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Lead in articles

– a government assignment reported by the Swedish Chemicals Agency and the Swedish Environmental Protection Agency

SWEDISH CHEMICALS AGENCY

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Order address: Telefax +46 8 50 59 33 99, e-mail: kemi@cm.se

Foreword

This report is an account of the assignment given by the Swedish Government to the Swedish Chemicals Agency and the Swedish Environmental Protection Agency in June 2005 to investigate the consequences of the forthcoming prohibitions of ammunition containing lead in hunting and target shooting and to conduct a review of the use of lead in articles and products. The Swedish Chemicals Agency and the Swedish Environmental Protection Agency were each given identical assignments.

The first part of the assignment was to investigate the consequences of the prohibitions of lead in ammunition. The results of the investigation were presented to the Swedish Government on 10 November 2006 (Swedish EPA report 5627).

In a second part of the assignment the Swedish Chemicals Agency and the Swedish Environmental Protection Agency review the use of lead in articles and products as a whole and submit proposals for the regulations they consider to be most urgently needed to attain the environmental quality objective of A Non-Toxic Environment.

Background reports are available on the Swedish Environmental Protection Agency website (www.naturvardsverket.se) and can be downloaded free of charge in electronic form.

Swedish Chemicals Agency

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1. SUMMARY

Lead is an element commonly present in soil at low concentrations. Lead, zinc and silver to a large extent occur together in nature. In the majority of mines around the world where zinc is extracted, large quantities of lead are also extracted.

Lead is a non-essential metal. The harmfulness of the lead ion has long been known and is fairly well documented. The lead ion is classified as toxic to reproduction, category 1, i.e. it affects fertility and can be harmful to foetal development. Lead compounds, for example lead acetate, are suspected of being carcinogenic (cancer, category 3) because of the lead ion.

Substances that can release lead ions to the environment are also classified as very toxic to aquatic organisms and can cause harmful long-term effects in the aquatic environment, that is to say they pose an environmental hazard.

The Swedish Parliament has adopted environmental quality objectives in 16 areas. One of these objectives is “A Non-Toxic Environment”. This means that “the concentrations of substances that naturally occur in the environment are close to background levels”. According to the wording of interim target 3 for A Non-Toxic Environment, newly manufactured finished products are as far as possible to be free from lead by 2010.

The commission

In June 2005 the Swedish Government commissioned the Swedish Chemicals Agency and the Swedish Environmental Protection Agency jointly to investigate the consequences of the ban on lead in ammunition that comes into force in 2008 and to review the use of lead in articles and products. A report on the first part of this commission, concerning the consequences of the ban on lead in ammunition, was presented to the Government on 10 November 2006.

In the second part of the commission the Swedish Chemicals Agency and the Swedish Environmental Protection Agency are to review the use of lead in articles and products as a whole and submit proposals for regulations they consider to be most urgently needed to attain the environmental quality objective of A Non-Toxic Environment. The two government agencies are also to consider the cost-effectiveness of the regulations proposed. Part two of the commission is the subject of this report.

Environmental risks

Lead in petrol in the past was the most significant source for the dispersal of lead to the environment and gave rise to the effects on microorganisms suspected of occurring in forest soil in parts of Sweden. As the use of leaded petrol continues to decrease in Europe and the rest of the world, fallout of lead will decline further and levels in forest soil can be expected to diminish. The general level of exposure to lead in urban environments is also falling sharply with the decreasing use of leaded petrol.

Lead-containing articles that end up in waste may contribute to atmosphere fallout of lead when the waste is incinerated, or potentially be dispersed to the environment in some other way.

The use of articles containing lead, such as shot and fishing weights, can result in general dispersal of metallic lead in some areas, similar to that from atmospheric fallout. It has not been possible to quantify what effects this will have on aquatic and soil organisms. The

environmental impact of lead from the use of other types of articles will be more concentrated, and risks may possibly arise locally in soil and water.

The greatest environmental risk identified in the use of articles is the poisoning of birds and other animals that can ingest lead objects (shot, fishing weights) directly or through the food chain.

Health risks

Measures to reduce the dispersal of lead in Sweden have been successful. They have resulted in reduced blood levels of lead over the last 20 years. The mean value of lead in the blood of Swedish men at present is approximately 0.2 µmol/l. The mean value is lower in women, adolescents and children. The average level of lead in the blood of children in areas without activities that result in major emissions is approximately 0.1 µmol/l.

However, it is difficult to establish a safe level for lead exposure as lead can damage the nervous system even at low levels of exposure. Sensitivity is particularly great during brain development in foetuses and small children. In studies on children, delayed development, lower IQ and behavioural disorders have been observed at blood lead levels of around 0.5 µmol/l. Suppressed erythropoiesis (blood formation) and hearing impairment are other effects observed at relatively low lead exposure. The neuropsychological effects on children are severe, and lead levels in the blood of children and women of childbearing age should therefore be lower than 0.5 µmol lead per litre of blood. However, there are indications that these effects do not have a threshold, which means that it is not possible to establish a “safe” level of lead in the blood of children and foetuses.

Today the general population is exposed to lead principally through food, but based on calculations of weekly intake of lead through food this exposure generally appears to be low in Sweden.

Certain at-risk groups which may be exposed to harmful quantities of lead through consumer products have, however, been identified. Examples of such at-risk groups are anglers who make their own fishing weights, people who use solder and those who cast tin soldiers and make lead bullets for black powder shooting. These activities can lead to high “uncontrolled” exposure to lead vapour. Lead vapour is formed when lead melts at high temperatures. This “vapour” contains small inhalable lead particles, and uptake in the lung is assumed to be 100 per cent. Another example of at-risk groups is people who spend time in rooms in which scented candles/gel candles with a lead-containing wick are lit. When these candles are lit lead vapour is released, which might give rise to high concentrations of lead in air.

Rules on lead in articles

Lead is found in a large number of applications, and regulations on lead can therefore be found in a number of different European directives. The report presents a broad description of regulations in the EU that explicitly relate to lead, either as a substance or in articles. Certain other products that are of great significance in limiting the use of lead, e.g. cars, petrol and batteries, have been regulated. Another example of the regulation of the level of lead in articles is a new directive which imposes limits on lead in electrical and electronic products. New product directives concerned with lead will probably also be added. The new chemicals legislation REACH may signify further restrictions on lead.

Use of lead in articles

The use of lead has decreased in most of the groups of articles considered in the report over the last decade. It is principally in *paint pigments, plastics, crystal, lead-jacketed cable, electronics and shot* that quantities of lead have fallen. The forces driving this positive development have been tightened legislation for certain uses of lead in products but also customer requirements and other voluntary initiatives in industry.

Product areas where the use of lead has not diminished are *batteries, boat keels, fishing tackle, alloys, weights and radiation protection.* A reduction in the quantity of lead is, however, expected shortly, with regard to *balance weights,* as the previous exemption from the limitation of lead in end-of-life vehicles has ceased to apply (ELV Directive, 2000/53/EC, see Annex 3).

Prioritised groups of articles

The risks associated with lead vary between different product groups. This principally depends on the form in which the lead occurs, what volumes of lead are used in the product group, the dispersal of the products in society and how they are disposed of at the end of their life. In addition, it is significant to the risks whether use of the product may mean that people or the environment are exposed to lead, particularly in the case of sensitive groups such as children.

Lead can emit and be dispersed during various phases of the life cycle of products. Emissions in production are principally a working-environment issue, but in some cases also have an impact on the natural environment. The release of lead during the use of products may pose a risk to humans and the environment, as may emissions from end-of-life articles. Dispersal of lead and the risk of harm must be taken into account in prioritising products for proposed measures. In addition, account must be taken of whether there are already rules limiting lead in the product group. On the basis of these criteria the following product groups have been prioritised for further measures:

- ***Fishing tackle* in *angling* and *commercial fishing*** – because of substantial dispersal to the environment. Seabirds are poisoned by ingesting lead fishing weights. Fishing tackle is not separated from other waste and lead therefore ends up in domestic waste. Lost lead fishing tackle corrodes which may lead to exposure of organisms in the aquatic environment. The private casting of lead for fishing tackle also implies health risks.
- ***Consumer products*** – as they can pose a risk of serious health effects. Certain products lead to exposure by inhalation, such as leaded wicks and tin solder. Other articles such as chalks and jewellery could imply a health risk since children might swallow parts of the article.
- ***Aviation spirit*** – as lead in the aviation spirit is dispersed to the environment. Lead in petrol is the most dangerous form of lead from the toxicological point of view.
- ***Batteries –*** due to the large quantities of lead they contain.
- ***Residual products, e.g. iron sand*** – as waste and residual products may contain a large amount of lead, from the quantitative point of view. The exposure scenario is often unclear with regard to both health and the environment.

Swedish Environmental Protection Agency and Swedish Chemicals Agency proposals

Rules on limitation in fishing products

On the basis of the risk scenario that exists for products in *angling and commercial fishing* and for certain *consumer products that contain lead*, these products appear to represent the most pressing need for further regulation. Taking account of the consequences possible regulation may have for the parties concerned and for society in general, the Swedish Chemicals Agency and the Swedish Environmental Protection Agency propose that a ban be introduced on fishing tackle. The limitation should at first hand be introduced at EU level. However, the timetable for limitations under the Limitations Directive (see section 14.1) is, highly uncertain and it is therefore proposed that a national ban be introduced.

A national ban is proposed for all fishing tackle, i.e. tackle for angling and for household requirements as well as commercial fishing tackle. The tackle must not contain lead in an amount exceeding 0.1 per cent by weight. Under this proposal, the sale and use of tackle would be banned, according to the proposal. Some transitional provisions are also proposed, adjusted for the availability of alternatives. Tackle which was in use prior to the ban coming into force may continue to be used.

Rules on limitations in consumer products

The Swedish Chemicals Agency and the Swedish Environmental Protection Agency propose that Sweden should press for a limitation under the Products Safety Directive (2001/95/EC) in the case of certain consumer products since the risk pattern for these products makes them suitable for regulation. Other product groups considered in the report could also be regarded as consumer products, but this proposal only concerns the kind of consumer products known to the Swedish Chemicals Agency to be capable of causing a health risk. In the opinion of the Swedish Chemicals Agency, consumer products to be regulated are jewellery and accessories that have been soldered and cast, chalks, plus candles and alloys containing lead, which are available to consumers for casting.

Authorisation to the Swedish Chemicals Agency concerning lead in consumer products

There may be a need to regulate further consumer products of which we are not currently aware and which are not regulated by other rules on limitations. This need is reinforced by the argument that zinc production controls lead availability on the market and that if the use of lead in batteries decreases new applications may become relevant. An alternative option to a ban at government level may be to authorise the Swedish Chemicals Agency to decide on bans on certain consumer products at the level of agency regulations, if there are serious environmental and health reasons for doing so. Therefore, it is proposed that the Swedish Chemicals Agency be given an authorisation in Section 14 of the Chemical Products (Handling, Import, and Export Prohibitions) Ordinance (1998:944).

A general authorisation could also send a signal to the market that lead must not be present in consumer articles.

Aviation spirit

Sweden has to date had a derogation from EU provisions that fuels for private recreational flying have to be taxed. This derogation came to an end on 31 December 2006 and Sweden will probably need to introduce taxation of *aviation spirit* in the near future. In conjunction with investigation of the formulation of this tax, the Swedish Environmental Protection Agency and the Swedish Chemicals Agency consider this to be an appropriate time to also investigate ways of making it advantageous to use the alternative unleaded aviation spirit through differentiation.

Batteries

With regard to *batteries,* the Swedish Chemicals Agency and the Swedish Environmental Protection Agency consider it important to follow developments both in Sweden and the EU closely. If the interim target of newly manufactured finished products being free of lead is to be attained, there is a need for extensive technical development of lead-free battery alternatives.

Residual products

A discussion is under way in the EU on the interpretation of what is waste, and the Commission has recently published a communication concerning waste and residual products. Iron sand is an example of problems concerned with residual products containing lead. In view of this ongoing discussion it is difficult at present to propose limitations for *iron sand* or other waste and residual products as the options depend on whether these are products (raw materials, substances, preparations) or waste.

REACH covers raw materials, substances and preparations, but not waste. When all titles in REACH comes into force, the requirements for registration and risk assessment will gradually also come to apply to iron sand, provided iron sand has ceased to be waste. If iron sand is still to be regarded as waste, it is the rules under the Framework Directive on Waste and its national implementation in Sweden that are applicable.

In view of the fact that many activities are in progress both nationally and in the EU with regard to increased requirements for risk assessment of both products and waste, the Swedish Chemicals Agency and the Swedish Environmental Protection Agency do not consider there to be reason within the framework of this commission to propose further measures for iron sand or other wastes and residual products.

The example of iron sand makes it clear, however, that the aim of the strict policy in relation to lead in articles (phasing out lead in newly manufactured articles as far as possible and handling existing articles that contain lead in such a way that nothing leaks into the environment) will not be successfully met unless the rules on waste also have the same orientation and level of ambition.

Crystal Directive

With regard to the *Crystal Directive (69/493/EEC),* the Swedish Chemicals Agency and the Swedish Environmental Protection Agency consider it essential to press for this directive to be amended in the EU.

2. SAMMANFATTNING (SWEDISH)

Bly är ett grundämne som är allmänt förekommande i marken i låga halter. Förekomsten av bly, zink och silver följs i stor utsträckning åt i naturen. I huvuddelen av de gruvor världen över där zink utvinns, utvinns också stora mängder bly.

Bly är en icke essentiell metall. Skadligheten hos blyjonen är känd sedan lång tid och tämligen väldokumenterad. Blyjonen är klassificerad som reproduktionstoxisk kategori 1 d.v.s. påverkar fertiliteten och kan skada fostrets utveckling. Blyföreningar, t.ex. blyacetat, är klassificerade som misstänkt cancerframkallande (Cancer, kategori 3) p.g.a. blyjonen.

Ämnen som kan frisätta blyjoner till miljön är också klassificerade som mycket giftiga för vattenlevande organismer och kan orsaka skadliga långtidseffekter i vattenmiljön d.v.s. de är miljöfarliga.

Riksdagen har antagit mål för miljökvaliteten inom 16 områden, varav ett är *Giftfri miljö.* Detta innebär bl.a. att ”halterna av ämnen som förekommer naturligt i miljön är nära bakgrundsnivåerna”. Enligt målformuleringen för delmålet 3 till Giftfri miljö ska nyproducerade varor så långt det är möjligt vara fria från bl.a. bly år 2010.

Uppdraget

Regeringen gav i juni 2005 Kemikalieinspektionen och Naturvårdsverket det gemensamma uppdraget att utreda konsekvenserna av det förbud mot bly i ammunition som träder i kraft 2008 samt göra en översyn av blyanvändningen i varor och produkter. Den första delen av uppdraget, om konsekvenserna av förbuden mot bly i ammunition, redovisades till regeringen den 10 november 2006 [1].

I den andra delen av uppdraget ska Kemikalieinspektionen och Naturvårdsverket göra en översyn av användningen av bly i varor och produkter som helhet och lämna förslag till de regleringar som är mest angelägna för att uppnå miljökvalitetsmålet Giftfri miljö. Myndigheterna ska även beakta kostnadseffektiviteten i de regleringar som föreslås. Del två av uppdraget redovisas således i och med denna rapport.

Miljörisker

Bly i bensin har tidigare varit den viktigaste spridningskällan av bly till miljön och lett till de effekter på mikroorganismer som misstänks förekomma i skogsmark i delar av Sverige. I takt med att användningen av blyad bensin fortsätter att minska även i Europa och övriga världen kommer nedfallet av bly att minska ytterligare och halterna i skogsmark förväntas därmed sjunka. Även den generella belastningen i urbana områden minskar avsevärt med den minskande användningen av blyad bensin.

Blyinnehållande varor som hamnar i avfallet kan vid förbränning bidra till det atmosfäriska nedfallet av bly, eller riskerar att spridas på annat sätt till miljön.

Användning av blyinnehållende varor, såsom hagel och fiskesänken, kan i vissa områden ge en generell spridning av metalliskt bly, liknande den från atmosfäriskt nedfall. Det har inte

[1] Naturvårdsverket och Kemikalieinspektionen (2006). *Konsekvenser av förbud mot bly i ammunition – ett regeringsuppdrag rapporterat av Naturvårdsverket och Kemikalieinspektionen,* NV rapport 5627

gått att kvantifiera vilka effekter detta medför på vatten- och markorganismer. Miljöbelastningen av bly från användningen av andra typer av varor kommer att ske mer koncentrerat, och risker kan eventuellt uppstå lokalt i mark och vatten.

Den största miljörisken som identifierats för användning av varor är den direkta förgiftningen av fåglar och andra djur som kan få i sig blyföremål (hagel, fiskesänken) direkt eller via näringskedjan.

Hälsorisker

Åtgärder för att minska spridningen av bly i Sverige har varit framgångsrika. De har, under de senaste 20 åren, resulterat i minskade blodblyhalter. Hos svenska män är för närvarande medelvärdet för bly i blod cirka 0.2 µmol/l. Medelvärdet är lägre hos kvinnor, ungdomar och barn. Den genomsnittliga halten bly i blod hos barn i områden utan verksamheter med större utsläpp är cirka 0.1 µmol/l.

Någon säker lägsta nivå är emellertid svår att fastställa för blyexponering eftersom bly kan skada nervsystemet redan vid låg exponering. Särskilt när hjärnan utvecklas hos foster och små barn är känsligheten stor. I studier på barn har man vid blodblyhalter kring 0.5 µmol/l observerat fördröjd utveckling, lägre IQ och beteendestörningar. Hämmad blodbildning och nedsatt hörsel är andra effekter som observerats vid relativt låg blyexponering. De neuropsykologiska effekterna på barn är allvarliga och därför bör blyhalten i blod hos barn och kvinnor i fertil ålder ligga under 0.5 µmol bly/liter blod. Det finns dock indikationer på att dessa effekter saknar tröskel, vilket leder till att man inte kan fastställa en ”säker” blyhalt i blod hos barn och foster.

Idag exponeras den allmänna befolkningen för bly framför allt via födan men baserat på beräkningar av veckointaget av bly via mat så förefaller denna exponering generellt sett vara låg i Sverige.

Vissa riskgrupper, som via konsumentprodukter kan exponeras för skadliga mängder bly, har emellertid identifierats. Exempel på sådana riskgrupper är sportfiskare som själva stöper sina fiskesänken, personer som använder lödtenn, de som gjuter tennsoldater och blykulor till svartkrutsskytte. Dessa aktiviteter kan leda till hög ”okontrollerad” exponering av blyånga. Blyånga bildas då bly smälter vid höga temperaturer. Denna ”ånga” innehåller små inandningbara blypartiklar och upptaget i lungan antas vara 100 procent. Ytterligare exempel är personer som vistas i lokaler där doftljus/geléljus, med blyinnehållande veke, är tända. Då ljusen tänds frigörs blyånga, vilket kan ge upphov till höga halter bly i luften.

Regler om bly i varor

Bly återfinns i ett mycket stort antal användningsområden och regleringar av bly återfinns därför i en rad olika EG-direktiv. I rapporten beskrivs översiktligt de regleringar inom EU som uttryckligen reglerar bly, antingen som ämne eller i varor. Vissa produkter som har stor betydelse för att begränsa blyanvändningen har reglerats, t.ex., bensin, bilar och batterier. Ett annat exempel på reglering av blyinnehåll i varor är ett nytt direktiv om begränsning av bly i elektriska och elektroniska produkter. Nya produktdirektiv som reglerar bly kommer också sannolikt att tillkomma. Även den nya kemikalielagstiftningen REACH kan innebära att ytterligare begränsningar av bly tillkommer.

Användningen av bly i varor

I flertalet av de varugrupper som redovisas i rapporten har användningen av bly minskat under det senaste decenniet. Det är främst i *färgpigment, plast, kristall, blymantlad kabel, elektronik och hagelammunition* som mängderna bly har minskat. Drivkrafterna för denna positiva utveckling har varit skärpt lagstiftning för vissa användningar av bly i produkter men även kundkrav och andra frivilliga initiativ inom industrin.

Produktområden där användningen av bly inte har minskat är *batterier, båtkölar, fiskeredskap, legeringar, vikter och strålskydd*. När det gäller *balansvikter* förväntas dock en snar minskning av mängden bly eftersom det tidigare undantaget från begränsningen av bly i uttjänta bilar har upphört (ELV-direktivet, 2000/53/EG, se bilaga 3).

Prioriterade varugrupper

Riskerna med bly varierar mellan olika produktgrupper. Det beror främst på i vilken form blyet förekommer, vilka volymer bly som används i produktgruppen, produkternas spridning i samhället samt hur produkterna tas om hand efter att de tjänat ut. Dessutom har det betydelse för riskerna om produktanvändningen kan medföra att människor eller miljön exponeras för bly, särskilt om det är känsliga grupper t.ex. barn.

Bly kan emittera och spridas under olika faser av produkternas livscykel. Emissioner vid produktion är främst en arbetsmiljöfråga men också i vissa fall en fråga om påverkan på den yttre miljön via utsläpp. Frisläppande av bly under användning av produkter kan medföra risk för människor och miljö, liksom emissioner från uttjänta varor. Spridning av bly och risken för skada måste vägas in vid prioriteringen av produkter för åtgärdsförslag. Dessutom bör det beaktas om det redan finns regler som begränsar bly i produktgruppen. På basis av dessa kriterier har följande produktgrupper prioriterats för ytterligare åtgärder:

- ***Fiskeredskap*** - stor spridning till miljön. Sjöfåglar förgiftas då de fått i sig fiskesänken av bly. Fiskeredskap skiljs inte från annat avfall och bly hamnar därför i hushållsavfall. Tappade fiskeredskap av bly korroderar vilket kan leda till att organismer i vattenmiljön exponeras. Privat gjutning av bly till fiskeredskap förekommer också vilket innebär hälsorisker.
- **K*onsumentprodukter*** – kan medföra risk för allvarliga hälsoeffekter. Vissa produkter leder till exponering via inandningen så som t.ex. bly i ljusvekar och i lödtenn. Andra produkter så som kritor och smycken kan utgöra en hälsorisk då barn kan svälja delar av produkten.
- ***Flygbensin*** - bly i flygbensinen sprids till miljön. Bly som förekommer i bensin är den mest hälsofarliga varianten av blyföreningar.
- ***Batterier*** **-** innehåller stora mängder bly.
- ***Restprodukter t.ex. järnsand*** - avfall och restprodukter kan innehålla mycket bly, kvantitativt sett, exponeringsscenariot är ofta oklart både vad gäller hälsa och miljö.

Naturvårdverkets och Kemikalieinspektionens förslag

<u>Begränsningsregler för fiskeredskap</u>

Baserat på den riskbild som finns för produkter inom *fritidsfisket och yrkesfisket som innehåller bly* framstår dessa produktgrupper som angelägna för ytterligare regleringar.

