharges to water.

Monitoring of lead, as a mandatory determinand, under RID and CAMP will continue.

Under the CEMP monitoring in sediments and biota will continue. Where available, OSPAR will seek to periodically compile results from EC WFD monitoring.

OSPAR reports on the dumping of dredged material will be taken into account in relation with other secondary sources.

The significance of inputs from the offshore sector is not clear, past data on the lead content of produced water will be examined to assess its significance.

LEAD AND ORGANIC LEAD COMPOUNDS MONITORING STRATEGY	
Implementation of actions and measures	• Examination of progress in the implementation of regulations on marketing and/or use or emission and/or discharge which have been agreed, or are endorsed, by the Background Document
Emissions to air	• Examination and assessment of trends in emissions to air as reported annually by Contracting Parties to the UNECE/EMEP database in the context of LRTAP Convention and, for IPPC sources, to EPER
Discharges and losses to water	• Examination and assessment of trends in discharges to water from IPPC sources in data reported annually by Contracting Parties to EPER. *Additional voluntary activities:* • *Estimation of data on discharges to water from sources not covered by EPER*
Production/use/sales/figures	• The lead country will update information on production, sales and use of lead and lead compounds during review statement of the Background Document when necessary.
Atmospheric inputs	• Monitoring will continue under the CAMP
Riverine inputs	• Monitoring will continue under the RID
Inputs from the offshore industry	• Past data on the heavy metals content of produced water discharges will be examined to judge its significance
Maritime area:	
Dredged Materials	• Continued reporting to OSPAR of the concentrations of lead in dredged materials disposed to the maritime area
Concentrations in sediments	• Monitoring will continue under the CEMP
Concentrations in water	• Where available, data will be periodically compiled from EC WFD monitoring
Concentrations in biota	• Monitoring will continue under the CEMP

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OSPAR's vision is of a healthy and diverse North-East Atlantic ecosystem

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