Inberäknat de konsekvenser som en eventuell reglering kan få på aktörerna och samhället i övrigt föreslår Kemikalieinspektionen och Naturvårdsverket att ett förbud ska införas för fiskeredskap. Begränsningar bör i första hand införas på EU-nivå. Det är dock en stor osäkerhet om tidplanen för ämnesbegränsningar inom begränsningsdirektivet (se kap 14.1) och därför föreslås att ett nationellt förbud införs.

Ett nationellt förbud föreslås gälla för samtliga fiskeredskap, d.v.s. fritidsfiskeredskap för sportfiske och husbehovsfiske samt redskap för yrkesfiske. Redskapen får inte innehålla bly i en koncentration över 0,1 viktprocent. Enligt förslaget förbjuds försäljning av redskapen och användning. Även vissa övergångsregler anpassade efter tillgången till alternativ föreslås. Redskap som är i bruk före ikraftträdandet får fortsätta att användas.

Begränsningsregler för övriga konsumentprodukter

Kemikalieinspektionen och Naturvårdsverket föreslår att Sverige verkar för ett förbud inom produktsäkerhetsdirektivet 2001/95/EG för vissa konsumentprodukter då riskbilden för dessa produkter gör dem angelägna att reglera. Även andra produktgrupper som behandlas i rapporten kan räknas som konsumentprodukter, men detta förslag gäller övriga konsumentprodukter som Kemikalieinspektionen har kännedom om där användningen kan medföra hälsorisk. De konsumentvaror som enligt Kemikalieinspektionens mening bör regleras är lödda och gjutna smycken och accessoarer, kritor, ljus samt legeringar som innehåller bly och som tillhandahålls konsumenter för gjutning av t.ex. tennsoldater.

Bemyndigande till Kemikalieinspektionen avseende bly i konsumentprodukter

Det kan finnas behov av reglering av ytterligare konsumentprodukter som myndigheterna i dagsläget inte känner till och som inte regleras av andra begränsningsregler. Behovet förstärks av att zinkproduktionen styr tillgången till bly på marknaden och om blyanvändningen i batterier minskar kan nya applikationer för bly bli aktuella. En alternativ möjlighet till förbud på förordningsnivå kan vara att Kemikalieinspektionen ges ett bemyndigande att besluta om förbud för vissa konsumentprodukter på föreskriftsnivå om det finns allvarliga miljö- och hälsoskäl för detta. Därför föreslås ett bemyndigande till Kemikalieinspektionen att införas i 14 § i förordning (1998:944) om förbud mm i vissa fall i samband med hantering, införsel och utförsel av kemiska produkter.

Ett sådant mer generellt bemyndigande ger också signaler till marknaden att bly inte ska förekomma i konsumentvaror.

Flygbensin

Sverige har hittills haft ett undantag från EU-bestämmelser om att drivmedel för privat nöjesflygning ska beskattas. Detta undantag löpte ut 31 december 2006 och Sverige kommer sannolikt att inom kort behöva införa beskattning av *flygbensin*. I samband med att utformningen av denna skatt utreds bedömer Naturvårdsverket och Kemikalieinspektionen det som rätt tillfälle att även utreda möjligheterna att genom differentiering göra det fördelaktigt att använda den alternativa blyfria flygbensinen.

Batterier

Vad gäller *batterier* anser Kemikalieinspektionen och Naturvårdsverket att det är viktigt att noga följa utvecklingen både i Sverige och inom EU. Ska delmålet nås om att nyproducerade varor ska vara fria från bly krävs en omfattande teknikutveckling av blyfria batterialternativ.

Restprodukter

Det pågår en diskussion inom EU om tolkningen av vad som är avfall och Kommissionen har nyligen publicerat en kommunikation angående avfall och restprodukter. Järnsand utgör ett

exempel på problematiken med restprodukter som innehåller bly. Mot bakgrund av denna pågående diskussion är det i dagsläget svårt att föreslå begränsningsåtgärder för *järnsand* eller andra avfall och restprodukter eftersom möjligheterna är avhängiga av om dessa är produkter (råvaror, ämnen, preparat) eller avfall.

REACH omfattar råvaror, ämnen och preparat men inte avfall. När REACH träder i kraft kommer så småningom kraven på registrering och riskbedömning gälla även för järnsand, såvida järnsand upphört att vara avfall. Är järnsand fortfarande att betrakta som avfall så är det istället reglerna under ramdirektivet om avfall och dess nationella genomförande i Sverige som är tillämpliga.

Med tanke på att det pågår många aktiviteter både nationellt och inom EU, vad gäller ökade krav på riskvärdering av såväl produkter som avfall, anser Kemikalieinspektionen och Naturvårdsverket att det inom ramen för detta uppdrag inte finns skäl att föreslå ytterligare åtgärder för järnsand eller andra avfall och restprodukter.

Exemplet med järnsand åskådliggör dock att målet med den strikta politiken visavi bly i varor (att fasa ut bly i nyproducerade varor så långt det är möjligt och att hantera befintliga varor som innehåller bly på ett sådant sätt att inget läcker till miljön) inte kan uppnås om inte reglerna om avfall får samma inriktning och ambitionsnivå.

Kristalldirektivet

Vad gäller *kristalldirektivet* (69/493/EEG) anser Kemikalieinspektionen och Naturvårdsverket att det är angeläget att verka inom EU för att förändra detta direktiv.

3. THE ASSIGNMENT

The Swedish Government decided on 30 June 2005 to commission the Swedish Environmental Protection Agency and the Swedish Chemicals Agency in cooperation to investigate the consequences of the forthcoming prohibitions of ammunition containing lead in hunting and target shooting. The reporting was also to cover:

- what quantities of lead are used in other articles and products and where the lead ends up when these articles and products have reached the end of their life,
- which of these uses are regulated in European Community legislation,
- how great the supply via air deposition is in relation to the dispersal of lead from ammunition and other articles and products.

The assignment given to the government agencies included proposing, on this basis, what regulations are most urgently needed to attain the environmental quality objective of A Non-Toxic Environment with respect to lead in articles and products and making proposals on ways in which prohibitions relating to ammunition already decided on should be managed. The government agencies were also to consider the cost-effectiveness of the regulations proposed.

The assignment was to be carried out following consultation with affected central authorities, the business community and other affected organisations and players.

Insofar as they are applicable, the provisions of the Ordinance (1998:1829) on a Special Impact Assessment of the Effects of Rules on Conditions for Small Enterprises are to be respected.

A part report on the assignment relating to lead in ammunition was presented to the Swedish Government on 10 November 2006 [2]. A final report on the assignment is due to be presented by 20 April 2007.

3.1 Limitations

This report presents an account of the part of the investigation relating to the use of lead in articles other than ammunition. Lead in ammunition is not dealt with in this report as the Swedish Environmental Protection Agency and the Swedish Chemicals Agency, as a partial account of this government assignment, has recently reported on the consequences of the forthcoming prohibitions of ammunition containing lead in hunting and target shooting (Swedish EPA report 5627).

The assignment to investigate the need for restrictions on lead in articles and products is oriented towards proposing what regulations are most urgently required to attain the environmental quality objective of A Non-Toxic Environment. The assignment does not include proposing other market-driven instruments. The investigation has nevertheless touched on other instruments in certain cases where this has been judged relevant.

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[2] Swedish Environmental Protection Agency and the Swedish Chemicals Agency (2006). *Konsekvenser av förbud mot bly i ammunition – ett regeringsuppdrag rapporterat av Naturvårdsverket och Kemikalieinspektionen*, NV report 5627 (Consequences of the Swedish ban on lead in ammunition - a government assignment reported by the Swedish Chemicals Agency and the Swedish Environmental Protection Agency) In Swedish with an English summary.

The investigation describes rules relating to the restriction of lead in certain product groups. However, assessing the effectiveness of existing rules has been beyond the scope of the investigation.

The assignment has included discussing what quantities of lead are used in articles and products and where the lead ends up when these articles and products have reached the end of their life. It has been found particularly to be difficult while carrying out the assignment to provide a good account of where lead ends up when the articles have reached the end of their life. The investigation has therefore focused the quantitative estimates for lead on articles and products, while the basis of priority-setting and risk assessments with regard to end-of-life articles have been more qualitative in nature. The by-product iron sand, which is described in the investigation, should be viewed as an example of an important and remaining flow of lead in society. There are more such examples which it is not been possible to present in this investigation, such as bottom ash from smeltworks, fly ash from biofuel-fired power stations and end-of-life lead cables which are often left in the ground.

3.2 Method

The Swedish Chemicals Agency and the Swedish Environmental Protection Agency have conducted the investigation in collaboration. Bo Berbäck of the University of Kalmar has acted as external consultant for the study.

Background reports are available on the Swedish Environmental Protection Agency website (www.naturvardsverket.se) and can be downloaded free of charge in electronic form.

There has been contact with affected central authorities. The Swedish Chemicals Agency and the Swedish Environmental Protection Agency have consulted the National Board of Fisheries, the Swedish Consumer Agency, the Swedish Business Development Agency (Nutek) and the Swedish Geological Survey (SGU) in particular. A reference group consisting of representatives of other organisations has been given an opportunity to follow the work on the assignment, and around 15 actors have chosen to actively avail of this opportunity. The reference group has been shown the background material produced under the investigation and has been given an opportunity to submit its views verbally and in writing. In an Internet consultation exercise, the Swedish Chemicals Agency has invited parties concerned to describe what alternatives there are to leaded ammunition and lead in other products.

The preliminary investigative proposals in this report were sent in a rapid referral exercise (11 days) to the reference group, which was given an opportunity to submit views on the report and proposals verbally and in writing. The views of the reference group have subsequently been taken into account in the investigation as far as possible.

4. ENVIRONMENTAL AND HEALTH ASSESSMENT

4.1 Lead – hazardousness and classification

Lead is a non-essential metal. The harmfulness of the lead ion has long been known and is fairly well documented. The lead ion is classified as toxic for reproduction, category 1, that is to say it affects fertility and can be harmful to foetal development. Lead compounds, for example lead acetate, are classified as suspected carcinogens (cancer, category 3) because of the lead ion.

Chemical substances that can release lead ions to the environment are also classified as very toxic to aquatic organisms and can cause harmful long-term effects in the aquatic environment, that is to say they pose an environmental hazard.

Even at a low level of exposure, lead can harm the nervous system. Sensitivity is particularly high when the brain is developing in foetuses and small children (see also section 4.3 on the assessment of health risk).

4.2 Effects of lead in the environment

4.2.1 Dispersal to the environment

Lead has a pollution history of more than three thousand years in Europe. Metal production and the combustion of coal and leaded petrol have resulted in large emissions to the atmosphere. As a result of fallout from the air, soil and sediment in Sweden have accumulated lead originating within the country but also transported over long distances. Of the total quantity of lead that has been dispersed through human activity and accumulated in the environment, approximately half originates from before 1800. The fallout of lead peaked in the 1960s. According to analyses of terrestrial mosses, lead fallout in the southern parts of the country today have fallen to a fraction of 1970s levels. Production emissions in Sweden during the 20th century were relatively limited geographically, with an environmental impact around metalworks (Rönnskär) and the iron and steel industry (Bergslagen). The glass-producing area in Småland and areas around the rubber industry in Helsingborg, Trelleborg and Malmö, as well as Värnamo/Gislaved, also have lead pollution. In the 20th century, consumption of articles and products containing lead also accounted for significant sources of diffuse lead emission in Sweden. Such consumption-based emissions have been accumulated in particular in urban areas[3].

An even pattern of dispersal of anthropogenically supplied lead takes place with precipitation and dry fallout (deposition). Present-day (2004) deposition of lead in Sweden is of the order of 200-300 tonnes of lead per year. The use of ammunition for hunting and fish sinkers also results in wide dispersal across the country. Other articles are concentrated more in the metropolitan regions. The total quantity of lead dispersed to the environment in the city of Stockholm through human activity has been estimated at 6 tonnes per year, with fishing sinkers and ammunition accounting for the largest sources[4]. Altogether around 110 tonnes of lead are dispersed in hunting and 200 tonnes in angling in Swedish soils and rivers and streams. As in the case of many other articles, this dispersal takes place in the form of metallic lead, in contrast to deposition, where the lead occurs in various compounds. It is

[3] Bergbäck. Bo (2006). Faktisk miljöpåverkan av bly i varor samt luftdeposition av bly och annan spridning av bly, NV report 5624

[4] The City of Stockholm's Environment and Health Administration
http://www.miljobarometern.stockholm.se/main.asp?mp=MG&mo=3

therefore not possible to compare these quantities of dispersal directly with respect to environmental effects. It is only when metallic lead is converted to what are known as bioavailable and toxic forms that it has a detrimental impact on health and the environment. This conversion takes place for example through the acids present in the stomach in various species or through corrosion in soil and rivers and streams.

Corrosion

The rate of corrosion varies greatly depending on the ambient conditions to which the metallic lead is exposed. Humidity and acidity, for example, are of decisive significance to the rate of corrosion. The Corrosion and Metals Research Institute (KIMAB) in Sweden has studied the corrosion of lead plates that have lain in soil of various kinds in field trials over a long period of time. The rate of corrosion is consistently low (a few µm per year) and the rate decreases with time. In sandy moraine soils, the rate of corrosion is 0.2-0.4 µm/year, while it is 1.7 µm/year (after 7 days) in peat soils[5]. The results of this study can be used to estimate the rate of corrosion for different products. The rate of corrosion is usually expressed in µm corroded lead per year or g/cm^2 and year, but may also be expressed as a corrosion factor stated as a percentage. For a 3 mm plate (with a corrosion layer on both sides), the corrosion factor is approximately 1‰ per year in peat soil. If these results are instead converted to spherical 2.5 mm lead shot, the maximum annual corrosion factor is around 1.0 per cent after one year and 0.4 per cent after seven years. As the very "worst" type of soil (from the point of view of corrosion) has probably not been tested, and the diameter of the shot may be larger or smaller (after many years of corrosion) than 2.5 mm, it may be assumed that 1 per cent annual corrosion during the life of lead shot can be regarded as a realistic worst-case scenario. This corrosion factor has therefore been used in calculations in the background report to this report[5].

A corrosion rate of 1 per cent has also been used as a realistic worst-case scenario in the preliminary risk assessment on lead by the lead industry[6], which is currently under discussion in the EU. An annual weight loss of around 1 per cent has also been estimated for "lost" fishing sinkers of lead (which are not buried in the sediment). As the losses of lead take place at the surface of the products, the corrosion factor depends on the surface area/volume ratio. For products with a smaller surface area/volume ratio, such as the extreme case of boat keels, the corrosion factor is significantly lower with the same bases of calculation as in the cases above.

What is important, however, is not the relative corrosion rate but the quantity of bioavailable lead that may be supplied to the environment from the accumulation of the total quantity of lead-containing articles.

Forms in which lead occurs

When metallic lead has corroded, it may be released and converted to various forms with varying bioavailability and toxicity. The free lead ion and certain organic forms of lead (for example tri- and tetraalkyl lead which are emitted/formed in the use of leaded petrol) are more toxic than other inorganic forms.

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[5] Bergbäck, Bo (2006). Faktisk miljöpåverkan av bly i varor samt luftdeposition av bly och annan spridning av bly, NV report 5624

[6] Lead Development Association International (2006). Draft Voluntary Risk Assessment on lead metal, lead oxide lead tetroxide and lead stabiliser compounds.

Lead in the atmosphere occurs principally in the form of small airborne particles. In soil, lead is strongly bound to the organic matter and mobility is therefore relatively low, but increases in acidic conditions.

In water lead may occur as lead ion (with high bioavailability and mobility) in acidic waters or as lead carbonate in more alkaline waters, as a complex with loose organic matter (relatively strong binding that limits bioavailability), adsorbed to particles such as iron/manganese hydroxides, and in particles of clay and organic matter (very limited mobility and availability). In seawater chloride complexes are also formed[7].

4.2.2 Effects in soil

Lead accumulates very effectively in the top layer of forest soil (the humus layer), and it has been found that almost all the lead in this layer is of anthropogenic origin. In the summary of the Swedish Environmental Protection Agency's extensive research programme "Metals in town and country"[8] it was found that the then (around 2000) regional levels of lead in the humus layer of soil in southern Sweden might signify adverse effects in the soil. There are indications that the microbiological processes, which are important for nutrient metabolism in the soil, were disrupted as a consequence of the elevated lead concentrations.

Negative effects on soil respiration in southern Sweden have been observed in a field study at concentrations of ≥ 74 mg Pb/kg dry weight. This value is in good agreement with the limit value for effects on soil organisms presented in the lead industry's preliminary risk assessment on lead[9]. As the results of the risk assessment are based on laboratory studies in which all the lead has been recently added, often in the form of a salt, the lead industry wishes to apply an ageing factor so that this value gives a better representation of realistic conditions. This factor has not yet been established, but will probably mean that the value for the minimum effect level is raised. However, this is contradicted by the Swedish field study, which instead points to greater sensitivity in field tests compared with laboratory experiments[10].

Critical load limits for lead in Europe (in 2000) have been calculated in the work on CLRTAP (Convention on Long-Range Transboundary Air Pollution)[11]. The critical load for the occurrence of ecotoxicological effects in the soil was calculated for most of Sweden to be between 5 and 20 grams per hectare and year (based on median values). In 2000 the estimated critical load was exceeded in a large part of Sweden. However, 2000 was an extreme year from the meteorological point of view, leading to particularly high deposition. Deposition is expected to decrease over the next decade as a result of a continued reduction in global use of leaded petrol. It an anticipated that lead concentrations in forest soil will consequently also decrease.

To summarise, further increases in lead concentrations in soil should be prevented as large-scale effects are already to be feared in forest soil in parts of southern Sweden.

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[7] United Nations Environment Programme (2006). Interim review of scientific information on lead
[8] Water, Air and Soil Pollution (2001). FOCUS/Volume 1 Nos. 3-4.
[9] Lead Development Association International (2006). Draft Voluntary Risk Assessment on lead metal, lead oxide lead tetroxide and lead stabiliser compounds.
[10] Bringmark, Lage. The Swedish University of Agricultural Sciences, Uppsala, Personal Communication 2007-02
[11] Slootweg et al. (2005). Working Group on Effects of the Convention on Long-Range Transboundary Air Pollution – Critical Loads of Cadmium, Lead and Mercury in Europe. Report 259101015/2005.

4.2.3 Effects in water

Based on the lead industry's preliminary risk assessment[12] a preliminary water quality standard for lead of 7.2 µL has been arrived at in the work on the Water Directive. This value may, however, be amended depending on the final outcome of the industry's risk assessment report.

No reliable data have emerged in which elevated levels of lead in water can be directly linked to emissions from articles. The mean concentration (for the period 2000 to 2005) of total lead in surface water from the estuaries of the major Swedish rivers varies between 0.1 (Indalsälven) and 1 µg/l (Nyköpingsån). In smaller "national reference watercourses", mean concentrations range from 0.03 (Abiskojokk) to 5.5 µg/l (Dalbergsån)[13]. Concentrations of up to 14 µg/l have been measured in individual samplings.

Products of metallic lead that end up in open and deep lakes and coastal areas generally pose a smaller environmental risk than objects that end up in shallower waters. The bottom sediment here is usually loose, and the lead objects sink down a little below the sediment surface. As time goes by, the objects are overlain by more sediment and they are steadily moved further away from the biological system.

In areas close to the shoreline and shallow lakes, rivers and streams, there is a risk of birds being directly exposed to lead objects such as shot and sinkers, by pecking them (see below). There is also a greater risk here of lead objects being more exposed to water movements and the lead that corrodes therefore more readily reaching biological systems.

4.2.4 Effects on marine animals and birds

Declining lead levels have been observed particularly in marine animals over recent decades. The lead content in guillemot eggs has fallen by 13 per cent a year since 1996. In Baltic herring, cod and perch there is also a clear trend towards declining lead levels over the same period. Decreasing lead levels have also been noted in reindeer and pike from northern Sweden, according to the Swedish Museum of Natural History.

With regard to the impact of lead of ammunition, poisoning in wild birds in North America has been known for more than a century. There is great variation in sensitivity to lead, and different species absorb different quantities of lead from the gut. Ducks, geese and swans are far more sensitive than poultry and eagles are far more sensitive than hawks and owls. Before restrictions on lead ammunition were introduced, several per cent of the ducks, geese and swans in the United States annually died from lead poisoning. Swedish calculations have shown that the situation was similar in Sweden. It has also been shown in the United States that eagles selected lead-poisoned ducks as food, which resulted in lead poisoning of eagles. Studies have shown that the situation may still be similar in Sweden. Of the 22 Swedish eagle corpses analysed in 2005, three had died of lead poisoning, according to statistics from the National Veterinary Institute. However, it is not apparent from the study how the eagles ingested the lead, although it may be assumed that they did so by eating sea birds poisoned with lead. Sea birds make up an important part of the diet of white-tailed eagles. Lead poisoning is also reported for several types of birds such as doves, waders, poultry and woodpeckers. According to a recently published article[14], on lead poisoning caused by

[12] Lead Development Association International (2006). Draft Voluntary Risk Assessment on lead metal, lead oxide lead tetroxide and lead stabiliser compounds.
[13] From the database on water chemistry in lakes and rivers, The Swedish University of Agricultural Sciences: http://info1.ma.slu.se/ma/www_ma.acgi$Project?ID=Intro
[14] Fisher. I. J. - Pain, D.J. - Thomas, V.G. (2006). A review of lead poisoning from ammunition sources in terrestrial birds. Biological Conservation, 131, 421-432.

ammunition in terrestrial birds, many types of birds such as doves, cranes, pheasants and partridge ingest lead shot by pecking and are poisoned.

The most common reported cause of lead poisoning is that the birds ingest lead shot through their diet. With regard to ducks, geese and swans, it is not fully known whether the birds eat the shot in the belief that it is grit or mistake it for food. In the glandular stomach (proventriculus) and the gizzard (ventriculus) the shot is ground down and together with the hydrochloric acid forms a salt that is absorbed in the small intestine. Experiments on Canada geese have shown that the shot was totally ground down after 45 days.

In addition to exposure through shot, it is reported that other sources of lead can cause poisoning. Fishing sinkers are a common cause of lead poisoning in trumpeter swans in the United Kingdom. According to statistics from the National Veterinary Institute, three out of ten trumpeter swans analysed had died of lead poisoning in Sweden in 2005.

Most of the lead absorbed is stored in bone tissue, liver and kidney. The biological half-life for lead in humans is more than 20 years. This half-life is also very long in birds, and analyses of bone tissue have therefore been used as a measure of chronic lead poisoning.

Lead is a metal which is relatively stable in its surroundings and dissolves only slowly. Lead in solid form in soil and water therefore in general poses a small risk of poisoning to higher animals, provided the lead is not consumed as described above. Lead likewise is not absorbed in significant quantities in vegetation, and lead levels in wild herbivores are generally low.

4.2.5 Conclusions on environmental risks of lead

Lead in petrol in the past was the most significant source for the dispersal of lead to the environment and gave rise to the effects on microorganisms that are suspected of occurring in forest soil in parts of Sweden. As the use of leaded petrol continues to decrease in Europe and the rest of the world, fallout of lead will decline further and levels in forest soil can be expected to fall. The general level of exposure to lead in urban areas is also falling sharply with the decreasing use of leaded petrol.

Articles containing lead that end up in waste may contribute to atmospheric fallout of lead in incineration.

The use of articles containing lead, such as shot and fishing sinkers, may lead to general dispersal of metallic lead in certain areas. It has not been possible to quantify what effects this has on aquatic and soil organisms. The environmental impact of lead from the use of other types of articles will be more concentrated, and risks may possibly arise locally in soil and water.

The greatest environmental risk identified in the use of articles is the poisoning of birds and other animals that can ingest lead objects (shot, fishing sinkers) directly or through the food chain.

4.3 Assessment of health risk

Measures to reduce the dispersal of lead in Sweden have been successful. They have resulted in reduced blood levels of lead over the last 20 years. The mean value of lead in the blood of Swedish men at present is approximately 0.2 µmol/l. The mean value is lower in women, adolescents and children. The average level of lead in the blood of children in areas without activities that result in major emissions is approximately 0.1 µmol/l.

The lowest lead level in blood that has shown effects on health in the general population is 0.3 µmol/l. At this level and just above it effects are observed on the metabolism, kidneys and cardiovascular system. These effects are based on data from a large number of epidemiological studies. They are mild effects and do not constitute a serious risk to the health of the individual.

Lead may also already damage the nervous system at low exposure. Sensitivity is particularly great during brain development in foetuses and small children. In studies on children, delayed development, lower IQ and behavioural disorders have been observed at blood lead levels of around 0.5 µmol/l. Suppressed erythropoiesis (blood formation) and hearing impairment are other effects observed at relatively low lead exposure. The neuropsychological effects on children are severe, and lead levels in the blood of children and women of childbearing age should therefore be lower than 0.5 µmol lead per litre of blood. However, there are indications that these effects do not have a threshold, which means that it is not possible to establish a "safe" level of lead in the blood of children and foetuses. Severe adverse health effects on a large number of organs begin to appear in adults at a lead level in blood of around 1.5 µmol/l. The lead ion (lead acetate), for example, is classified as a suspected carcinogen (cancer, category 3).

Today the general population in principally exposed to lead through the diet. The provisional tolerable weekly intake (PTWI) for lead, according to the WHO, is 25 µg/kg body weight and includes all types of exposure, and is intended to cover the whole population. The value is based on that fact that at an intake of 3-4 µg lead/kg body weight and day the concentration of lead in the blood will not be raised (WHO, 2005). In a comparison between weekly intake of lead through food and drink for an adult Swede (0.8 µg/kg body weight and week) and a Swedish child (3.7 µg/kg body weight and week) and PTWI (25 µg/kg body weight and week), exposure from lead through food and drink appears to be reassuringly low. Lead was formerly used for the soldering of cans and the sealing of wine bottles. This no longer occurs, resulting in reduced exposure to lead through the diet.

On the other hand, certain other identified activities posing a risk of lead exposure may lead to the PTWI for lead being exceeded.

Identified groups at risk are:

1. Those who work with lead professionally. These individuals are monitored in accordance with rules laid down by the Swedish Work Environment Authority with medical checks and air measurements at the workplace.
2. Shooters who often practise their shooting with lead ammunition indoors in halls with inadequate ventilation and maintenance. Elevated blood lead levels are reported for this group.
3. Women of childbearing age and children in families in which large quantities of meat from game shot using lead shot are consumed. Studies have shown that a certain quantity of lead, in small invisible fragments, remains in the animal's body and the person who eats the meat is exposed to lead. This is confirmed by the results of studies on Greenlandic men in whom elevated levels of lead in the blood are observed in the part of the population that consumes large quantities of sea birds shot using lead ammunition.
4. Persons who spend time in rooms where scented candles or gel candles, with wicks containing lead, are lit. When these candles are lit lead vapour is released, which may result in high concentrations of lead in the air.

5. Anglers who make their own fishing sinkers, people who use solder and those who cast tin soldiers and cast lead bullets for black powder shooting. These activities can lead to high "uncontrolled" exposure to lead vapour. Lead vapour is formed when lead melts at high temperatures. This "vapour" contains small inhalable lead particles, and uptake in the lung is assumed to be 100 per cent.
6. Children who swallow or suck on objects that contain lead. Pastel crayons and jewellery, made for children, have been found to contain very high levels of lead. Jewellery for adults may also contain high concentrations of lead.
7. Persons who are exposed to lead in incorrect use of products that are on the market. An example of this that has attracted attention is ceramics. Several reported cases of lead poisoning have occurred in Sweden in the last few years as a result of the use of ceramics. These are ceramics that have been purchased abroad and used to keep foods. These ceramics have not fulfilled the standard required under the regulations.
8. Persons treated with ayurvedic preparations. Ayurveda is the name of an Indian philosophy of health that goes back several thousand years and has also started to spread across the western world in recent years. The concept includes a number of herb and spice-based health products that are drunk or swallowed to ensure better health. It has been found that products of this type may contain high concentrations of toxic heavy metals such as lead, mercury and arsenic.

In all these identified possible forms of lead exposure the risk of harmful effects increases if the person exposed is a child or a woman of childbearing age and if the person performs activities where there is a risk of lead exposure. The margin between the blood lead levels measured in women of childbearing age and children without any known lead exposure and the levels at which measurable effects at group level may start to appear is relatively small (a factor of 2-5). Caution should therefore be exercised in the identified activities that lead to exposure to lead.

5. A NON-TOXIC ENVIRONMENT – PHASING-OUT OF LEAD

The Swedish Parliament has adopted environmental quality objectives in 16 areas. One of these objectives is "A Non-Toxic Environment". The objectives describe the state of Sweden's environment and natural and cultural resources that is sustainable in the long term. The Swedish Government has set up an Environmental Objectives Council which is responsible for following up the environmental quality objectives[15].

The environmental quality objectives are intended to:

- promote human health
- safeguard biological diversity and the natural environment
- utilise the cultural environment and the cultural heritage
- preserve the long-term production capability of ecosystems
- ensure good management of natural resources

Generational objective

The aim is to have solved the great environmental problems by the next generation. This means that all important measures relating to the environmental quality objectives must be implemented by 2020 (2050 in the case of the climate objective). However, nature needs time to recover, and in some cases we will not have time to attain the desirable environmental quality, even if great efforts are made.

The wording of the environmental objective of A Non-Toxic Environment is that "the environment must be free from man-made or extracted compounds and metals that represent a threat to human health or biological diversity." This means, among other things, that "the concentrations of substances that naturally occur in the environment are close to the background concentrations, the levels of foreign substances in the environment are close to zero and their impact on the ecosystems is negligible". A Non-Toxic Environment also means that "overall exposure in the working environment, the natural environment and the indoor environment to particularly dangerous substances is close to zero and, as regards other chemical substances, to levels that are not harmful to human health".

If we are to attain the generational objective, a strong commitment is required by many players in society, both in Sweden and in other countries. Technological development may contribute towards solving some of the problems, but more rapid changes in society may also be required.

Proposals for interim targets and action strategies for the environmental quality objective of *A Non-Toxic Environment* are presented in the Swedish Government bill entitled *Chemicals strategy for a non-toxic environment*, which was adopted by the Swedish Parliament (Riksdag) in 2001.[16] The interim targets indicate courses of action for the objective-based work and identify the need for knowledge and information on the properties of the substances, what properties are to be prioritised for risk reduction and the need for continuous risk reduction in accordance with indicators that can be monitored.
The nine interim targets for A Non-Toxic Environment are presented in Annex 1.

[15] http://miljomal.nu/
[16] http://www.regeringen.se/sb/d/108/a/1274

In-depth evaluations of the environmental quality objectives are carried out every four years. An evaluation is currently under way which is to due to be presented to the Government in the autumn of 2008.

5.1 Interim target 3 Phase-out of substances of very high concern

According to the wording of interim target 3, newly manufactured articles will as far as possible be free from:

- new organic substances that are persistent and bioaccumulating, new substances that are carcinogenic, mutagenic and toxic to reproduction, and mercury, as soon as possible, but no later than 2007,
- other substances that are carcinogenic, mutagenic and toxic to reproduction, as well as such substances as are endocrine disrupters or highly allergenic by 2010, if the articles that contain them are intended to be used in such a way that they will enter the natural cycle,
- other organic substances that are persistent and bioaccumulating, as well as cadmium and **lead**, by 2010.

Nor will these substances be used in production processes unless the company can prove that health and the environment will not be harmed.

Articles already in existence that contain substances with the above properties or mercury, cadmium and **lead** must be handled in such a way that the substances do not escape into the environment.

Spread of substances covered by the interim target by air or water to Sweden will decrease continuously.

The interim target applies to substances that are man-made or extracted from the natural environment. It also applies to substances that give rise to substances with the above properties, including those formed unintentionally.

6. EU RULES ON LEAD IN ARTICLES

This section of the report presents a brief summary of the EU's new chemicals legislation REACH and the important specific product rules relating to lead at EU level. A brief description is also given of the General Product Safety Directive (2001/95/EC), which means that only consumer products that are safe from the point of view of health may be placed on the market. Both acute and long-term health risks are taken into account when an assessment is made of what is "safe". A directive that differs from the other product directives described is the Crystal Directive (69/493/EEC), which contains requirements for the lead content of crystal glass.
The various rules are described in more detail in Annex 3.

Lead is found in a large number of uses, and regulations on lead can therefore be found in a number of different European directives. As lead is a well-documented hazardous metal, all the directives except one referred to in this report contain some form of restriction of lead in articles or chemical products.

The account given in Annex 3 of secondary law that governs lead does not claim to be exhaustive but should cover most of the directives and EC regulations that are relevant in this context. The selection has been made through studies of the directives that govern known uses of lead and searches in EurLex and elsewhere. The regulation of lead in emissions, waste, the working environment, air quality or transport is not covered by the survey.

For certain product groups selected for regulation at EU level there is a self-evident link to health effects. Several regulations relate for example to the restriction of lead in foodstuffs and water for human consumption, as well as packaging in contact with foodstuffs. A directive concerned with an area adjacent to foodstuffs indicates a maximum lead concentration in sewage sludge to be re-used in agriculture.

There are rules that prohibit lead and its compounds in cosmetic products. It is also necessary to restrict the lead content of toys, as children are a particularly sensitive group.

Certain other products that are of great significance with regard to restricting the use of lead, e.g. cars, petrol and batteries, have been regulated. Another example of the regulation of the level of lead in articles is the new directive that came into force on 1 July 2006, which imposes limits on lead (and another five chemical substances) in electrical and electronic products. Other rules that restrict the level of lead are described in more detail in Annex 3. New product directives that govern lead will probably also be added. The new chemicals legislation REACH may also signify further restrictions on lead. At present there are restrictions at EU level relating to chemical products or articles that contain a dangerous substance in what is known as the Limitations Directive (76/769/EEC). This directive will cease to apply on 1 June 2009 and be incorporated into REACH.

The General Product Safety Directive (2001/95/EC) signifies that only consumer products that are safe from the point of view of health may be placed on the market. Both acute health risks and more long-term health risks are taken into account in assessing what is a safe product. A product can be stopped if it is not sufficiently safe. If information is judged to be a sufficient measure (safety information, warning information), this will be used instead of prohibition. A prohibition of sale may be combined with recall of the products, for example from a wholesaler, a retailer or a consumer who has already bought the product. There is an information system in the Community known as RAPEX in which Member States can inform one another (through the Commission) if they have taken any measure pursuant to the Product

Safety Directive. The Swedish Consumer Agency is the government agency responsible for this system in Sweden.

The Product Safety Directive may be of relevance to articles containing lead. In 2006 the United Kingdom notified the RAPEX system[17] that the Reebok company had voluntarily recalled an item of jewellery that contained high levels of lead. The lead content attracted attention in connection with a fatal accident in the United States when a child unintentionally swallowed the item of jewellery or parts of it.

The European Community Directive 69/493/EEC on Crystal Glass is not restrictive in nature but actually specifies the use of lead. This directive does not allow crystal glass in marketing to be called "full crystal" in categories one and two or "crystal" in categories three and four unless the glass contains a certain quantity of lead. The content of lead for full crystal glass in category one must be as high as 30 per cent and in category two the content must be 24 per cent lead for the glass to be called full crystal glass. The Swedish glass industry has objections to this directive, as it is possible to produce at least semi-crystal glass of the same lustre and quality without lead. This is described in more detail in section 10.2. The Swedish Chemicals Agency and the Swedish Environmental Protection Agency consider it essential to press for amendment of this directive in the EU. See the Swedish Chemicals Agency and Swedish Environmental Protection Agency proposals on restrictions in section 12.

Lead is otherwise on the agenda in the Regulation on Existing Substances, 793/93, through the voluntary risk assessment the industry is working on. The discussion on the scientific content of the report has not been completed, and the Commission has not taken any decision on whether conclusions reached in the report will lead to any risk-limiting measures.[18]

6.1 The EU's chemicals legislation - REACH

REACH[19] (Registration, Evaluation, Authorisation and Restriction of Chemicals) is the new chemicals legislation in the EU. This regulation covers chemical substances, and certain rules cover substances contained in articles. An example is that the substance manufacturer, in registering a substance that is manufactured in volumes in excess of 10 tonnes a year, also has to assess the risk of intended use of the substance, which may for example be in a product that contains lead.

Companies that produce lead metal as a raw material are obliged to register this manufacturing to the central chemicals agency in Helsinki. There are also certain special rules on articles, which are discussed in more detail below. The legislation adopts a life-cycle perspective.

The REACH-regulation came into force on 1 June 2007 and will signify radical changes in knowledge and control of chemical substances that are hazardous to health and the environment. The basic ideas behind REACH are to increase knowledge about many more of the approximately 30,000 substances estimated to be on the market today, giving enterprises that manufacture and import chemical substances greater responsibility and introducing stricter control for substances of very high concern. Priority is given to substances that are handled in large volumes and substances of very high concern.

Some important elements of REACH are briefly described below.

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[17] Notification number 0191/06

[18] Lead Development Association International (2006). Draft Voluntary Risk Assessment on lead metal, lead oxide lead tetroxide and lead stabiliser compounds

[19] Regulation (EC) No 1907/2006 of the European Parliament and of the Council; Registration, Evaluation, Authorisation and Restrictions of Chemicals.

Manufacturers and importers of chemical substances have to provide test data to be able to make a registration. The registration has to contain

- identity (company/undertaking, substance)
- information about all identified uses
- classification and labelling
- guidance and safe use
- summary of tests already performed
- proposals for further tests
- chemical safety report (for substances in excess of 10 tonnes per year and registrant)

This dossier has to be sent to the new European Chemicals Agency in Helsinki. Registration has to be preceded by what is known as pre-registration no later than 12-18 months after REACH has entered into force. The purpose of pre-registration is to enable companies/undertakings to coordinate testing to avoid unnecessary tests on vertebrates. How detailed the data requirements are depends on quantity (1-10 tonnes per year, 10-100 tonnes per year, 100-1000 tonnes per year, >1000 tonnes per year with increasing requirements). Under the regulation the first group, 1-10 tonnes per year, only needs to present chemical/physical data, that is to say they do not need to present data on environmental and health aspects. Only if certain criteria are met, such as suspicion of carcinogenicity or if the substance is suspected of being hazardous and consumers are exposed to it, do more data need to be provided.

The chemical safety report, including exposure scenarios which have to accompany the safety data sheet as an annex, also has to describe the intended use downstream in articles and describe each identified use and how risks with differing exposures are sufficiently checked. This means that downstream users, that is to say those who use a chemical substance or a mixture, have to describe their use to the manufacturer so that that their use can be included in the chemical safety report. If downstream users do not wish to provide information on their use of the substance, they must supply a chemical chemical safety report themselves. This is of significance to manufacturers as information has to be provided and new risk assessments need to be made that are to lead to instructions on safe handling. Chemical safety reports are required for substances that are used in a volume of more than 10 tonnes per year, per manufacturer.

The registration applies to substances manufactured in the EU and to substances imported as a substance or as part of a mixture. It is likely to be difficult for the substance manufacturer to cover all uses in the chemical safety report in cases where there are many intermediaries before final use, for example in a composite article.

The use of hazardous substances in articles that are manufactured in third countries and imported into the EU will even become far less known through the registration of substances than use in articles manufactured in the EU. Requirements are being introduced so that some information on use in imported articles is nevertheless obtained:

- for registration of substances that intentionally released from the article, for example a highlighter pen,
- for substances of very high concern in articles to be notified, regardless of whether they are emitted or not, if the concentration is higher than 0.1 per cent, for example a plasticiser in plastic.

The chemicals authority may request full registration if serious risks are suspected.

Restriction of use

There are two ways of implementing restrictions on the use of hazardous substances in the REACH system. Firstly there is ***authorisation*** for substances of very high concern (SVHC). Lead compounds have the potential to be regarded as SVHC as all lead compounds are classified as toxic for reproduction, that is to say fulfilling the CMR criterion contained in Article 57 of the REACH regulation[20]. Manufacturers, importers or users must apply for authorisation to use such a substance.

Restriction for other hazardous substances may be imposed after a Member State or the chemicals agency has conducted an investigation that shows risks in the EU and that existing risk management measures are not adequate. A socio-economic analysis may need to be conducted in practice. An authorisation procedure cannot be undertaken for substances contained in imported articles, and a restriction procedure must be applied instead.

Information on substances of very high concern to customer (Article 33).

If an article contains more than 0.1 per cent of a substance of very high concern (SVHC), whosoever places an article on the market must inform his customers accordingly, regardless of tonne limits. The information must be such as to allow safe use of the article, but as a minimum the name of the substance.

The requirement does not apply until the substances of very high concern have been placed on what is known as a candidate list. The substances that are to undergo the authorisation procedure are then sorted from this list. The list of substances for the authorisation procedure is due to exist two years after REACH comes into force, that is to say in June 2009, which means that the candidate list ought to exist earlier. When a list is in place, information on these substances is to be provided.

The information requirement also applies to a consumer at the latter's request. The information has to be provided free of charge within 45 days after a request has been received.

How 0.1 per cent is to be applied to complex articles will be the subject of further investigation. If the rule is to have any effect, the percentage content needs to be applied to the homogeneous component/part/material contained which actually contains the SVHC substance and which from the outset was a separate article.

[20] Substances that fulfil the criteria in article 57 may be adopted on annex XIV through the procedure in article 58. One of these criteria is if the substance should be classified as Carcinogenic (category 1 or 2), Mutagenic (category 1 or 2) or Toxic to Reproduction (category 1 or 2) according to the directive on Classification and Labelling of Dangerous Substances 67/548/EEC

7. THE REGULATION OF LEAD IN INDIVIDUAL COUNTRIES AND INTERNATIONAL ACTIVITIES

Certain countries in the EU have special rules for lead in various articles. These rules are described in this section of the report without any claim being made to completeness. Rules that cover the product groups prioritised in this investigation are primarily described. There are countries outside the EU that have regulated lead in some respects, and the regulations we have learnt about are described here.

7.1 Denmark

The "Statutory Order concerning prohibition of import and sale of products which contain lead" came into force in Denmark on 13 November 2000. The legislation applies to chemical compounds of lead and metallic lead. The concentration limit for lead and its compounds is 0.01 per cent in homogeneous parts of the products. The importing and sale of chemical compounds that contain lead was prohibited under this executive order in Denmark on 1 March 2001. Certain time-limited exemptions are, however, made. With regard to metallic lead, import and sale of certain product categories are prohibited. With effect from 1 March 2001 products for hobby use, chafing dish candles and other candles, curtain and drapery weights, products for decorative purposes such as jewellery, security/safety seals and products for roofing buildings are regulated. With regard to products for flashings and weatherings on buildings, fishing gear for commercial fishing, fishing tackle for angling, soldering alloys for plumbing and sanitation uses, except for the soldering of zinc sheets, sheaths for electrical cables below 24 kV, the rules came into force on 1 December 2002. The Danish Environmental Protection Agency has given instructions for an evaluation to be made of the statutory order in 2006, in which the need for continued exemption of those uses for lead that have been exempted following entry into force is examined.

Changes to the statutory order based on the evaluation were proposed in 2006 and there is a draft for the new statutory order. Denmark has notified the Commission of the proposed amendments. The proposal contains for example new times for when the products in the category of professional fishing equipment are to be prohibited. The new proposal also differentiates between import and sale. In addition, a distinction is made between sinkers and head ropes. It is proposed in the revised draft that prohibition of the importing of sinkers and head ropes will start to apply from 2007 and 2011 respectively. It is proposed that the sale of sinkers and head ropes be prohibited with effect from 1 June 2008 and 1 June 2012 respectively. With regard to cables, it is proposed that buried electrical cables below 100 kV AC and buried electrical cables below 150 kV DC be prohibited. Further amendments are that it is proposed that two new categories be proposed, "products for repair, refurbishment and extension of houses, with the exception and listed buildings and buildings worthy of protection" and "lead in balancing weights for vehicles over 3.5 tonnes".

7.2 Norway

Norway has notified the Commission of prohibition of various substances in consumer products. The prohibition applies to production, import, export and use of these substances in consumer products. Products employed for industrial use are not covered. The prohibition applies to another 20 different substances in addition to lead.[21]

[21] Three brominated flame retardants (deca-BDE, TBBPA och HBCDD), middle-chain chlorinated paraffins C14-C17, arsenic, cadmium, mercury and their substances, organotin substances (TBT and TFT), substances in

The concentration limit for lead and its compounds is 0.01 per cent in homogeneous parts of consumer products. Yacht keels, ceramic glaze that does not come into contact with foodstuffs, crystal glass, lead belts for diving, lead batteries and aviation gasoline are exempt from the prohibition. Artists' paints, lead shot, packaging and electrical and electronic products are also exempt from the prohibition as these are governed by other legislation. Norway is bound by legislation in the EU, for example the REACH legislation, under the EEA agreement.

7.3 Finland

In Finland, lead in candle wicks has been prohibited since 2001 for use indoors through regulations which the Finnish Consumer Agency has published[22].

7.4 United States

In the US state of California there is rule known as Proposition 65[23]. Proposition 65 requires information on substances with such properties as can cause cancer, foetal damage or other reproductive harm to be supplied when the substances are included in articles. Lead appears in the annex that lists such substances. Although the law only applies to those articles that are marketed within California, it has had a significantly wider impact when the same article is sold in other federal states and also in Europe. There are examples of labelling in accordance with Proposition 65 on the contained substance lead in trolling spoons for fishing on the European market[24].

The use of lead sinkers has been prohibited in three national parks in the United States. Several states, including New Hampshire, Maine, Vermont and New York, have also prohibited the use and/or sale of small lead sinkers[25].

7.5 Canada

Since 1 January 1991 it has been prohibited to sell, import or use petrol containing more than 5 mg lead per litre[26]. Petrol (gasoline) for competition vehicles is exempt from the prohibition until 1 January 2008 and aviation gasoline is not covered by the prohibition[27].

Canada does not have any national guidelines on occupational lead exposure, and each province decides what limit values will apply to lead in blood. This level averages 50 µg/dl blood[25].

The Hazardous Products Act contains commitments to protect the health of children and regulates the lead content in particular types of products for children, such as toys, certain clothing, beds, buggies and pacifiers. There is zero tolerance for lead in baby food[25].

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perfume (musk xylene and musk ketone), perfluorinated substances (PFOS and PFOA), surfactants (DTDMAC, DODMAC/DSDMAC, DHTDMAC), Bisphenol A, DEHP, pentaclorophenol and triclosan.

[22] The Finnish Consumer Agency Report 5/2001, Finland

[23] Safe Drinking Water and Toxic Enforcement Act of 1986

[24] Swedish Chemicals Agency report 6/04 Information om varors innehåll av farliga kemiska ämnen (Information on the content of hazardous chemical substances in articles). In Swedish with an English summary.

[25] http://www.wildlife.state.nh.us/Fishing/get_the_lead_out.htm 13/3-07

[26] Commission for Environmental Cooperation, Decision Document on Lead under the Process for Identifying Candidate Substances for Regional Action under the Sound Management of Chemicals Initiative, Public Consultation Draft, 2003.

[27] Gasoline Regulations (SOR/90-247)
http://www.ec.gc.ca/CEPARegistry/regulations/DetailReg.cfm?intReg=11&x=14&y=9

Jewellery intended for children under the age of 15 years which is imported, marketed and sold in Canada must not contain more than 600 ppm lead in total or 90 ppm which can migrate from the item of jewellery.[28]

There are limit values for lead in various types of coating materials that are marketed in, sold in or imported into Canada. The rules apply to furniture, toys and other products intended for children, pens and brushes.[29]

In Canadian national parks it is prohibited to use fishing sinkers of lead that weigh more than 50 g. A bill has been tabled to extend the prohibition of lead to the whole country[30].

7.6 Australia

Candles with wicks of lead were prohibited in Australia in 1999[31]. A debate is also in progress here on the use of lead in fishing sinkers.

7.7 International work

Lead as a global health and environmental problem has been under discussion in the UN Environment Programme (UNEP) for the last few years. A report is being prepared that describes environmental and health problems associated with lead, as well as what measures have been taken at regional and national level. It was decided at the 2007 meeting of the Governing Council of UNEP[32] that the report should be completed and provide a basis for the next meeting in 2009. Governments were urged to work towards continued risk-limiting measures. UNEP has worked to get rid of lead from petrol for vehicles through a large number of projects in Africa, Asia, South America and Eastern Europe. With effect from 1 January 2006, leaded petrol for cars has been prohibited in all African countries south of the Sahara[33].

The work within the framework of UNEP is in line with SAICM[34] and the 'Global Plan of Action', where lead is included under several activities (nos 49, 57, 60, 156, 157 and 244). Governments are urged to work towards the elimination of leaded petrol and the risk reduction of lead. Industry is urged to develop alternatives to lead in products.

Lead is covered by the Heavy Metals Protocol under the Geneva Convention on the Long-range Transboundary Air Pollution[35] which entered into force in December 2003. The protocol contains requirements for restrictions on emissions and for the parties to consider risk-limiting measures for lead in products. There are binding requirements for leaded vehicle petrol. An evaluation of the Heavy Metals Protocol is now under way and a decision is due to be taken in the autumn of 2007 on whether the protocol should be revised or not. To date there has been strong resistance to a revision of the protocol from the United States and Canada in particular.

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[28] Children´s Jewellery Regulations (SOR/2005-132) http://canadagazette.gc.ca/partII/2005/20050601/html/sor132-e.html
[29] Surface Coating Materials Regulations http://www.hc-sc.gc.ca/cps-spc/legislation/acts-lois/coating-revetements_e.html
[30] http://www.wildlife.state.nh.us/Fishing/get_the_lead_out.htm 13/3-07
[31] http://www.lead.org.au/lanv7n4/L74-3.html 13/3-07
[32] Governing Council of the United Nations Environment Programme, UNEP/GC/24/CW/CRP.11, 9 February 2007
[33] United Nations Environment Programme (2005). The environment in the news, 2005-12-28
[34] Strategic Approach to International Chemicals Management
[35] UNECE Convention on Long-range Transboundary Air Pollution, LRTAP

8. SWEDISH PRODUCTION, EXPORTS AND IMPORTS OF LEAD

This section of the report describes Swedish production, exports and imports of lead as a raw material and as a refined product. A more detailed review of the presence of lead in various products can be found in Section 10.

Galena (PbS) is the predominant mineral for the production of lead. It often occurs in complex ores together with sulphides of zinc or copper. The majority of all lead ore comes from zinc-lead mines. In terms of quantity, lead is the sixth most important metal after iron, aluminium, manganese, copper and zinc.

Sweden is a net exporter of lead ore and refined metal containing lead. The refined lead metal is produced partly by primary production, where the raw material is the virgin lead ore and partly by secondary production, where the raw material is recycled lead, for example lead from spent starter batteries.

Mine production in the EU decreased over the period 1995-2004, see Table 1 in Annex 2. Up to 2001, when the mine in Laisvall closed, Sweden had the largest mine production in the EU. In 2004 Sweden was in third place (after Ireland and Poland) with a share of around 30 per cent.

Mining of lead in Sweden and in Swedish-owned mines abroad is heavily dominated by Nya Boliden (with mines at Tara in Ireland, Garpenberg, the Boliden area, the former Laisvall mine and Los Frailes in Spain) and Lundin Mining (Zinkgruvan). The largest quantity of lead today comes from Zinkgruvan and from Garpenberg and the Boliden area. Following the closure of the Boliden mine in Laisvall (2001), Swedish mine production declined and today totals just over 50,000 tonnes lead/year[36].

Boliden has two smeltworks in Sweden – Rönnskär with mainly primary lead production and Bergsöe (Landskrona) which is solely concerned with secondary production, particularly from recycled batteries. Lead production has decreased over the last decade chiefly due to lower primary production (see Table 1, Annex 2). Most of both primary and secondary lead production today goes for export.

The inflow and outflow of lead can be roughly estimated by assuming an average lead content for various products. Altogether an outflow of lead from Sweden of around 50,000 tonnes is estimated for 2004, that is to say the same order of magnitude as Swedish mining. A corresponding calculation for 2000 gives a net outflow of just over 100,000 tonnes, again of the same order of magnitude as mining. A principal cause of the change is obviously the closure of the Laisvall mine in 2001. The flow of lead into Sweden in 2004 was dominated by lead batteries, firstly as new starter batteries and secondly as spent batteries for recycling (Boliden Bergsöe), as well as imported lead ore. Inflow in 2000 is heavily dominated by batteries. Starter batteries were imported from Spain, the Czech Republic, Poland and Korea and were exported principally to Denmark, Finland and Norway. Spent batteries were imported from Germany, the United Kingdom, Switzerland, Poland and the United States.

Exports of lead ore in 2004 principally went to Germany and the United Kingdom, while imports came from Australia. Unprocessed lead was principally exported to Germany and the Czech Republic. If the net flow of lead through importing/exporting of lead ore (I-E) is compared with mine production (P) in Sweden in the same year, a simple measure of the

[36] Bergbäck, Bo (2006). *Kartläggning av bly i varor*, NV report 5624

quantity of lead used in primary production is obtained (I+P-E). From the figures in Tables 1 and 2 in Annex 2, this calculation gives a quantity of lead of around 30,000 tonnes, which is in relatively good agreement with actual lead production at the Rönnskär works. Deviations may obviously occur due to time shifts between mine and metal production and as a result of a smaller proportion of recycled lead also being used at Rönnskär.

It is more difficult to find agreement between the trade statistics of Statistics Sweden and actual production for secondary lead production at Boliden Bergsöe in Landskrona. The net inflow (I-E) of lead through spent batteries (Table 1, Annex 2) was around 8,000 tonnes of lead in 2004 according to Statistics Sweden. In addition to this there are domestic spent lead batteries (around 20,000 tonnes of lead according to Returbatt). This together gives around 28,000 tonnes of lead, which differs sharply from the secondary production of approximately 45,000 tonnes. The deviation is explained by the fact that imports of battery scrap from the Nordic countries are not reflected in the statistics from Statistics Sweden. Imports to Boliden Bergsöe from Denmark Finland, Norway and Iceland totalled approximately 20,600 tonnes of lead for 2004[37].

Demand for metals is increasing globally, and this also applies to lead. The price of lead is consequently rising, and this means that Swedish mine production continues to be lucrative, as well as primary (Rönnskär) and secondary (Boliden Bergsöe, Landskrona) lead production. Swedish lead exports will also continue to be significant.

[37] Nilsson, Jan Stefan. Boliden Bergsöe, Personal Communication

9. LEAD IN ARTICLES – AN OVERVIEW

Lead is a heavy, soft and easily worked metal that has been used for a long time in a large number of different areas. The concentration of lead in the Earth's crust is relatively low, the mean concentration being 16 g/tonnes. The metal is easy to isolate and process and was already put to use in the ancient world. Lead has a high density (11.3 kg/dm^3), good insulating capacity, high absorption capacity for radiation and resistance to air and many chemicals.

Lead has been used and continues to be used in both metallic and non-metallic form. Metallic lead has many uses: ammunition, batteries, cable sheathing, chimney flashings, radiation protection, weights and large numbers of other metal products. These have been the heavily dominant uses in terms of quantity. Chemical lead compounds in paint pigments have historically been an important use, for example lead white - $Pb_3(OH)_2(CO_3)$, minium (red lead) – Pb_3O_4 and lead chromate – $PbCrO_4$. Lead compounds have been used for example as biocides (lead arsenate – $PbHAsO_4$) and as petrol additives (tetraethyl lead – $Pb(C_2H_5)_4$ and tetramethyl lead – $Pb(CH_3)_4$).

9.1 Use of lead in articles in the EU and globally

Use at the global level is shown by the pie chart below, and is heavily dominated by batteries (76%). Similar patterns of use exist in the EU, where batteries account for just over 60 per cent of use. Another use that is relatively large globally and in the EU is as a roofing sheet to prevent water ingress, for example at penetrations such as chimney flashings. In Sweden (see 9.2), this use is virtually non-existent in new construction, but it does occur on older buildings. Lead is also used as a pigment to a significantly greater extent both globally and in the EU.

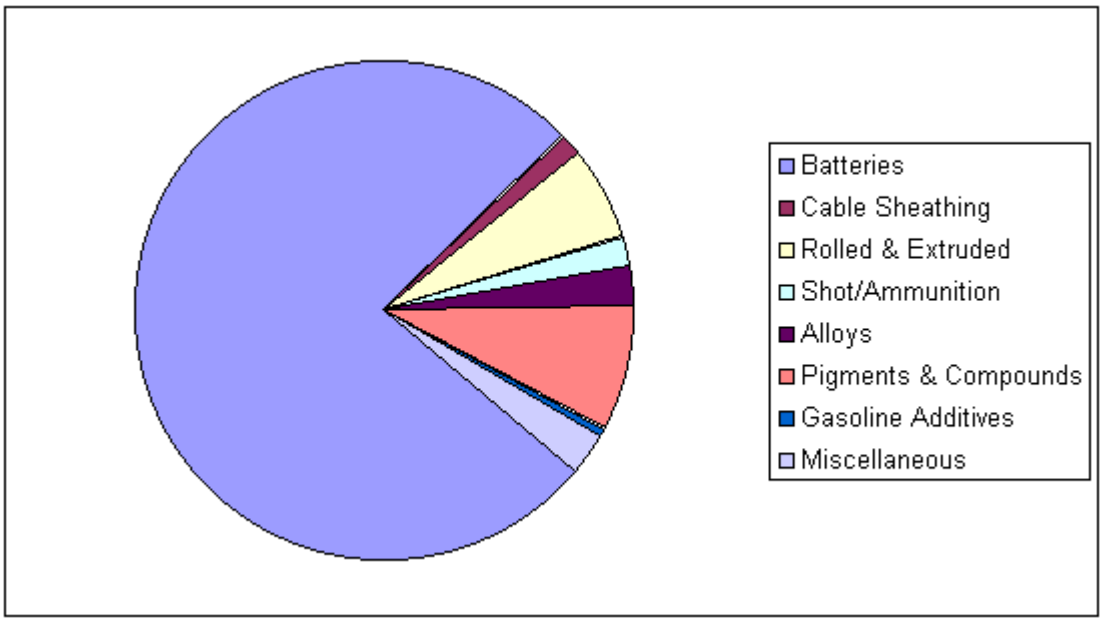

Figure 2. Global lead use in 2001. From Lead Development Association International (www. ldainf.org/information)

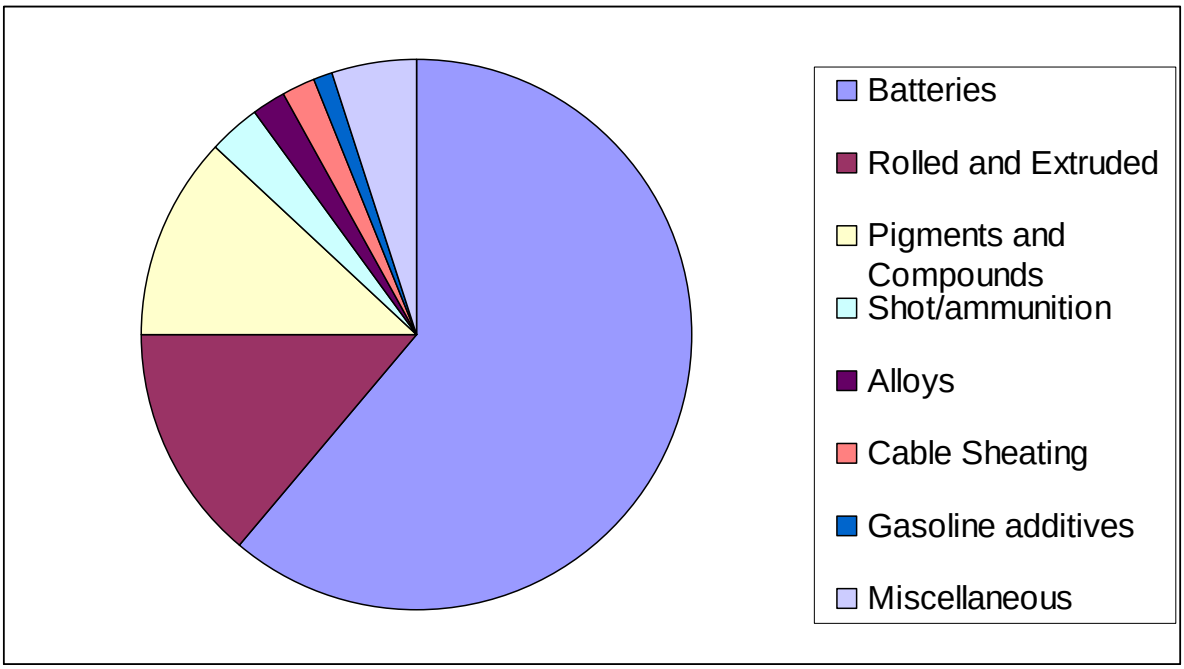

Figure 3. Lead use in the EU, From voluntary risk assessment, Lead Development Association International

9.2 Use of lead in articles in Sweden

The Swedish Chemicals Agency has previously conducted several surveys of the use of lead, and these are presented in the reports KemI 10/90, KemI 8/94 and KemI 6/97. A consultant study has been conducted under this government assignment with the aim of surveying the present-day use of lead in articles in Sweden and comparing this with previous lead use (1995, presented in KemI report 6/97) in order estimate trends. The complete consultant study was presented in Swedish EPA report 5624.

Table 1 shows the consumption of lead in different groups of articles in 2005 in comparison with 1995. The term consumption in this report is defined as *those products that are placed on the Swedish market*, that is to say production in Sweden plus imports into Sweden minus exports of the article from Sweden. The consumption of lead in Sweden has fallen over the last decade for a number of different groups of articles (see Table 1) such as paints, plastic articles, electronics/monitors, lead crystal, cable sheathing and ammunition. The consumption of wheel balance weights is expected to decrease significantly over the next few years as an exemption in the EU directive on end-of-life vehicles has recently expired.

Batteries (including car batteries) still account for the largest volumes of lead (around 80%), which is in good agreement with the global and European patterns of use.

The consumption of the various product groups is described in more detail in the following section.

Table 1: *Consumption of lead in Sweden in various groups of articles (Source: Bo Bergbäck 2006*)

Article	**Consumption (tonnes lead/year) 1995**	**Consumption (tonnes lead/year) 2005**	**Uncertainty in estimated quantities - 2005**
Ammunition	1 180	580	Low
- of which bullets	300	310	Low
- of which shot	880	270	Low
Batteries	22 000	20 000	Low
Lead crystal	1 320	120	Low
Cable sheathing	3 000	0	Low
Boat keels	500	1000-2000	High
Electronics	1 355	500	High
Fishing sinkers	600	400	High
- of which commercial fishing	400	200	High
- of which angling	200	200	High
Paints	330	30	Low
Alloys	860	800	High
Plastic articles	1 700	20	High
Radiation protection	70	70	High
Weights	900	900	High
- of which wheel balance	400	500	High
Total (rounded)	**33 000**	**25 000**	

10. GROUPS OF ARTICLES CONTAINING LEAD

This section contains a review of the individual product groups with an analysis of causes of changes in product volumes and prospects for the development of alternative products. Lead in ammunition is not described in more detail in this section as an investigation of this product group has recently been published (Swedish EPA report 5627) by the Swedish Environmental Protection Agency and the Swedish Chemicals Agency.

10.1 Batteries

Lead is used in three types of batteries: starter batteries (in vehicles), traction batteries (in fork-lift trucks and electric cars) and stationary batteries (backup systems in factories, hospitals etc.). Approximately 19,000 tonnes of newly produced starter batteries and 8,000 tonnes of lead in traction and stationary batteries were imported in 2004, making a total of around 27,000 tonnes. The equivalent figures in 2005 were 17,500 tones and 7,000 tonnes. [38] Lead batteries are used for various types of vehicles and tools, for example cars, boats, motor cycles, snowmobiles, mopeds, grass-cutting machines, golf carts, submarines and certain hand tools. The market for lead batteries for electric vehicles for the time being is negligible. A very small quantity of lead is used for batteries for wheelchairs/Permobil.

10.1.1 Collection of lead batteries

It is difficult to estimate the rate of collection of batteries as the life of starter batteries extends over several years, generally around five years, and new car sales vary sharply from one year to the next. In 2005 collection was estimated at 98 per cent, which would mean that around 17,640 tonnes were collected and that 360 tonnes were not collected. The batteries that have not been collected have probably been left on farms, in sheds, in the forest, in old vehicles, in caravans, boats and garages. Some will end up at the intended battery collection points, while others will end up in bulk refuse or without being separated, or in nature. Some batteries are burnt when old vehicles, boats, caravans or barns are set on fire, while others end up at the bottom of a lake or sea when boats or cars sink. Factors driving the collection of lead batteries from consumers are probably a desire to protect the environment, the impracticality of keeping them and the fact that collection is stipulated by law.

No calculations have been made of the collection rate for traction and stationary batteries. These are not in circulation in society in the same way as starter batteries are and remain as relatively large and fixed systems until they are replaced. They are then often collected by the supplier or Returbatt AB at the time of replacement. They are so large that they tend not to be left lying around, and for practical reasons people want to get rid of them. The collection rate can therefore be estimated to be around 100 per cent[39]. There are fully developed collection systems with collection at the gate for users of stationary and traction batteries. Contractors who deal with collection receive payment from the producers via the Swedish Environmental Protection Agency. The tariff is established in consultation between Returbatt AB and the Swedish Environmental Protection Agency.

10.1.2Recycling and new production of lead batteries

All recycling of lead batteries in Sweden is done by Boliden Bergsöe AB in Landskrona They recycle a total of 65,000 – 70,000 tonnes of lead batteries per year. Of these, approximately 30,000 tonnes come from Sweden and the remainder is imported from Denmark, Finland,

[38] Boliden Bergsöe AB, Personal Communication
[39] Fjelde, Gunilla. Returbatt AB, Personal Communication

Norway and Iceland. Boliden Bergsöe AB is one of the five largest secondary lead works in Europe. Their sales go to Europe, principally to Germany, Poland and Italy. The uses are battery manufacturing, lead roofing and boat keels[40].

There is no production of lead batteries in Sweden or the other Nordic countries today. Production is relatively evenly distributed, principally across the continents of Asia, Europe and North America (approximately 2 million tonnes of batteries for each continent). Around 50 per cent recycled lead and 50 per cent virgin lead are used at present in the new manufacturing of batteries.

The lead used in batteries is one of one of two different grades. The smaller "pure" grade becomes what is known as lead grid in the battery and contains various alloys with antimony, copper, sulphur, tin etc. The purer grade in the battery is lead paste and is manufactured from lead oxide, where one of the requirements is that tellurium, silver and bismuth do not exceed 5 g/tonne, 10 g/tonne and 20 g/tonne respectively. From the purely technical point of view it would be possible to refine all the recycled lead to an approved level of purity to re-use it to 100 per cent in the new production of batteries, but is considered more resource-efficient to start from primary lead for the purer grade. The reason for this is that the refining of lead for example with respect to bismuth and silver involves extra stages in the industrial processes in which zinc, for instance, is added to extract silver. Primary lead contains more silver than the secondary lead recovered by Boliden Bergsöe. More zinc is consumed per kilogram of removed silver if the process is based on the secondary lead handled by Boliden Bergsöe.

In the Czech Republic, for example, the purer grade of lead from secondary lead is also manufactured, but the grade on which the process is based contains significantly more impurities for example of mixed electronic scrap and it therefore becomes cost-effective to "extract" silver, for example, from this impure secondary lead.[41]

Another factor driving the addition of newly extracted lead to the process is that car sales around the world are increasing, particularly in Asia, while few countries have a level of collection of lead batteries of nearly one hundred per cent as Sweden does.

10.1.3 Alternatives

A review of alternatives to lead batteries is presented in section 12.

10.2 Crystal glass

Lead is used for glass manufacturing to give the molten glass certain processing properties. The EU's Directive 69/493/EEC on crystal glass specifies certain quality requirements and requires glass to contain a certain quantity of lead to be called crystal glass in marketing. For the highest quality category, full crystal in category 1, the crystal glass has to contain as much as 30 per cent lead. Full crystal glass in category 2 must contain 24 per cent lead. There is also crystal glass in categories 3 and 4.

Production of full crystal glass (24% or more lead) has fallen sharply in recent years. The proportion of full crystal in the total production of Orrefors Kosta Boda AB has fallen from 65 per cent in 2000 to around 1 per cent in 2005, which is equivalent to around 21 tonnes of lead[42]. Today production mainly takes place at Målerås Glasbruk AB. Approximately 115

[40] Boliden Bergsöe AB, Personal Communication
[41] Viktoria Granström, Boliden Bergsöe, Personal Communication, 2007-03-28
[42] Davidsson, Anders. Orrefors Kosta Boda, Personal Communication

tonnes of lead were used in new production in 2005[43]. Other glassworks do not have any or have very limited manufacturing of full crystal glass. The Swedish production of full crystal glass is estimated to total the equivalent of 136 tonnes of lead.

Exports are estimated at 70 tonnes of lead, i.e. around half of production. The lead used in production is imported. It can be mentioned by way of comparison that it was estimated for 1999 that 650-700 tonnes of lead are consumed by the Swedish manual glass industry[44].

Half the production of full crystal glass at Orrefors Kosta Boda in 2005 went to the Swedish market, equivalent to around 10 tonnes of lead. In addition to this there is a smaller quantity importing of articles by the company. In the case of Målerås 55 tonnes of lead were used in full crystal glass for the Swedish market. These companies together account for a large share of the Swedish market for full crystal glass. Imports of lead crystal glass in 2004 exceeded exports and produced a net inflow equivalent to 60 tonnes of lead. The net inflow of lead in glass in 2005 was around 45 tonnes.

The quantity of lead in crystal glass for sale (2005) in Sweden is estimated to be of the order of 120 tonnes per year[45]. Swedish glass manufacturers have developed alternatives to lead in crystal glass, and around 90 per cent of the former use of lead has been substituted. The principal reasons for the reduction in lead in glass is increased awareness in the industry of the risks associated with lead in the working environment, dialogue with authorities and the requirements of clients.

10.2.1 Alternatives

The composition of the whole glass has been modified to replace lead, and the quantity of barium and zinc has been increased in particular. This type of glass has the same properties as what is known as semi-crystal glass, which contains 10-15 per cent lead. There is no actual alternative to full crystal glass (24-30% lead). Lead-free glass is, however, a sufficiently good alternative in the vast majority of applications.

There continue to be problems in replacing lead crystal for some artificial glass products in which other materials are added. This also applies to lead in coloured glass which in relation to tension has to be adapted to other glass raw materials and lead in decorative paints for glass painting.[46]

10.3 Cable sheathing

There are both heavy-current cables and light-current cables. Only heavy-current cables are described in this report as no light-current cables have been either produced or newly laid in Sweden since the 1980s.

Lead-sheathed heavy-current cables are now only used for marine cables to provide protection against moisture ingress. Most of the lead-sheathed cable produced is exported. ABB Power Technologies AB in Karlskrona produces lead-sheathed marine cable, and the quantity of lead for 2005 totalled 5100 tonnes[47] but consumption in Sweden in the same year was zero according to Table 1. However, lead-sheathed marine cable is used in Sweden, for example for offshore wind farms. Domestic use of marine cable varies from one year to another, however, depending on current projects. Lead sheathing was previously also used in

[43] Magnusson, Ove. Målerås, Personal Communication
[44] Swedish Chemicals Agency PM 1 /01
[45] Bergbäck, Bo (2006). Kartläggning av bly i varor, NV report 5624
[46] Davidsson, Anders. Orrefors Kosta Boda, Personal Communication
[47] Larsson Hofstein, Magnus. ABB, Karlskrona, Personal Communication

underground cable, but this use of lead has creased and aluminium laminate is used instead. Lead may, however, occur, in underground cable produced for export.

The Swedish company Telia has a policy on lead which means that “dead cable”, i.e. decommissioned cable, which is easy to remove has to be taken away within 2 years. Cable in tunnels, ducts, marine cable and overhead cable is removed, while underground cable is left. Nationally around 1200-2000 tonnes of cable are removed every year. Removed lead cable is sent to Boliden for recycling.[48]

10.3.1 Alternatives

Lead in underground cable has now been replaced by aluminium laminate. There are no alternatives at present for cable lengths under water (marine cable).

10.4 Boat keels in leisure craft

Boat keels of lead have become more common, partly because they are easier to repair if damaged than other types of keel. A boat keel on average weighs around 4 tonnes[49] and it is estimated that 500 yachts with lead keels are manufactured annually in Sweden. This gives a broadly estimated quantity of 2,000 tonnes of lead in Swedish production per year (2005). The majority of this is exported (approx. 90%).

Around 10 per cent of Swedish production of yachts with lead keels is sold in Sweden, equivalent to around 200 tonnes of lead. In addition to this there are imported yachts. As imports of yachts are nearly as great as exports, this may mean that of the order of 1000-1500 tonnes of lead are sold in Sweden by way of imported yachts. A total quantity of 1000-2000 tonnes of lead can be estimated through the sale of boat keels in Sweden.

The increase in boats with lead keels is thus due to increased imports of yachts and to lead keels having become more common owing to the relatively better sailing characteristics compared with other materials (see below).

10.4.1 Alternatives

The most common alternative to lead keels is iron. A lead keel is smaller in size than the alternatives owing to its high density, and the sailing characteristics are therefore better for a boat with a lead keel due to the friction with the water being minimised. Another drawback of iron keels is that running aground causes greater damage to the boat than in the case of a lead keel.

10.5 Electronics

Lead may be present in television and computer screens. It may also be present in solders. The quantity of lead in electronics has decreased by 70 per cent in recent years (Table 1). This is due to new legislation and technical development. The inflow of lead in electronics and electronic products to Stockholm was 70 tonnes for 2002. The stock of lead in electronics already existing was estimated at around 600 tonnes[47].

The RoHS Directive (2002/95/EC[50]) on restriction of the use of certain hazardous substances in electrical and electronic equipment was transposed into Swedish law in the summer of 2006 (Annex 3). Several hazardous substances, including lead, were consequently prohibited

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[48] The City of Stockholm's Environment and Health Administration (2006). *Bly i Stockholm 2002 - en substansflödesanalys* , ISSN 1652-022X (http://www.miljo.stockholm.se/arkiv/rapporter.asp)
[49] Karlsson, Thomas. Hallberg-Rassy, Personal Communication
[50] Restriction of the use of certain Hazardous Substances in electrical and electronic equipment

in electrical and electronic equipment. This has meant that manufacturing industry in the EU has amended its processes (different technology) to phase out lead or has substituted lead with a different substance to comply with the new legislation. Importers of electrical and electronic goods into the EU are also covered by the RoHS directive, as they have to be able to show that their products do not contain any of the prohibited substances. RoHS covers electric light bulbs and luminaires in households, as well as household appliances, IT, telecommunications and office equipment, home equipment (television, audio-visual equipment), lighting equipment, electrical and electronic tools, toys, leisure and sports equipment and automatic dispensers. To encourage the re-use of electrical and electronic products, the prohibition does not apply to spare parts for products put on the market before entry into force on 1 July 2006.

Development has, however, taken place in lead-free technology. Large quantities of lead which were previous used as radiation protection in television and computer screens have been phased out with the change-over to flat screens. The use of lead for light bulbs has also decreased. As 60 million light bulbs are sold annually in Sweden, this entails a large environmental gain. Lead was formerly present in the terminal of tin solder at the bottom of the base of the light bulb and in the glass. Figures for how much lead each bulb contains range between 0.2 and 0.7 grams[51].

10.5.1 Alternatives

Lead has most often occurred in the soldering of components in electronics. Copper, silver, antimony, bismuth and zinc are principally used as alternatives today. These replace the lead in various mixing ratios in the alloy with tin to obtain low, medium or high melting temperature. The most common alloy on the market today is tin/silver/copper. The lead solder in the base of light bulbs has also been replaced by the new alloys. Lead-free alloys for soldering generally have poorer wetting characteristics than tin/lead alloys and this leads to slightly poorer soldered joints. Lead-free alloys also entail a longer time in the oven during the remelting process, higher heat and soldering with more aggressive fluxes. The function of the components to be soldered in position must also be guaranteed, i.e. it must be ensured that they withstand the higher soldering temperatures.

There are no alternatives to lead for certain applications that come under the RoHS Directive. Manufacturers have been granted exemptions in these cases. There are several exemptions for lead in RoHS. There are exemptions, for example, for lead as an alloying element in steel containing up to 0.35% lead by weight, aluminium containing up to 0.4% lead by weight and as a copper alloy containing up 4 per cent lead by weight and lead in high melting temperature type solders. There are a total of 22 exemptions that relate to lead in the RoHS Directive (Annex 3).

10.6 Fishing tackle for angling

The term leisure fishing signifies fishing undertaken for enjoyment and recreation, where the catch is not sold. Angling is a branch of leisure fishing which comprises fishing with a rod, hook and line. Leisure fishing also includes subsistence fishing with quantity-catching gear such as nets, which is discussed in section 10.7. Lead is present in varying quantities in a number of types of fishing tackle for angling. Some fishing tackle consists solely of lead, for example sinkers and split shot (shot with a notch where the line is attached). In other fishing tackle lead has been added to obtain certain functions. There may be lead in lures (trolling spoon, jig head, wobbler and fly) and on lines to give the fishing tackle weight in the water,

[51] Ny Teknik, 021204

and in some trolling spoons lead balls are also added so that the lure will rattle. An advantage of lead is that it is easy to work as it is soft and has a low melting point. In addition, lead is cheap, has a high density and is slow to corrode. Most lead for angling tackle is lost, while a few per cent ends up in household waste[52].

The National Board of Fisheries has carried out collections of old net from commercial fishing, known as ghost nets, and has found an average of 100 kg of trolling spoons from angling in 12 km of net. Just over 1.2 million Swedes fish with rod, hook and line[53]. It is difficult to obtain precise figures on the use of lead in angling. Statistics Sweden does not keep any statistics on lead in angling tackle. The Swedish Anglers' Association does not monitor the use of lead either. Keeping statistics of lead in fishing tackle is also problematic as private individuals and angling clubs may also cast their own fishing tackle. The lead used by private individuals for casting may come from angling shops, toy shops or scrap stocks. 2850 tonnes of lead scrap were imported into Sweden in 2004 (Annex 2 Table 2). In a mass flow analysis which the Swedish Chemicals Agency commissioned, the total use of lead for angling in Sweden was estimated at 200 tonnes per year[54]. In 2000 the use of lead in angling tackle was estimated at 200-300 tonnes[55].

An equally large proportion of lead sinkers as alternative sinkers are sold today in Swedish angling shops[56].

10.6.1 Alternatives

The alternatives to lead in angling are reviewed in section 12.1.2.

10.7 Fishing gear for commercial and subsistence fishing

Both small-scale and large-scale commercial fishing are undertaken in Sweden. There are around 1560 fishing boats in Sweden, and 1880 people hold commercial fishing licences. As the problems associated with lead in nets are the same in subsistence fishing as in commercial fishing, these are described in the same section. Just over 400,000 private individuals in Sweden fish with quantity-catching gear for home use[57]. Lead is present mainly in nets in this gear.

In some of the fishing tackle used by commercial fishermen there is lead for example in nets, trawls and purse seines. Lead is encapsulated in fishing nets in long ropes, head ropes, so that the net is vertical in the water. Sinker lines are available as standard in weights of between 0.8 and 20 kg per 100 m, but 1.2-7 kg per 100 m are most common. A Swedish producer of fishing nets states they buy in around 15 tonnes of lead each year from Finland and receive between 5 and 6 tonnes from commercial fishermen in old nets.[58] In some trawling lead is used to weigh the trawl down on the bottom. Lead weights each of 110 g are threaded onto the line, and the total quantity on a trawl is 20-35 kilograms depending on the size of the

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[52] Danish Environmental Protection Agency, Denmark (2004). *Masseströmelseanalyse för bly 2000 reviderad utgåva*. Environmental project Nr 917

[53] http://www.fiskeriverket.se/vanstermeny/fritidsfiske/undersokningomsvenskarsfritidsfiske.106.624ca9d110071d953a800020.html 2007-03-21

[54] Bergbäck, Bo (2006). Kartläggning av bly i varor, NV report 5624

[55] The Swedish Chemicals Agency (2001). Lägesbeskrivning för avveckling av bly, bromerade flamskyddsmedel, kvicksilver, nonylfenoletoxilater och klorparaffiner. KemI PM 1 /01

[56] Personal Communication during a meeting with representatives from the Swedish Anglers, 2006-12-08

[57] http://www.fiskeriverket.se/vanstermeny/fritidsfiske/undersokningomsvenskarsfritidsfiske.106.624ca9d110071d953a800020.html 21/3-07

[58] Gustavsson, Joachim, Blekinge Fiskeredskap, Personal Communication, 2007-01-22

trawl. A trawl can be used for about 10 years.[59] A purse seine is a long net with floats at the top and lead weights at the bottom. The lead is not enclosed in a purse seine and there is a total of around 1200 kg lead in the purse seine. There are about 15 purse seines in Sweden, and they can be used for 20 years[60], of which the six large ones (surrounding nets) do not use lead.

Total consumption of lead for fishing gear for commercial fishing is estimated at 2000-9000 tonnes per year. This quantity is based on assumptions on the fishing fleet of the Member States and how much lead is used in fishing. Commercial fishing is estimated to use 60-220 tonnes of lead in Sweden in 2002[61]. Total consumption of lead for fishing gear for commercial fishing is estimated at 50-180 tonnes per year.

Lead was banned in fishing gear for commercial fishing in Denmark in 2002. Time-limited exemptions for sinkers and head ropes in nets for commercial fishing have been approved. The situation now is that imports of sinkers are prohibited, while sale of sinkers and importing and sale of head ropes are permitted[62]. The Danish Ministry of the Environment had calculations made of the consumption of lead before the prohibition came into force. The quantity of lead is calculated in this study at 430-740 tonnes per year, that is to say higher than the Commission's estimate. It is possible that the quantity of lead in Sweden is also higher than has been stated. In a Swedish material flow study the quantity of lead in fishing tackle was estimated at 200 tonnes/year[63].

10.7.1 Alternatives

A review of the alternatives to lead in commercial fishing and fishing for home use can be found in 12.2.2.

10.8 Lead pigments in paint products

The quantity of lead substances for paint manufacturing in Sweden in 2004 was 23 tonnes[64]. Of these substances, 21 tonnes were exported.

The consumption of lead compounds in paints has stabilised at around 50-60 tonnes for the period 2000-2003 after having been around 100 tonnes in 1996.

Red lead (minium, lead tetraoxide) was previously the dominant paint for rustproofing with use estimated at around 320 tonnes in 1993[64]. However, most lead tetraoxide has been used in the electrical industry. A very sharp drop occurred from total use of lead tetraoxide of around 2,500 tonnes in 1992 to 0.3 tonnes in 2004. Red lead today is used to a very limited extent as a rustproofing agent for the maintenance of historic buildings.

The use of lead chromate has fallen sharply in Sweden, from 76 tonnes in 1992 to 3.5 tonnes in 2004[65]. This is equivalent to around 2 tonnes of lead. Today lead chromate is used in car

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[59] Eliasson, Bo, Västkustens Trålbinderi, Personal Communication, 2007-02-28
[60] Johansson, Börje, Yrkesfiskare, Personal Communication, 2007-01-12 Cosmos Trawl http://www.cosmostrawl.dk/
[61] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks
[62] Danish Ministry of the Environment (2006). *Evaluering av blybekendtgörelsen* Environmental Project Nr 1080
[63] Bergbäck, Bo (2006). Kartläggning av bly i varor
[64] Swedish Chemicals Agency, PM 1 /01
[65] Swedish Chemicals Agency, Products Register

touch-up paints as a pigment in yellow and orange paints where it is not been possible to develop alternatives with same the shade of colour and coverage.

According to the Swedish Chemicals Agency's Product Register there was a total quantity of lead chromate sulphate of 36 tonnes in 2004. Around 16 tonnes of this was made up of pigments for paints and printing inks. On the basis of the above, the use of lead in paints for 2005 is estimated to be of the order of 20 tonnes.

Lead is also present as an impurity in Falu Red paint (0.15-0.3 per cent by weight). Sales of Falu Red paint in Sweden have been estimated at just over 6 million litres per year[66]. With an average lead content of 0.2 per cent this is equivalent to 12 tonnes of lead per year. Taken together with the estimated use of lead in paint of approximately 20 tonnes, this gives a total quantity of around 30 tonnes of lead.

10.8.1 Alternatives

The opportunities for replacing lead in paint are very good, and substitution has been effectively carried out in the Swedish paint industry. There has been an agreement in the Swedish Paint and Printing Ink Makers Association (SVEFF) since 1989 not to use pigments containing lead chromate in products. The European organisation for the paint industry, CEPE, has also reached agreement on phasing out lead compounds by 2004.

A large selection of organic pigments or metal compounds are now used as alternatives in decorative paints. The composition is confidential information.

Tolyl fluanide is now used instead of lead compounds as a fungicide to prevent fungal growth on painted surfaces. Calcium, cobalt and zirconium compounds are used instead of lead carboxylates as drying agents. Zinc compounds such as zinc phosphate are used for rustproofing. Iron mica has been indicated as an alternative to red lead for the needs of the Swedish National Heritage Board.

Some use of lead compounds (lead chromates) remains in car touch-up paints, however, such as yellow pigment where it is not been possible to develop alternatives with the same shade of colour and coverage. The problem is that if a thicker coat is applied to compensate for coverage, the coat of paint becomes brittle. The lead chromate pigment is principally present in solvent-based paints, and with the change-over to water-thinnable products this use of lead will disappear. However, some pigments containing lead chromates will remain in certain "high solid" paints.

Red lead continues to be used as a rustproofer for the maintenance of historic buildings. This use is, however, limited in comparison with previous use. It use is entirely dictated by the needs and requirements of the Swedish National Heritage Board. Alternative rustproofers that will also meet the needs of the National Heritage Board are being looked at in a project directed by the Swedish National Testing and Research Institute. The problem is mainly in finding a rustproofer that is capable of penetrating and acting effectively in small cracks and joints that are always present in old iron objects such as railway bridges. There are satisfactory forms of rust protection for new iron objects.

10.9 Alloys

The use of lead in alloys in steel, aluminium, brass and solder (tin, lead) was around 225,000 tonnes/year in the western world over the period 1960-1980. It has since declined to around 120,000 tonnes of lead per year. The decrease is largely due to reduced use of tin/lead solder.

[66] Dagens Industri 2004-04-07

Alloying with lead endows brass with good cuttability, because the lead has a lubricating effect that makes the brass easier to work. Approximately 800 tonnes of lead is in circulation in Swedish brass, principally through the recycling of brass scrap. Around 80 tonnes of lead was added to brass products in 2005. In the same year 24,000 tonnes of brass scrap "disappeared" from the Swedish market due to strong demand abroad. This is equivalent to just over 200 tonnes of lead with an average lead content of 1 per cent in brass[67].

In the RoHS directive on restriction of the use of certain hazardous substances in electrical and electronic equipment (2002/95/EC) and the directive on end-of-life vehicles (2000/53/EC), there is an exemption for lead as an alloying in steel containing up to 0.35 per cent lead, in aluminium containing up to 0.4 per cent lead and as a copper alloy containing up to 4 per cent lead (weight-based). However, in the directive on end-of-life vehicles it is specified that aluminium for machining purposes may contain up to 1.5 per cent lead by weight until 1 July 2008. Aluminium is principally present in vehicles in wheel rims, engine parts and window levers. Brake linings of copper containing up to 0.4 per cent by weight lead are exempt from the prohibition until 1 July 2007. In 2005 the quantity of lead dispersed from bake linings had fallen to a tenth of the value calculated in 1998[68].

10.9.1 Alternatives

There is now a new type of alloy in which the lead has been replaced by bismuth as an alternative to copper alloys containing lead (bronze and brass). Alloys with bismuth are normally quite brittle and fragile, but in this case the alloy has been successfully made to assume other properties so that strong and easily machinable bronzes have been obtained. According to the manufacturer all copper alloys containing lead can be replaced by variants of the new lead-free alloy. The lead-free alloy is available as a bar for casting.

The health and environmental characteristics of bismuth have not been fully investigated. There is also some scepticism about introducing bismuth in the copper cycle as bismuth normally provides more brittle materials. In the case of many other types of alloys no lead-free alternatives with the same properties as the original alloy have yet been found. This applies for example to certain types of steel.

10.10 Plastic articles

The quantity of lead element (i.e. the quantity of substances containing lead) that went to the Swedish production of basic plastic or plastic manufacturing was 0 tonnes in 2004[69].

Lead compounds in plastic have decreased sharply from around 800 tonnes in 1996 to around 50 tonnes in 2003. Lead has been used principally as a stabiliser and pigment in PVC plastic. According to KemI PM 1/01, the established target for lead in PVC was estimated to be virtually met in 2002. Only a small quantity of lead in plastic-sheathed cable equivalent to 30 tonnes was estimated to remain, and this use too was decreasing. Imported PVC may continue to contain lead, but lead has been virtually phased out for the PVC produced in the Nordic countries.

Stabilisers

[67] Sundberg, Marianne, Scandinavian Copper Development Association, Personal Communication
[68] The City of Stockholm's Environment and Health Administration (1998). Metallemission från trafiken i Stockholm- Bromsbelägg
[69] Swedish Chemicals Agency, Products Register

Tetralead trioxide sulphate is used as a stabiliser in plastic. Consumption of this substance as a stabiliser in various products was approximately 8 tonnes in 2004 according to the Product Register.

Pigments

Pigments based on lead chromate/molybdate have been used in certain types of sheets and profiles of PVC. Requirements for red-brown paint on waste pipes in the ground could only be fulfilled in the past with lead chromate, but there are now alternatives through the use of organic pigments. The use of lead chromate has fallen sharply in Sweden, from 76 tonnes in 1992 to 3.5 tonnes in 2004[70]. This is equivalent to around 2 tonnes of lead (64% lead in PbCrO4). It is not apparent, however, how large a proportion might be used as pigments in plastics. The use of lead molybdate was 0 tonnes in 2004. In the same year around 10 tonnes of lead chromate sulphate was used in the plastic products industry[71]. The use of lead in 2005 in domestic manufacturing of plastic products is estimated as being of the order of 20 tonnes on the basis of the above.

Plastics containing varying compounds may also be important are components of articles. The quantities of plastic imported into Sweden according to the waste industry[72] are significant, and there is therefore great uncertainty about how much lead is contained in the plastic that is consumed. The lead contained in imported plastic is not included in this estimate.

10.10.1 Alternatives

The PVC industry in Sweden has replaced lead both as a stabiliser and as a pigment. The European equivalent has set a target of phasing out lead as a stabiliser in PVC in the EU by 2015. At present around 15-20 per cent of all the lead used as a stabiliser has been phased out.[73]

The alternatives used as a stabiliser instead of lead compounds are organotin compounds, barium/zinc compounds (Ba/Zn) or various types of calcium/zinc alloys (Ca/Zn). The Swedish Chemicals Agency advocated the use of CaZn in report 6/96, and this is also the product group that is increasing most.

The Swedish PVC industry does not have any product area in which it would not be theoretically possible to replace lead[74]. It may, however, take a few years for some product areas to move over to a different stabiliser as long-term tests are required to ensure that the new material (PVC + alternative stabiliser) fulfils quality standards.

10.11 Radiation protection

It has not been possible to survey present-day Swedish production and consumption of lead in radiation protection through contacts with various manufacturers. Sörme[75] estimates stored quantities of lead in radiation protection at 220 tonnes in Stockholm and new supply as negligible (in 2002). Converting to national level, this is equivalent to a stock of just over 2,000 tonnes of lead. The consumption of lead for radiation protection in Sweden was estimated at 70 tonnes per year in the early 1990s. An inflow of 70 tonnes/year and a stock of

[70] Swedish Chemicals Agency, Products Register
[71] Swedish Chemicals Agency, Products Register
[72] Karlsson, Anna, Vattenfall. Reference Group Meeting 2007-03-06.
[73] See www.vinyl2010.org
[74] Swedish Chemicals Agency, Internet consultation, Lena Lundberg, PVC-Forum, 2006-02-20
[75] The City of Stockholm's Environment and Health Administration (2006). *Bly i Stockholm 2002 - en substansflödesanalys ISSN 1652-022X (http://www.miljo.stockholm.se/arkiv/rapporter.asp)*

2,000 tonnes is equivalent to a life (average period of use) of 30 years, which may be reasonable for this use.

10.11.1 Alternatives

Lead has very good radiation-absorbing properties. The same absorption can also be achieved with other metals or with concrete, but relatively thicker material is required. In most cases where there is a need for radiation protection there are viable alternatives to lead from both the practical and economic points of view. An example is the lead aprons used in X-ray rooms, where equivalent protection with concrete aprons is not feasible in practice.

10.12 Weights

Lead is used as weights in a number of different areas, such as balance weights for wheels, lifts, furniture, pianos, curtain and drapery weights and industrial robots. Balance weights may be of interest from the environmental point of view as they become detached and end up in the surroundings so that lead may be dispersed to the environment through the corrosion of metallic lead to lead compounds.

It has been prohibited to put balance weights for vehicles on the market since July 2005 for vehicles below 3.5 tonnes according to the EU directive on end-of-life vehicles (2000/53/EC), nor may they be put on the market as spare parts. Lead has been mainly replaced by zinc[76]. There are significant quantities of led in wheel balance weights in existing vehicles. There are balance weights for vehicles in sizes ranging from 5 to 400 grams of lead[77]. An average weight of 100 grams of lead is estimated for more recent cars. Multiplying this by the number of cars in Sweden in 2005 (4,150,000) gives a quantity of just over 400 tonnes. In addition to this there are heavier vehicles (just over 450,000) in which average weight may be assumed to be higher. An average weight of 250 grams per heavy vehicle gives a further approximately 100 tonnes of lead. It is therefore calculated that of the order of 500 tonnes of lead are present as balance weights in vehicles in Sweden.[78]

Other use of lead as a weight takes place in protected environments where corrosion is judged to be very limited (lifts, furniture, curtain and drapery weights, industrial robots). According to KemI 1/01 the use of lead in industrial robots is decreasing. The use of lead for weights in 1995 (Table 1) is estimated at 900 tonnes, divided into wheel weights (400 tonnes) and other weights (500 tonnes). Use here is assumed to be of the same order of magnitude today.

Curtain and drapery weights of lead are often sold in furnishing stores, and certain chains have used lead weights in ready-sewn curtains and in shower curtains but have ceased doing so because of the risks associated with lead. The Swedish Chemicals Agency intends to raise this issue in conjunction with planned dialogues with the textiles industry.

10.12.1 Alternatives

There are a number of different materials that can replace lead as a weight, for example iron and concrete. As the alternative materials do not have the same high density as head, weights based on these materials are generally more bulky unless the design is altered at the same time. In developing industrial robots, for example, ABB has altered the design so that the

[76] Påhlman, Martin, Naturvårdsverket, Personal Communication 2007-02-08

[77] Sander K., Lohse J & Pirntke U., 2000. Heavy metals in vehicles. Report compiled for the Directorate General environment, nuclear safety and civil protection of the Commission of the European Communities. Contract No B4-3040/99/75869/MAR/E3. Ökopol, Hamburg.

[78] Bergbäck, Bo (2006). Kartläggning av bly i varor

need for heavy balance weights for robot arms decreases, thus improving the options for using materials other than lead. Re-design is not possible in some cases.

10.13 Other consumer products

Lead may occur in various consumer products. Other sections in chapter 10 also deal with consumer products. Other consumer products of which the Swedish Chemicals Agency is aware and where use may pose a risk to health are described in this section.

Tin soldiers/soldering tin for hobby use

There are several different grades of alloys for the casting of tin soldiers. The most common types are known as *model metal*, *standard metal* and *star metal.* The composition of the alloys is shown in the table below.

Table 2: Composition of the most common alloying metals

Type	**Lead**	**Tin**	**Bismuth**	**Antimony**	**Zinc**
Model metal	56 %	9 %	35 %	-	-
Standard metal	65 %	33 %	-	2 %	-
Star metal	-	94.5 %	-	2.5 %	3 %

According to information from one of the leading Swedish importers of tin soldiers there is no Swedish manufacturing of products for the casting of tin soldiers, and the quantity of lead accounted for by own sale of alloying metal was less than 50 kg in 2006. There are no figures for total imports of tin for the casting of tin soldiers in the statistics. It is estimated that 90 per cent of the tin sold for the casting of tin soldiers is lead-free.

Jewellery and accessories

It is cheap jewellery that has lead added to it to make it appear exclusive and heavy. This jewellery is principally marketed to children. In the United States thousands of items of jewellery are recalled annually because the lead content is too high[79]. According to information from a consultant in the industry, a very large proportion of all cast and soldered jewellery may contain 20-40 per cent lead and in some cases as much as 50 per cent. Some jewellery may also contain high concentrations of cadmium. In many cases the jewellery is covered with a thin membrane of gold. This jewellery is almost always manufactured in India or China. What is otherwise noteworthy is that some jewellery with high levels of lead that occur in the Swedish market also carry a recycling mark, which may influence the customer to think that the jewellery does not contain any hazardous substances such as lead. The Swedish Testing and Research Institute (SP) in Borås is able to confirm that there is jewellery containing lead on the market[80]. One of the major companies importing jewellery has its own restrictions on chemicals that are harmonised with Danish legislation. According to these restrictions, decorative metal parts must not contain more than 100 ppm lead and functional metal parts must not contain more than 0.3 per cent lead. This company does not have any restrictions regarding lead for soldering. [81]

[79] Van Arsdale, J.L et al.(2004). *Lead Poisoning From a Toy Necklace*. Pediatrics 114:1096-9
[80] Haraldsson, Conny, SP, Personal Communication 2007-01-25
[81] Sundberg, Karin, Hennes och Mauritz, Personal Communication, 2007-01-31

It is difficult to estimate the total extent of imports of lead-containing jewellery into Sweden as there is no industry organisation for the jewellery organisation and there are a number of smaller players who import jewellery onto the Swedish market. No information is available on whether any Swedish manufacturing of jewellery containing lead takes place.

Crayons for hobby use

It has been found that pastel crayons may contain high concentrations of lead. These crayons are in most cases manufactured in and imported from Asia. The Swedish Chemicals Agency carried out an inspection project in 2005 targeted at toy companies to examine compliance with the legislation in this area, including the Toys Directive (see 8:13).[82] During the inspection pastel crayons were encountered which on chemical analysis were found to contain lead and chromium which exceeded the migration value under the Toys Directive more than 100 times. Despite the high values, the products bore the CE mark. Products may only carry the CE mark if they meet the requirements set forth in the Toys Directive. The Swedish wholesaling company that had been importing the crayons immediately stopped selling them voluntarily after it learned of the high lead and chromium concentrations in them. The Swedish Chemicals Agency requested the company to contact the stores the crayons had been sold to, and the company then recalled the packs that were in the stores and disposed of these as hazardous waste. A total of 266 packs of the crayons had already been sold to consumers.

After this discovery the Swedish Chemicals Agency checked another 30 or so brands of oil pastel crayons. The two packs of crayons contained crayons with up to 18 per cent lead and high concentrations of chromium. According to the Swedish importer of the crayons, these had been purchased at a trade fair in southern China. The word *non-toxic* appeared on the packaging, so that the Swedish company had felt reassured and had not asked for certificates. This company too withdrew its crayons from sale voluntarily.

Candle wicks

Candles that contain lead in the wick were relatively common on the Swedish market up to the end of the 1990s. The function of the lead wire in the wick is to give the wick firmness when the candle melts and forms a liquid phase. It is in what are known as gel candles in glass or a container in particular that there is a need to prop up the wick. According to a compilation of tip-offs received by the Swedish Chemicals Agency between December 1999 and March 2000, the agency was informed on 14 occasions about candles with a suspect wick of lead or other metal. The candles were imported from China, the United Kingdom, France, Israel or Mexico. As a result of these reports, the Swedish Chemicals Agency issued a press release in December 1999 urging the public to take these candles back to the place where they been purchased. The Swedish Consumer Agency had also received information on the presence of candles containing lead on the market. It is unclear whether candles containing lead continue to be present on the Swedish market.

The European Commission has examined the need for EU-wide regulation of lead in candle wicks in an investigation[83]. According to this report there are candles with lead wicks on the European market, but on a very limited scale. These candles are often imported from Asia, but it has not been possible to estimate the scale of these imports.

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[82] Swedish Chemicals Agency (2005). Kemikalier i leksaker. Inspection project 2005, English version (Chemicals in toys), http://www.konsumentverket.se/mallar/sv/artikel.asp?lngCategoryId=1542&lngArticleId=3372)

[83] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks

Ceramics

Lead is sometimes used in glaze for ceramics. There is an ISO standard (ISO 7986 2:2000) for the leakage of lead from ceramics, and there are recommended limit values at EU level (84/500/EEC). However, lead occurs in glaze on ceramics bought by private individuals abroad. There are reported cases of lead poisoning in Sweden resulting from the use of ceramics. These ceramics had not met the standard required under the regulations.

Ayurveda

Ayurveda is the name of an Indian philosophy of health that goes back several thousand years and has also started to spread across the western world in recent years. The concept includes a number of herb and spice-based health products that are drunk or swallowed to ensure better health. It has been found that products of this type may contain high concentrations of toxic heavy metals such as lead, mercury and arsenic.

10.13.1 Alternatives

A review of alternatives to lead in consumer products is presented in section 12.

10.14 Aviation gasoline

It is principally small propeller planes that have piston engines and are therefore powered by aviation gasoline. There are around 2200 small propeller planes in Sweden with a take-off weight of less than two tonnes. The number has risen steadily, by about 30 planes a year in recent years.[84]

The engines of propeller aircraft require fuels with high octane numbers. Lead is added to the aviation gasoline to raise the octane number and reduce the strain on the engine valves. The lead content may be up to 0.56 g/litre, which is four times more than in the high-octane petrol for cars that was sold up to 1994 at Swedish filling stations[85].

Around 4.5 million litres of aviation gasoline are sold annually in Sweden, according to Swedish Petroleum Institute statistics. The gasoline is largely leaded, which means that around 2 tonnes of lead annually are dispersed through the use of aviation gasoline. The use of aviation gasoline in Sweden fell from 6274 to 4561 m^3 in Sweden in five years, between 2001 and 2005.

The lead contained in petrol is organic lead compounds which pose a greater risk to health than inorganic lead because it passes into the blood quickly through the inhaled air and even small amounts can affect the brain and nervous system in humans and animals.

10.14.1 Alternatives

A review of alternatives to aviation gasoline containing lead is presented in section 12.

10.15 Iron sand (residual products and waste)

Lead also occurs as an impurity in various kinds of waste, several of which are re-used in product-like forms, with a consequent risk of the lead being dispersed and posing risks to health and the environment.

Several different metals are produced from ore raw materials and from scrap raw material at the Rönnskärsverken metal smeltworks of Boliden AB. The processes also generate various

[84] SIKA Statistik, *Luftfart 2005*, 2006:17
[85] Ny teknik, 2001-11-07

wastes, residual products and by-products. At present it is only the residual product known as iron sand (iron silicate or fayalite) that is re-used.

Approximately 270,000 tonnes of iron sand arise annually, which are re-used as construction material in road-building or in other construction (around 75%, internally by Boliden for building purposes (around 20%) and as blasting sand in new construction and refurbishment in the building sector (around 5%). The iron sand contains impurities from a number of heavy metals, including lead. In total there are around 25-50 tonnes of lead annually. The concentration in iron sand is thus approximately 0.01-0.02 per cent.

The iron sand has been regarded to date as a residual product, that is to say it is has been relatively unclear to date from a legal point of view whether product regulations or waste regulations are applicable in assessing iron sand. Iron sand does not appear in the Swedish Chemicals Agency's product register, nor does not appear in the statistics on the use of lead in articles drawn up in 1996 and 2006.

10.15.1 Alternatives

A review of the alternatives to iron sand can be found in Chapter 12.

10.16 Fireworks

Lead produces a crackling effect in fireworks and has previously been used for this purpose and continues to be used to some extent as an ingredient in fireworks. The Swedish Rescue Services Agency has to approve fireworks before they may be offered for sale and used under Section 10 of the Flammables and Explosives Ordinance (1988:1145). The approval procedure takes place on the basis of the criteria contained in Section 1 of the Act (SFS 1988:868) on Flammable and Explosive Articles. The criteria are directed towards damage and accidents that take place as a direct consequence of fire or explosion. The Swedish Rescue Services Agency gains access to a list of substances in fireworks in connection with the approvals procedure. However, the SRSA considers that the regulations for the approval of fireworks do not allow them to take account of indirect consequences to which certain substances such as lead can give rise.

There is an overall European product standard for fireworks (prEN 14035), compliance with which is voluntary. This standard, which is market-oriented, i.e. not mandated by the Commission, is targeted at requirements for the design, function, packaging and labelling of fireworks and requirements for test methods to ensure that the fireworks fulfil the requirements. It is apparent from the standard that it is not applicable to fireworks that contain certain substances listed in it. These substances include mercury and lead compounds. This means that the industry itself does not consider that these substances should be present in fireworks.

A European Directive for the placing of fireworks on the market has just been adopted. This directive means that firework articles have to be CE-marked by an independent body. When the directive has come into force it will mean that the SRSA no longer approves firework articles. The directive does not contain any direct prohibition of the use of lead.

10.16.1 Alternatives

The fireworks manufactured in the western world now do not contain any lead. The crackle effect that lead produces can also be obtained with bismuth oxide, copper oxide and to some extent iron. According to a spokesman for the firework industry lead is to be regarded as having been largely phased out from fireworks (both those manufactured in the country and imports). The attention of the fireworks industry was drawn to the problem of lead emissions

in 1998 after high levels were measured at the time of the Stockholm Water Festival. In the same year the industry took a decision in principle not to approve formulations for fireworks that contain lead. The formulations have a period of validity of around 10 years, which means that there is some lag in the use of leaded fireworks.

10.17 Leaded lights

It is possible that lead started to be used from framing windows as long ago as the 6th century. There is a description of leaded lights from just before the year 1000. It became a more general craft in the 14th century. Germany has the largest quantity of leaded glass today.[86]

The Swedish Glass Trade Association has compiled figures on lead work among its member companies in a survey conducted in 2002. Of 74 companies that responded to the survey plus two that there contacted later by telephone, 47 have manufacturing of leaded glass or buy in and sell such glass. Between 7 and 9 tonnes a year are used by these companies (including solder containing lead). This lead is mostly used for the renovation/restoration of old windows, for example in churches. Around 3-4 tonnes of lead are also used annually in furniture.

The lead used in manufacturing is largely recycled, around 4-5 tonnes. Lead is also imported for this purpose from Belgium and Germany, principally through wholesalers. The quantity of imported lead is of the order of 3-4 tonnes.

The work of the member companies of the Swedish Glass Trade Association involves the lead framing of glass, principally renovation but also new production of leaded windows.

The rejoining of leaded lights means that damaged carnes (lead framing) are replaced and new profiles are rolled and joined by soldering. Lead can be bought in by the glazier in the form of sections which are then drawn (cold working) so that the section takes on the desired shape for intended application. Alternatively various sections that can be used without being worked are bought.

10.17.1 Alternatives

According to the Swedish Glass Trade Association there are no satisfactory alternatives to leaded lights that are accepted by the National Heritage Board.

[86] The Swedish Glass Trade Association (2003). Report - Bly inom glasbranschen

11. PRIORITISATION BY THE SWEDISH CHEMICALS AGENCY AND THE SWEDISH ENVIRONMENTAL PROTECTION AGENCY OF PRODUCT GROUPS FOR THE REGULATING OF LEAD

An account is given here of the priorities the Swedish Environmental Protection Agency and the Swedish Chemicals Agency have to follow according to the government remit in order to submit proposals for the regulations most urgently needed to attain the environmental quality objective of A Non-Toxic Environment with respect to the use of lead in articles and products. According to the environmental quality objective of A Non-Toxic Environment articles have to be free from lead as far as possible (see Chapter 5).

Lead is a metal of very high concern from the point of view of health and the environment. The risks associated with the use of lead are well documented, and against this background lead has been regulated in a large number of different product groups and in other environmental rules. Rules are a powerful force in driving restriction, and it has been judged necessary to introduce rules in certain cases to limit the presence and risks of lead. Examples of this are the product groups of *ammunition* and *electronics.*

Lead in ammunition has decreased as consequence of hunting with lead shot having been prohibited in wetlands[87] along with lead shot in sports shooting.

The phasing-out of *lead in electronics* has been pursued through development of the rules that came into force in the EU in 2006[88]. These rules affect all international electronics manufacturing.

It has been found that market-driven instruments have also been strong factors driving the restriction of lead in some cases. Environmental aspirations among businesses in certain sectors and the demands of customers have also influenced development. The decrease in lead in *paint additives* and *plastic additives* has largely been a consequence of market-driven forces, such as the decrease in the use of lead in *crystal glass.*

The decrease in lead in products is partly dependent on the technical options and the costs of developing alternative products. The decrease in the use of lead has been more successful with regard to chemical products as these products are not allowed to be sold direct to the customer if they contain substances with properties that are carcinogenic, toxic to reproduction or mutagenic. All lead compounds are classified as toxic to reproduction (category 1)[89] and the market for chemical products containing lead compounds is consequently limited.

Lead has technical properties that mean that it can be used in many product areas. It is consequently cost-effective to recycle lead from end-of-life products for new use. A risk to

[87] The Swedish Environmental Protection Agency and the Swedish Chemicals Agency (2006). Konsekvenser av förbud mot bly i ammunition – ett regeringsuppdrag rapporterat av Naturvårdsverket och Kemikalieinspektionen, NV report 5627 (Consequences of the Swedish ban on lead in ammunition - a government assignment reported by the Swedish Chemicals Agency and the Swedish Environmental Protection Agency) In Swedish with an English summary.

[88] RoHS-directive (see chapter 6 and annex 3 in this report)

[89] Lead compounds are adopted as toxic to reproduction, category 1, according to the directive on Classification and Labelling of Dangerous Substances, 67/548/EEC, in the following way. Lead hexafluorosilicate, Lead alkyls, Lead acide, Lead chromate, Lead diacetate, Lead acetate (basic), Lead(II) methanesulphonate, Lead sulfochromate yellow, Lead chromate molybdate sulfate red, Lead hydrogen arsenate, Lead styphnate and Lead compounds with the exception of those specified elsewhere in this Annex

which attention has already been drawn is use in consumer products imported from countries outside the EU. Imports take place in some cases in contravention of applicable rules.

Lead-sheathed cable was not used in Sweden in 2005, but as its use is strongly linked to major projects that require marine cables, the possibility that it may be used in the future cannot be ruled out.

Product areas where the use of lead has not diminished are *batteries, boat keels, fishing tackle, alloys, weights and radiation protection*. With regard to *wheel balance weights,* these are now covered by rules on restriction (the ELV directive, see Annex 3) as the former exemption for wheel balance weights on cars has now ceased. It can consequently be expected that the quantity of lead from wheel balance weights will diminish.

The prospects of replacing lead vary between different products, principally depending on what properties of lead have been utilised in the products, for example resistance, radiation-absorbing properties, shades of colour in lead salts, density or the softness of the metal which makes it easy to work.

11.1 Prioritisation of product groups for limitation of lead

The risks associated with lead vary between different products. This depends principally on the form in which the lead occurs[90], what volumes of lead are used in the product group and how widespread the products are in society. In addition, it is significant to the risks whether product use may lead to people or the environment being exposed to lead, particularly if they are sensitive groups such as children.

Lead can be emitted and dispersed during various phases of the life cycle of products. Emissions in production are principally a working-environment issue, but in some cases also have an impact on the external environment. The release of lead during the use of products may pose a risk to humans and the environment, as may emissions from end-of-life articles. Dispersal of lead and the risk of harm must be taken into account in prioritising products for proposed measures. In addition, account must be taken of whether there are already rules limiting lead in the product group.

According to the wording of the remit, the focus is to be on groups of articles where regulations are most urgently needed, and the product groups have therefore be classified in two levels of prioritisation. Table 3 presents the broad grounds on which the prioritisation of different products are based. The basis of prioritisation is described in more detail in Annex 4.

11.1.1 Prioritisation group 1

On the basis of the criteria outlined above, the following product groups have been prioritised for further investigation in Chapter 12.

Batteries on the basis of the large quantities of lead they contain.

Fishing tackle because of substantial dispersal to the environment and because there are exposure scenarios that indicate that there are environmental risks.

Consumer products as they can pose a risk of serious health effects in certain cases

Aviation gasoline as lead in petrol is the most dangerous form of lead from the toxicological point of view.

[90] Metallic lead, lead ion or organic lead compound

Residual products, e.g. iron sand as waste and residual products may contain a large amount of lead, from the quantitative point of view, and the exposure scenario is often unclear with regard to both health and the environment.

11.1.2 Prioritisation group 2

On the basis of the criteria outlined above, the following product groups have been placed in prioritisation group 2, which means that they are not investigated further in this report.

Electronics and *wheel balance weights for cars* as rules on restriction have recently been introduced for these product groups with respect to lead.

Paint pigments and *plastic articles* as these industries have been pursuing conscious and effective substitution of lead in the products for several years. The quantities of lead in PVC plastic might, however, be further reduced if imported products were also free of lead. With regard to plastic articles the European industry body for plastic additives, ESPA,[91] has committed itself through a voluntary agreement to completely replace lead in PVC with alternatives by 2015[92].

For *alloys*, *radiation protection* and *weights*, the assessment is that health and environmental exposure is relatively low, the products have a long life and end-of-life products can be disposed of safely.

Lead-sheathed cable is used to a very small extent at present. If its use increases, the risks will need to be investigated. Lead-sheathed cable corrodes very slowly in the ground owing to its low specific surface area.

Quantities of lead for *boat keels for leisure craft* are increasing, but the risk of emissions to the environment is low due to protective antifouling paints or plastic hulls. Non-protected lead keels are also estimated to corrode slowly because of the low specific surface area. As large quantities of lead occur in boat keels, it is important that the lead is disposed of safely when the boat is broken up.

Lead in fireworks has decreased sharply as a result of voluntary measures in the fireworks industry.

Leaded lights occur on the market principally as a result of the need to restore and maintain old buildings. Occupational exposure to lead is quite strictly regulated with a maximum permitted level of exposure with annual measurements in indoor air and prescribed control measures for instance with regular medical checks and blood sampling in the regulations of the Swedish Work Environment Authority[93].

Quantities of lead in *crystal glass* have fallen sharply in recent years. A measure that would be significant for the use of lead in crystal glass is an amendment to the European Community directive[94] that specifies that crystal glass must contain a certain quantity of lead. If the definition of crystal glass was amended to cover properties such as refractive index, density etc. instead, the quantities of lead could probably also be reduced in imported crystal glass. The Swedish glass industry today is prevented from calling its products “crystal” in marketing

[91] The European Stabilisers Producers Association
[92] Vinyl 2010, Progress Report 2005, www.vinyl2010.org
[93] The Swedish Work Environment Authority Provisions, AFS 1992:17 – Bly, med ändringar i (AFS 2005:08) samt AFS 2005:06 – Medicinska kontroller i arbetslivet.
[94] Crystal Directive (69/493/EEG)

and is instead obliged to use the term “Swedish crystal”. The Swedish Chemicals Agency and the Swedish Environmental Agency consider it essential to press for this directive to be amended in the EU.

There are already rules limiting lead in glaze for *ceramics* today. Several documented cases of lead poisoning have occurred in Sweden in recent years as a consequence of the use of ceramics. These have concerned ceramics purchased abroad and use to store foods. These ceramics have not fulfilled the requirements laid down in the regulations. Suitable measures in these cases are increased supervision rather than proposals for new rules.

Ayurvedic preparations are marketed as “natural products”. The Medical Products Agency is the agency responsible for natural remedies and has placed a special warning about Ayurvedic preparations on its website[95]. Measures to prevent the use of lead in Ayurvedic preparations have not been considered in the context of this government assignment.

Table 3. Overview of grounds for prioritising product groups for further investigation of measures limiting lead content.

Product group	**Volume - trend** tonnes 1995-2005	***Dispersal in products Exposure*** [I]	**Limitation rules**	***Comments***
Prioritisation group 1 for further investigation				
Batteries	20 000 →	Very large volumes, linked to use in other products Widespread product	None	
Fishing gear, commercial fishing	200 ↓	Wide dispersal environmental risk	None	Volumes have decreased, further measures needed
Fishing tackle, angling	200 →	Wide dispersal environmental risk	None	Not decreased despite information, alternatives exist
Consumer products	unknown volume	Wide dispersal, health risk	Prod. safety dir.[II]	Protection for consumers needed
Aviation gasoline	2	Organic lead, widespread	None	Alternatives exist
Residual products e.g. iron sand	25-50	Waste problem		
Prioritisation group 2				
Ammunition	580 ↓	Wide	Exist	Reported
Lead crystal	120 ↓	Volumes reduced	None	
Lead-sheathed cable	0 →?	No use at present	None	Uncertain development

[95] http://www.lakemedelsverket.se/Tpl/NewsPage____5074.aspx

Boats	1-2 000	↑	Large volumes of lead low exposure	None	Important that the lead is disposed of safely when the boat is broken up
Electronics, screens	500	↓	Wide dispersal risk in manufacturing, waste	Exist See Annex 3	Regulated
Paint pigment	30	↓	Significant decrease	Exist See Annex 3	Regulated
Alloys	800	→	Low exposure to lead	None	Difficult to replace lead in some alloys
Plastic articles	20	↓	Quantity of lead decreased	None	
Radiation protection	70	→	Low exposure in use	None	Weighing up against risk of radiation
Weights of which wheel balance weights	900 500	→ →	Low exposure Wide dispersal to environment	Exist see Annex 3 (balance weights regulated)	Expected to decrease
Fireworks	Close to 0	↓	Volumes decreased, wide dispersal to environment	None	Industry has phased out voluntarily
Leaded lights	7-9		Health risk in working environment	None	Exposure during occupational lead use is strictly regulated

[I] Note that there is always a risk of exposure in manufacturing of articles that contain lead, and also in disposing of end-of-life articles

[II] The Product Safety Directive means for instance that products that are not safe may be recalled from the market (see description in Annex 3.1). However, this rule is not to be equated to rules limiting lead which provide more definite protection.

12. REVIEW OF THE PRIORITISED PRODUCT GROUPS

This chapter describes the prioritised product groups in greater detail with respect to exposure and reasons for restriction.

12.1 Fishing tackle for angling

12.1.1 Exposure

Casting of fishing tackle

The hobby casting of sinkers from recycled lead is common in angling, which entails particular risks of exposure. The lead that is used comes from angling shops, toy shops or scrap dealers, among other places. Exposure takes place when lead enters the body through inhalation or ingestion. Lead that is inhaled is absorbed into the body more effectively than lead that is swallowed. Vapour from a lead-containing melt contains very small particles of lead oxide. Lead oxide is soluble in the body fluids and is absorbed into the body via the lungs. It is therefore essential to observe special caution in the melting of materials containing lead.[96] The emissions to air from home casting are estimated at 0.1-1 per cent of the volume of the mould (1-10 g per kilogram of molten lead)[97]. The commercial manufacturing of angling tackle also results in exposure, but as this is associated with protective measures in Sweden this is not investigated in more detail.

Use

Lead poisoning in wild birds has been known for more than a century. There are reports of lead poisoning for a large number of bird species, particularly with regard to sea birds such as loons and swans. Loons are exposed to lead as they peck pebbles and gravel from lake bottoms, because this assists with their digestion of food. As lead sinkers are the same size as pebbles and gravel, these may also be pecked.[98] In an American study on loons it was discovered that lead poisoning was the most common cause of death among adult breeding birds. Ingestion of lead sinkers was found in 52 per cent of the population.[99]

Fishing sinkers have been found to be a common cause of lead poisoning in trumpeter swans in both the United Kingdom and North America. In an American study the swan population had declined and ingestion of lead sinkers represented the cause of death in around 20 per cent. Swans are at risk of being exposed to lead as they consume large volumes of plant material and sediment and consequently may ingest lead sinkers.[100] In Sweden statistics from the National Veterinary Institute show that three out of ten analysed trumpeter swans had died of lead poisoning in 2005.

Birds of prey further up the food chain may also be affected by lead poisoning. It has been shown in the United States that eagles selected lead-poisoned ducks as food, which resulted in lead poisoning of the eagles. Studies have shown that the situation may be similar in Sweden.

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[96] The Swedish Work Environment Authority Provisions AFS 1992:17

[97] Danish Environmental Protection Agency (2004). Masströmelseanalyse för bly 2000, reviderad utgåva Environmental Project Nr 917

[98] TUFTS school of Veterinarian Medicine http://web.archive.org/web/20041229095125/http://www.tufts.edu/vet/loons/index.html 13/12-06

[99] Pokras, Mark A. - Chafel, Rebecka (1992) Lead adult toxicosis from ingested fishingsinkers in adult common loons (Gavia Immer), New England Journal of Zoo and Wildlife Medicine vol. 23 pp. 92.97

[100] Blus, Lawrence J - Stroud, Richard K. – Reiswig, Barry - McEneaney, Terry (1989). *Lead poisoning and other mortality factors in trumpeter swans*, Environmental Toxicology and chemistry, vol. 8 pp. 263-270

Of 22 Swedish eagle corpses analysed in 2005, three had died of lead poisoning, according to statistics from the National Veterinary Institute. However, it is not apparent from the study how the eagles ingested the lead, although it may be assumed that they did so by eating seabirds and that these had been poisoned with lead.

Corrosion of lead entails dispersal to the environment which may lead to organisms being exposed to higher levels of lead than the natural background level. The corrosion of metallic lead depends on several factors, including pH. As it has been estimated that "lost" fishing sinkers of lead may result in an annual loss of weight amounting to around 1 per cent, this rate of corrosion has been assumed to represent a realistic value[101]. According to the mass flow analysis commissioned by the Swedish Environmental Protection Agency and the Swedish Chemicals Agency, the consumption of lead for fishing tackle for angling totals around 200 tonnes per year (see 10.1), and this means that 2 tonnes of lead corrode annually. Spofa Spöfiske (the Swedish Fishing Tackle Distributors Association) estimates, however, that the lost quantity of lead in fishing tackle only amounts to 30 tonnes. This would mean that the level of corrosion is significantly lower than 2 tonnes of lead per year. But the total burden of corroded lead from fishing sinkers may also be substantially higher if account is taken of the accumulated quantities of fishing sinkers which may also be assumed to corrode at around 1 per cent per year. This can be compared with the total quantity of water-borne lead, around 40 tonnes, which enters the Baltic Sea annually from Swedish watercourses.[102] The major Swedish land-based point sources of lead to water account for around 2 tonnes of this.[103] Information on the other sources of water-borne lead is completely lacking,[104] but a certain proportion originates from soil pollution resulting from the thousands of years of mining and use of lead.

Lead poisoning has been studied under Swedish conditions in the flowing watercourses Lagan, Dalälven and Indalsälven. When lead weights had been exposed to flowing water for one to six months it was found that the sinkers that had been placed in the strongest flows in the Dalälven river had corroded most. Corrosion is measured as weight reduction per unit area. At the flow rate of 0.1-1 m/s the corrosion per year was 37 mg/cm^2, while at weaker flows of 0-0.1 m/s the rate of corrosion per year was 10 mg/cm^2.[105]

Waste management

If angling tackle that contains lead ends up in household waste, a large proportion of it will go to incineration. The purification of the flue gases from such waste incineration plants today is relatively effective, with approximately 6.6 tonnes of lead being emitted to air from point sources in Sweden annually. Waste incineration facilities contribute around 50 kg of lead out of this quantity. Most of the lead thus ends up in the ash and in most cases goes to landfill. Prohibiting lead in angling tackle might therefore contribute to reduced lead levels in the ash in the longer term.

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[101] Bergbäck, Bo (2006). Faktisk miljöpåverkan av bly i varor samt luftdeposition av bly och annan spridning av bly Delprojekt 2 och 4
[102] Baltic Sea Environment Proceeding No xx, Heavy metal pollution to the Baltic Sea in 2004, Manuscript
[103] Utläppsregistret – KUR, www.naturvardsverket.se, 2004
[104] Baltic Sea Environment Proceeding No xx, Heavy metal pollution to the Baltic Sea in 2004, Manuscript
[105] Jacks et al. (2001). Lead emissions from lost fishing sinkers

12.1.2Alternatives to lead in angling tackle

The reason why lead is used despite the risks is that it is easy to work as it is soft and has a low melting point, in addition to which it is cheap, has a high density and corrodes slowly. There has been extensive development of alternatives in angling equipment in recent years. The most common substitutes for lead are alloys of zinc and iron/steel, but alternatives based on iron, wolfram, tin and bismuth also exist. As the substitutes have a lower density than lead, the volume of the fishing tackle will increase. This means that the fishing tackle will take up more space and may be more difficult to handle. Another problem is corrosion as iron and zinc, for example, corrode more quickly than lead. The increased rate of corrosion means that larger quantities of the substitute, for example iron, will be consumed than in the case of lead.

It is important that the substitutes have less impact on the environment and health than lead. Zinc in high concentrations may have a toxic effect on both aquatic organisms and plants. The toxicity of metals depends on their bioavailability. Studies have shown that zinc is bioavailable as it is absorbed by bladderwrack. Zinc in compounds is classified as highly toxic to aquatic organisms and these compounds may cause harmful long-term effects in the aquatic environment. In a study on mallards fed with tin, nickel and zinc shot, no effect was observed in ducks fed with nickel or tin shot, while 70 per cent of the birds fed with zinc shot had clinical symptoms.[106] This should be considered before substitution with zinc takes place. An advantage of metallic zinc, however, is that it has lower acute toxicity in ingestion or inhalation than lead.

In the United Kingdom zinc and tin are used as alternatives to lead in split shot and sinkers, as the use of lead in split shot and sinkers larger than 0.06 g but smaller than 28.35 g is prohibited [107]. Substitutes for lead have also been developed in Denmark[108].

Split shot

The alternative types of split shot on the market use tungsten[109] and zinc[110]. Lead-free split shot is around 70 per cent more expensive. In those cases where split shot of lead is sold in the same shop as the alternatives, lead-free sales only account for 25 per cent.

Line for example for fly fishing

There are heavy lines for fly fishing that are labelled “Non-toxic – lead-free”. Tungsten is used instead of lead in these lines[111]. Both leaded and lead-free lines are sold in some shops, while others have completely gone over to lead-free fishing lines.

Sinkers

There are many types of sinkers with different functions. An alternative to lead in sinkers is iron, and these sinkers are available in Denmark. A Swedish manufacturer who supplies iron

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[106] The Swedish Environmental Protection Agency and the Swedish Chemicals Agency (2006). Konsekvenser av förbud mot bly i ammunition – ett regeringsuppdrag rapporterat av Naturvårdsverket och Kemikalieinspektionen, NV report 5627 (Consequences of the Swedish ban on lead in ammunition - a government assignment reported by the Swedish Chemicals Agency and the Swedish Environmental Protection Agency) In Swedish with an English summary.

[107] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks

[108] Danish Ministry of the Environment (2006). *Evaluering av blybekendtgörelsen.* Environmental Project Nr 1080

[109] Åström, Bernt, Anglers association in Stockholm, Personal Communication 2007-02-14

[110] Sjövall, Ulf, Darts, Written Document 2007-02-14

[111] Karpestam, Tony, Looptackle, Written Document 2007-02-15

sinkers states that sales of iron sinkers account for 30-50 per cent of its total sales of sinkers and that the price of these sinkers is twice that of lead.[112] There are also sinkers made of lead on the Swedish market.

Lures (trolling spoon, jig head, wobbler and fly)

Zinc, bismuth, tungsten and iron (pieces of reinforcing iron) are used as weights in various types of lures. Lead is being phased out by the major manufacturers.

12.1.3Previous measures

The Swedish Parliament (Riksdagen) established as long ago as 1990 in Government Bill 1990/91:90 that the use of lead should be phased out in the long term and that the phase-out should be mainly implemented through voluntary measures. The report entitled "Phase-out project" which the Swedish National Chemicals Inspectorate (now the Swedish Chemicals Agency) produced on behalf of the Swedish Government was published in 1997. As a result of this report the National Chemicals Inspectorate together with representatives of the angling industry and the Swedish Federation of Fishing Rights Owners conducted an information campaign in 1998 to encourage lead-free fishing. However, this did not produce satisfactory results.

Spofa Spöfiske (Swedish Fishing Tackle Distributors Association), which brings together importers and manufacturers of fishing tackle, states that several suppliers have the phasing-out of lead on their agenda. The Environment and Health Administration of the City of Stockholm has run an information campaign on lead in angling tackle. Following the campaign three shops decided to phase out lead from their product ranges. It emerged that the others did not intend to stop selling lead sinkers until legislation was introduced in the area.[113]

The Commission ordered a consultancy study on the use of lead in fishing tackle in 2004. This study analysed the market for lead in fishing tackle and the economic, social and environmental consequences of possible restriction were evaluated. Arguments both for and against joint regulation in the Limitations Directive 76/769/EEC are described in the report. A factor in favour of a joint approach in the Union is that fishing sinkers poison seabirds and that many of these are migratory birds. The problem of poisoning consequently extends beyond the borders of an individual Member State. An argument in favour of national regulation, however, is that the environmental impact of lead may depend on local water conditions. The fact that private individuals cast fishing tackle containing lead and the risk of lead ending up in waste also favour national regulation. National restrictions may at the same time be an obstacle to free trade. In the subsequent discussion between the Commission and the Member States Sweden has argued for future regulation of fishing sinkers at EU level. However, the Commission finally considered that the basis for regulating fishing sinkers was too weak and that there could also be problems with some of the alternatives. The only environmental problem identified in the report was the risk of poisoning of seabirds, which the Commission did not consider to be sufficient reason for restriction, The Commission therefore decided not to proceed with any regulation of fishing sinkers in the Limitations Directive. The conclusion drawn by the Commission from the study was instead that the EU should press for lead to be prohibited in the OSPAR convention for the protection of the

[112] Lindholm, Leif, Wiggler, Written Document 2007-02-14
[113] The City of Stockholm's Environment and Health Administration (2007). *Dags att sluta sälja blysänken?* Information on lead

marine environment in the North-East Atlantic. Lead is included in the OSPAR list of chemicals for priority action. Lead is also a chemical for priority action in the Water Directive 2000/60/EC.[114]

However, the Swedish Chemicals Agency and the Swedish Environmental Protection Agency regard the Commission report as deficient, as aspects of waste are not included in the assessment. In addition there are less environmentally harmful and hazardous alternatives to lead in fishing tackle today.

Denmark has already introduced a prohibition on lead in angling tackle, and Sweden therefore ought also to be able to do so. Norway too is investigating the prospects of banning lead in fishing tackle.

12.1.4 Justification of further measures

The principal environmental reasons for regulating angling tackle that contains lead are the poisoning of seabirds and the risk of environmental pollution in waste management.

A strong health reason for regulating lead is the melting of lead as a hobby activity, which leads to human exposure to lead oxide. The melting of lead poses risks, and the Swedish Work Environment Authority has issued rules on how employees are to be protected in the melting of lead. As private individuals do not have the same opportunities for protective measures, this activity should not be undertaken as a hobby.

As the voluntary phasing-out of lead in angling has been in progress for 15 years without adequate results having been achieved, stronger incentives are needed. The Health and Environment Authority in the City of Stockholm has conducted a survey among nine fishing tackle dealers. The respondents included small specialist shops and large chain stores such as ICA and Coop. All the shops except one supplied lead sinkers.[115] It can be seen from Table 1 that the quantities of lead used in angling have not fallen from 1995, despite information campaigns to encourage lead-free fishing in 1998 by the National Chemicals Inspectorate, the Federation of Fishing Rights Owners and the industry organisation Sportfiskarna (Swedish Angling Association).

There are alternatives to lead that are less hazardous to the environment and harmful to health. The industry association Spofa Spöfiske regards a prohibition as justified for pure lead products such as split shot and sinkers. The use of fishing tackle containing lead is already prohibited locally in certain watercourses. A uniform restriction would send clearer signals and be simpler to comply with.

It is likely that as long as there is angling tackle both with and without lead in the shops, some consumers will choose fishing tackle that contains lead out of habit.

In the United Kingdom it is prohibited to use lead in split shot and sinkers larger than 0.06 g but smaller than 28.35 g [116]. In Denmark, where lead in fishing tackle for angling has been prohibited since 2000, substitutes for lead have also been developed[117].

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[114] Swedish Chemicals Agency, minutes, Brussels, 2005-05-20

[115] The City of Stockholm's Environment and Health Administration (2007). Dags att sluta sälja blysänken? Information on lead

[116] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks

[117] Danish Environmental Protection Agency (2006). *Evaluering av blybekendtgörelsen* Environmental Project Nr 1080

In Sweden there are many lakes and also many anglers, with 13 per cent of the Swedish population fishing for leisure[118]. This is more than in other countries in Europe, only Finland having more anglers than Sweden in proportion to population. The average in the EU is 6.5 per cent[119]. The environmental impact of angling tackle is therefore a particularly important issue for Sweden to pursue, both nationally and in the EU.

The Swedish Environmental Protection Agency and the Swedish Chemicals Agency therefore propose that lead in angling tackle be restricted.

[118] http://www.fiskeriverket.se/vanstermeny/statistikochdatabaser/svenskarsfritidsfiske.4.624ca9d110071d953a80008.html 21/3-07

[119] EAA (European Anglers Alliance)

12.2 Fishing gear for commercial and subsistence fishing

12.2.1 Exposure

Casting of fishing gear

The casting of lead to produce fishing gear is carried out both among manufacturers and among individuals who fish commercially and for leisure. Emissions in professional casting are estimated at 1-10 g per kilogram of molten lead[120]. The Swedish Work Environment Authority specifies a number of requirements to protect employees in work with lead, for instance with respect to ventilation and protective clothing.

Use

Nets may be lost in use. The lead is woven into a long rope, a head rope of nylon in the nets[121]. The lost lead therefore does not come into direct contact with the water. The Swedish Fishermen's Federation states that fewer and fewer nets are being lost as it is possible to establish quite precisely with modern technology where fishing gear was deployed. Consequently it is possible to retrieve lost nets. Based on calculations and large-scale dragging exercises, the cumulative quantity of nets in the Baltic Sea has been estimated at 1000 km, and this quantity of net should contain around 75 tonnes of lead. The National Board of Fisheries calculates that the same quantity has been dispersed from Denmark and around twice as much from Poland[122].

The lead becomes worn in trawling, and it is anticipated that a trawl with lead will last 10 years[123]. No major wear of the lead occurs in the use of purse seines unless the purse seines are used in shallow water where there is a stony bottom, in which case visible wear takes place[124].

Corrosion of lead entails dispersal to the environment which may lead to organisms being exposed to higher levels of lead than the natural background level. Corrosion of metallic lead depends on several factors, such as the pH value. As it has been estimated that the annual loss of weight due to "lost" fishing sinkers is around 1 per cent, this rate of corrosion has been assumed to represent a realistic value.[125] If the consumption of lead for fishing tackle for angling is around 200 tonnes per year, this means that 2 tonnes of lead per year is corroded. The total burden of corroded lead from fishing sinkers is therefore substantially higher if account is taken of the accumulated quantities of fishing sinkers which are also assumed to corrode at around 1 per cent per year. This can be compared with the total quantity of water-borne lead, around 40 tonnes, which enters the Baltic Sea annually from Swedish watercourses. [126] The major Swedish land-based point sources of lead to water account for around 2 tonnes of this[127]. Information on the other sources of water-borne lead is completely lacking,[128] but a certain proportion originates from soil pollution resulting from the thousands of years of mining and use of lead.

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[120] Lassen et al. (2003). Masströmelseanalyse av bly
[121] Gustavsson, Mårten, The Swedish Board of Fisheries, Personal Communication 2007-01-11
[122] Per Olov, Larsson, The Swedish Board of Fisheries, Written Document 2007-03-05
[123] Eliasson, Bo, Västkusten Trålbinderi, Personal Communication 2007-02-28
[124] Wallentinson, Daniel, The Swedish Board of Fisheries, Personal Communication 2007-01-15
[125] Bergbäck, Bo (2006). Faktiskt miljöpåverkan av bly i varor samt luftdeposition av bly och annan spridning av bly Delprojekt 2 och 4
[126] Baltic Sea Environment Proceeding No xx, Heavy metal pollution to the Baltic Sea in 2004, Manuscript
[127] Utläppsregistret – KUR, www.naturvardsverket.se, 2004
[128] Baltic Sea Environment Proceeding No xx, Heavy metal pollution to the Baltic Sea in 2004, Manuscript

Waste management

A net manufacturer states that it receives up to 5-6 tonnes of lead from commercial fishermen in old nets, which it then re-uses. As float and sink lines make up 30-40 per cent of the price of a net, this is worthwhile.[129] The National Board of Fisheries sometimes carries out collections of old net, known as ghost net, but it has been discovered that it is difficult to ensure that the nets are disposed of when brought to land. It is common in trawling for boats to take nets that have been lost on the bottom with them. The nets are then dumped in the containers parked in harbours. As the lead is woven into head ropes, there is no simple way of separating the lead from other waste. There is no system for dealing with fishing tackle in harbours. There is a waste management centre in the port of Karlskrona, but it is not intended for fishing tackle, which the fishermen have to dispose of themselves[130]. It also happens that the lead in old fishing tackle is melted down and sold as scrap. If fishing tackle containing lead is not separated from other waste it may end up among ordinary household waste and be incinerated, which results in elevated levels of lead in the ash that goes to landfill (see 13.2.1).

End-of-life purse seines are returned to the seller, who is often in Denmark or Norway.[131]

12.2.2 Alternatives

Steel, zinc and/or iron are identified as alternatives to lead in fishing tackle. As the alternatives have a lower density than lead, the volume of the fishing tackle may increase. This means that they will take up more space and may be more difficult to handle. Replacing lead with iron, for example, may have an impact on the working environment of commercial fishermen as a noise occurs when the nets strike the boat. This needs to be studied more closely. It is also important that the environmental impact of the substitutes is investigated. The properties of zinc are discussed in 12.3.2 as it is also used in angling. Corrosion of zinc may have an adverse effect on the textile in the net[132].

Nets

There are alternatives today for head ropes in nets based on zinc, but they are not marketed as they are more expensive than lead head ropes. According to the Danish appraisal of the prohibition of lead the lack of head ropes for nets is due to economic and market incentives and not deficient technology[133]. There are no alternatives to lead in nets for commercial fishermen at present[134].

In Finland there is a net manufacturer who uses head ropes of specially treated iron wire coated with PE plastic. For the time being this is only done with light head ropes, max. 2.5 kg per 100 m, which are suited to subsistence fishing and can be used for lake fishing but not fishing at sea. These are also on the Swedish market. The company is also developing nets with heavier sinking lines, 3-15 kg per 100 m, which they anticipate can be on the market in the summer of 2007. This type of net is required for it to be possible for lead-free commercial fishing with nets to be carried out.[135]

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[129] Gustavsson, Joakim, Blekinge Fiskeredskap, Personal Communication 2007-01-22
[130] Lars Håkan Winkler. Hamnchef Karlskrona, Personal Communication 2007-01-22
[131] Johansson, Börje, Yrkesfiskare, Personal Communication 2007-01-12
[132] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks
[133] Danish Environmental Protection Agency (2006). *Evaluering av blybekendtgörelsen* Environmental Project Nr 1080
[134] Gustavsson, Joakim, Blekinge Fiskeredskap, Personal Communication 12-01-07
[135] Lindeman, Helena, AB Lindeman Oy, Personal Communication 2007-01-12

Trawls

Two main types of trawls are used, bottom trawls for fish that live on or close to the seabed and floating trawls for fish that live between the seabed and the surface. Different types of weights may be needed in the trawls for different types of bottom. Over the past 10 years lead has been phased out as a sinker in all trawls except for bottom trawls for crayfish fishing. Alternatives to lead sinkers in trawls may be a chain, or a rubber sweep, which is a steel cable with a disc of rubber. Rubber sweeps can also used in fishing for crayfish, with the advantage that they are more resistant to wear than lead[136]. There are also combination lines, which are lines of steel covered with a string[137].

Purse seines

There are lead-free alternatives to lead sinkers in purse seines on the market in which a steel cable is used instead.[138] Newly purchased purse seines in Sweden do not contain lead.

12.2.3Previous measures

In 1990 the Swedish Parliament (Riksdagen) established that the use of lead in the long term should be phased out and that the phase-out should take place principally through voluntary measures[139]. The report entitled "Phase-out project" which the Swedish National Chemicals Inspectorate (now the Swedish Chemicals Agency) produced on behalf of the Swedish Government was published in 1997. It is stated in this report that commercial fishermen should present a plan for the phasing-out of the use of lead in fishing gear, and that the plan should be presented to the National Chemicals Inspectorate in 2000. It is also pointed out in the report that joint information efforts should be made to persuade commercial fishermen not to use lead in their gear. With the aim of pressing for a phase-out plan, the National Chemicals Inspectorate organised meetings in the late 1990s with the Swedish Fishermen's Federation (SFR), but this work did not result in any plan for phasing out.[140]

In 2004 the Commission carried out a study on fishing gear and options for restrictions (section 12.1.3.).

12.2.4Justification of further measures

One reason for further measures against lead in fishing gear for commercial and subsistence fishing is the risk of environmental pollution at the waste stage. The melting of lead by individual fishermen also needs to be dealt with as it leads to exposure to lead. The melting of lead poses a risk, and as the Swedish Work Environment Authority has issued rules on how employees are to be protected in the melting of lead, this activity should only be performed professionally.

As there is no phase-out plan for lead in fishing gear, voluntary measures are not sufficient. There are alternatives to lead in purse seines and trawls. The Swedish Fishermen's Federation is in favour of the regulation of lead provided this is done at EU level[141].

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[136] Edvardsson Dan, Hönö Vadbinderi, Personal Communication 2007-02-28
[137] Andersson, Jan Olof, Fiskareföreningen Norden, Personal Communication 2007-02-28
[138] Johansson, Börje, Yrkesfiskare, Personal Communication 2007-01-12
[139] Government Bill 1990/91:90
[140] Swedish Chemicals Agency (2001). Lägesbeskrivning för avveckling av bly, bromerade flamskyddsmedel, kvicksilver, nonylfenoletoxylater, klorparaffiner KemI PM 1/01
[141] Lindberg Fredrik, Sveriges Fiskares Riksförbund, Personal Communication 6/3-06

As the draft of the Danish executive order (section 7.1) prohibits imports of sinkers for commercial fishermen from 1 December 2007 and the sale of sinkers from 1 June 2008, a similar arrangement should be possible in Sweden. The same applies to head ropes, where the Danish proposal is that the prohibition of import and sale should come into force on 1 December 2011 and 1 June 2012 respectively. The prospects of a ban are also being studied in Norway.

12.3 Other consumer products

Only some of the consumer products described in section 10.13 are included in priority group one. The consumer products that have been prioritised here are the ones for which there is information to the effect that use may pose a risk to health. The prioritisation has also been conditional on the product group as such not currently been covered by restriction rules (see Annex 4, Criteria for selection of product groups to regulate). An example of a consumer product that has been deselected in accordance with these criteria is ceramics. There are restriction rules for ceramics. Suitable measures in these cases are increased supervision rather than proposals for new rules. Nor have Ayurvedic preparations been prioritised as this group of articles comes within the area of responsibility of the Medical Products Agency and a dialogue between the authorities is required to find suitable measures to limit risk.

This section is concerned with *Tin soldiers/solder tin for hobby use, jewellery and other accessories, crayons for hobby use* and *candle wicks.* Note that these prioritised consumer products are not the result of a systematic review of existing products on the market that contain lead. There are probably other consumer products with equivalent risks, which means that the list of consumer products that should be regulated could probably be made longer.

12.3.1 Exposure

Tin soldiers/solder tin for hobby use

The exposure that arises in connection with the casting of tin soldiers and in the use of soldering tin is similar to the exposure to which anglers are subject in the casting of lead sinkers. When lead melts lead vapour containing small inhalable lead particles arises, and the uptake of these emissions in the lung can be estimated to be almost one hundred per cent.

Jewellery and accessories

There have been cases of poisoning in Japanese children who have ingested large quantities of lead from jewellery[142]. According to a Japanese newspaper report[143] extraction experiments have been conducted with jewellery under conditions resembling the environment in the stomach. One of the items of jewellery tested leaked 56 times more lead than the limit value for leakage applicable in the United States. Poisoning has also been reported from the United States, where a 4-year-old girl died from lead poisoning after swallowing a piece of a gilt necklace. The necklace contained a large proportion of lead and had been imported from China.[144] No cases of poisoning caused by such use have been reported in Sweden, but this could also occur in Sweden as items of jewellery for adults and toy jewellery containing large levels of lead may sometimes be encountered in Swedish shops.

Crayons for hobby use

The Swedish Chemicals Agency has recently measured levels of lead in crayons from China at up to 94 grams/kg or 9.4 per cent[145]. If a child were to swallow a piece of the pastel crayons that the Swedish Chemicals Agency has analysed, a 13,000th part of one of these crayons would be sufficient to reach the tolerable total daily intake for lead, 25 µg lead/kg body weight. There are no documented data on this, but there are data from the United States where children have suffered lead poisoning after sucking on a crayon intended to be used as

[142] Hilmersson, Louise, Embassy of Japan, Personal Communication, 2006-06-08
[143] The Asahi Shimbun, 2006-03-08
[144] RAPEX, 2006, week 12, 23, 0191/06
[145] Swedish Chemicals Agency, unpublished

billiard cue chalk. One crayon contained 7200 µg/lead, and the 3-year-old girl who had had it in her mouth had a level of 1.7 µmol lead/l blood.

Candles

Scented candles/gel candles in which the wick contains lead may lead to lead exposure. When these candles are lit lead vapour is released, which may result in high concentrations of lead in the air. There have been several studies of this, with varying results, with levels ranging between 0.02 and 49 µg/m^3 air. In a study from 1973, a level of 16 µg lead/m^3 indoor air (mean value) was measured in a room in which four candles had burnt out. These measurements were performed over a period of 13 hours. The applicable limit value for the level of lead in indoor air in general is 0.1 mg lead/m^3 for total dust and 0.05 mg lead/m^3 for respirable dust (AFS 2005:17).

The lead released in burning then settles as a dust on the floor and furniture and represents a source of further exposure for both children and adults, for example in cleaning. Some of the lead dust that is cleaned away ends up in the wastewater or in solid waste.[146]

12.3.2 Alternatives

Tin soldiers/soldering tin for hobby use

Soldering tin that does not contain any lead has been on the market for many years. According to the leading importer, the alternatives account for around 90 per cent of the market. The alternatives can be considered to work well, but the melting point may be slightly higher. However, this does not generally pose a major problem. There may be problems with the alternatives in some cases as they do not flow out as well as the soldering tin that contains lead, which means that that the mould used in casting is not properly filled. The most common alternative is 'star metal', which mostly consists of tin. Star metal is around 15-20 per cent more expensive than the equivalent grade of solder containing lead.

Jewellery and accessories

Lead is added to some cheap items of jewellery to give them weight and make them appear exclusive. The alternatives, apart from genuine jewellery, are items of jewellery that contain lead-free alloys. The advantage of leaded jewellery is that it can be sold at a substantially lower price than genuine jewellery.

Crayons for hobby use

Almost all crayons on the market are free of lead and work just as well as or better than crayons that contain lead.

Candles

Lead is used in certain types of candles (gel candles, scented candles) to give the wick firmness. The alternatives present on the market which meet the same needs as leaded wicks are thicker fabric wicks or wicks containing other metals such as zinc or tin.[79] Producers in Europe do not use zinc or in their wicks, but these metals are relatively common in candle wicks in the United States. According to an investigation by the European Commission[147]

[146] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks

[147] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks

there are no significant technical obstacles to replacing the technology in the production process of candles that need firmness in the wick.

The Association of European Candle Manufacturers (AECM) worked successfully on the phasing-out of lead in candle wicks during the seventies and eighties and argues for an EU-wide ban. The Association also proposes a limit value of 0.06 per cent lead as zinc naturally contains these levels.

12.3.3Justification of further measures

Under the Limitations Directive, chemical products sold to consumers may not contain lead as all lead compounds are classified as toxic to reproduction. It may therefore be reasonable to set equivalent requirements for all consumer products that contain lead and in particular products for which there are documented cases of lead exposure that can lead to ill-health. Regulating the lead content of certain consumer products is therefore a reasonable strategy that can be regarded as crucial to attaining the environmental quality objective of A Non-Toxic Environment. Tin soldiers, jewellery, crayons and candles are examples of such consumer products.

The Toys Directive regulates some of the articles identified here as consumer products, for example crayons intended for children, but a large number of the groups of articles mentioned are not regarded as toys, such as pure hobby products or jewellery. Rules aimed at consumer products would therefore have greater scope with regard to types of products and numbers.

There are rules prohibiting lead in jewellery in the United States and Canada, and the introduction of similar rules is under consideration in Japan.[148]

Other countries such as Finland, the United States, Canada and Australia have introduced rules banning lead in candles.

[148] Hilmersson, Louise, Japans ambassad, Personal Communication, 2006-06-08

12.4 Lead in aviation gasoline

12.4.1 Exposure

The manufacturing of aviation gasoline by adding lead is one of the few operations in Sweden in which organic lead compounds are used. The fact that the lead is organically bound means that it rapidly reaches the blood via the inhaled air and even small amounts can affect the human brain and nervous system. Handling at the manufacturing stage primarily signifies a working environment and health-related exposure. Work that may entail exposure to lead is regulated in the regulations of the Swedish Work Environment Authority with a maximum permitted level of exposure and regular medical checks.

When the aviation gasoline is used, lead is dispersed to air, water and soil over large areas. This dispersal means that it is impossible to dispose of the used lead.

There is a risk of spillage and leakage in connection with the refuelling of aircraft, despite measures being taken to attain safe and controlled handling. This can lead to lead being dispersed in the soil and also to the leaded fuel reaching the groundwater and polluting it[149].

12.4.2 Alternatives

Lead-free aviation gasoline exists but holds only a small part of the market. It has been manufactured and sold since 1981 by a small Swedish oil company. Sweden is the only country in the world to market lead-free aviation gasoline. It has been sold since 1 February 2007 at a price that is 50 öre lower per litre than the fuel containing lead. Sales of unleaded aviation fuel are increasing.

According to the supplier of the unleaded aviation gasoline many flyers are conservative and are controlled by what the mechanics tell them. They therefore refuel with leaded fuel without having any need to do so. Around 70 per cent of aircraft engines are certified for the lower octane number of unleaded aviation gasoline, but only around 30 per cent of these use the unleaded alternative.[150]

The engine makers state the minimum permitted octane number for a specific engine. Around 90 per cent of the aircraft used for sports and recreational flying can be powered by unleaded aviation gasoline. It is principally in utility aviation, for example air taxi flying, that larger aircraft which require the leaded fuel with a higher octane number are used. The octane number required for an engine is stated on the engine plate and can be read by the user.[151]

When the aircraft manufacturer has to certify an aircraft, the type of aviation gasoline that is easiest to obtain is used. In the United States, where most aircraft manufacturing and certification takes place, 100 octane leaded aviation gasoline is standard and unleaded aviation gasoline is not available. The aircraft are therefore certified for leaded fuel, and it is this 100 octane aviation gasoline that is stated in the aircraft manual. An aircraft is therefore often certified for a higher octane number than the engine in the plane requires. However, using unleaded fuel does not mean infringing the rules, provided the engine is approved for the lower octane number, even if the aircraft is not certified for this type of fuel. However, many aeroplane owners use leaded aviation gasoline to be on the safe side as it is this type of fuel that is specified in the manual[150].

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[149] County Administrative Board of Stockholm (2005). Förorenade områden. Inventering av gasverk, flygplatser, bilfragmentering, glasindustri och ackumulatorindustri i Stockholms län. Report 2005:04

[150] Hjelmberg, Lars, Hjelmco Oil, Personal Communication 2007-02-23

[151] Toth, Josef, Responsible for fuel supply Barkaby Flygklubb, Personal Communication 2007-03-05

The unleaded aviation gasoline offers many benefits in addition to being free of lead. It means that aeroplane engines can be operating longer between each overhaul. It does not contain any ozone-depleting substances such as bromine, as leaded aviation gasoline does. Nor does the unleaded alternative lead to such great particle dispersal in use, between 50 and 100 per cent lower than in the use of leaded aviation gasoline.[152]

The flying clubs the Swedish Chemicals Agency has spoken to [153] have nothing but positive experiences of unleaded aviation gasoline to relate. Unleaded fuel has been used for many years and it is felt to be conservative thinking and to some extent ignorance that explain why many people continue to use leaded fuel.

Only two of the 16 airports managed by LFV (formerly the Swedish Civil Aviation Administration) currently have refuelling points for unleaded aviation gasoline. There are refuelling points for unleaded aviation gasoline at around 70 places in Sweden. At most airports it is uneconomic to have refuelling points for both leaded and unleaded aviation gasoline, and a decision is often made to supply the leaded alternative with which all the aircraft concerned can be operated. [154]

12.4.3 Justification of further measures

As the lead in aviation gasoline is organically bound, dispersal and exposure represent a health risk despite the relatively small quantities involved. The prohibition of lead in petrol for road vehicles was of decisive significance in reducing use and dispersal. Despite aviation gasoline being used in substantially smaller volumes, it is important also to minimise this use of organically bound lead. The importance of lead for engines was exaggerated for a long time by the automotive industry, but most engines claimed to need lead turned out to work just as well without it. Breakdowns in the engines have worse consequences for an aircraft in the air than for a car on the ground, however, and further safety aspects therefore have to be taken into account.

Aircraft approved for operation with unleaded fuel can also be flown with leaded fuel, and an active choice therefore has to be taken between the two alternatives at the time of each refuelling in cases where the two alternatives are available. Well-established habits appear to mean that environmental factors are not a sufficient incentive to choose unleaded.

In Denmark leaded aviation gasoline is prohibited but for practical reasons an exemption has been granted for this use of lead until March 2008. The limited Danish market means that it is difficult to supply both leaded and unleaded aviation gasoline. A decision has therefore been taken only to supply leaded fuel, which can be used for all private aircraft. However, the Danish oil industry is not particularly interested in continuing the sale of leaded aviation gasoline as it is awkward and expensive to handle.[155] If more countries introduce bans on leaded aviation gasoline the market will grow, thus clearing the way for more countries to introduce similar restrictions.

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[152] Hjelmberg, Lars, Hjelmco Oil, Personal Communication 2007-02-23
[153] Linköpings flygklubb, Barkaby flygklubb
[154] Hjelmberg, Lars, Hjelmco Oil, Personal Communication 2007-02-23
[155] Danish Environmental Protection Agency (2006). *Evaluering av blybekendtgörelsen.* Environmental Project Nr 1080

A sharp rise in fuel prices might speed up the development of aircraft engines. The development of piston engines for aircraft has remained at more or less the same level since the 1930s[156].

[156] Mofly Newsletter (2006). *Hotande skatt i horisonten*, 2006-08-04

12.5 Batteries

12.5.1 Exposure

No lead batteries are manufactured in Sweden. There is relatively little human or environmental exposure during the use of lead batteries. As described previously, almost 100 per cent of all used lead batteries in Sweden are collected and sent to Boliden Bergsöe in Landskrona for recycling. Approximately 100 kg of lead is emitted to air and approximately 5 kg of lead to water annually in the recycling of lead batteries. The total exposure to lead is therefore relatively low during the first cycle of recycling of batteries but may be higher when the lead batteries are recycled into new lead products.

12.5.2 Alternatives

As hybrid cars and other alternatives to petrol-engine cars gain market shares, other types of batteries that do not contain lead are also starting to appear.

Nickel metal hydride batteries and lithium ion batteries are the alternatives that are in use today and are most relevant. However, it may take another three to five years before lithium ion batteries are sufficiently reliable and economic to be mass-produced[157]. Basic research to continue the development of the lithium ion battery is being undertaken for instance at the Department of Materials Chemistry of Uppsala University[158], which in turn forms part of a European network, Alistore, focused on developing advanced energy storage systems based on lithium[159].

Present-day lead batteries will continue to exist and will dominate the market for many years to come, as it will take a long time before the entire national fleet has been replaced. A possible technique for reducing the flow of lead to batteries in the meantime might be regeneration/pole reversal of lead batteries. The present-day life of around 5 years for a starter battery could then be doubled[160]. The Reaccumulation system AB company in Karlstad[161] markets a technique to recreate and raise capacity in various kinds of batteries and supply replacement cells, both for lead acid batteries and nickel cadmium batteries. To date this has principally related to traction and stationary batteries. With regard to large submarine batteries, no long-term tests have yet been carried out, and the method therefore cannot yet be regarded as a relevant alternative for these batteries in the present situation[162].

12.5.3 Justification of further measures

Batteries account for easily the largest supply of lead to society and in the present situation are a factor driving the use of lead in other products both in Sweden and in the rest of the world through the input of virgin lead.

In the ELV Directive (Directive 2000/53/EC on End-of-Life Vehicles) lead is prohibited in cars, with the exception of applications where there are no alternatives. Lead batteries are one such exception. The Commission's Environment Directorate-General now plans to conduct a

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[157] Swedish Chemicals Agency, internet consultation, Catharina Nordeman, Boliden Bergsöe, 2006-02-20
[158] Torbjörn Gustafsson, Ångström Advanced Battery Center, Department of Materials Chemistry, Uppsala University, Personal Communication 2007-04-03
[159] Alistore, European Network of Excellence on "Advanced Lithium Energy Storage Systems" http://www.u-picardie.fr/alistore/
[160] Boivie, Staffan. 2005-09-02. Reconditioning lead acid batteries for optional use in a reverse operational mode. United States Patent, Number 5,652,497. July 29, 1997.
[161] www.reacc.se
[162] Undén, Magnus, Donk Industries, Personal Communication 2007-02-12.

study to examine what alternative battery technologies are under development. The annex to the ELV Directive containing exemptions to the prohibition of lead is revised and updated regularly and in line with technical and scientific development in the area. A technical implementation committee comprising representatives of each EU Member State and chaired by the European Commission regularly monitors technological development and adapts the directive to it. The Swedish Environmental Protection Agency sits on this committee and acts on instructions from the Swedish Government Offices and in line with the Swedish environmental objective that newly produced articles as far as possible should be free of lead.

Lead batteries are regulated at EU level in the Batteries Directive, which is implemented in Swedish law through the Batteries Ordinance (1997:645). This Directive was revised in 2006 (2006/66/EC). Collection and recycling targets have been introduced in conjunction with the revision. Prohibitions on nickel cadmium batteries in certain types of applications have also been introduced, but no prohibition of batteries containing lead. In conjunction with the newly completed revision of the Batteries Directive demands were made for batteries containing mercury and cadmium to be prohibited where there are alternatives free of heavy metals. These demands did not, however, meet with any response from either the Council or the Parliament. It was consequently considered that there was no point in raising the issue of a ban on lead batteries, where satisfactory alternatives are often lacking. The next revision of the Directive is planned for after 2016. The original Batteries Directive is incorporated into Swedish law through the Batteries Ordinance (1997:645). The additional revisions have not yet been incorporated into Swedish law.

The Swedish Environmental Protection Agency considers there to be factors driving a high collection level for batteries and that these factors are particularly strong at present due to the high market price of lead. On the other hand there are no particular factors favouring reduced use of lead other than indirectly through the environmental quality objective of reduced climate impact. The ever increasing demand for different engines and fuels will probably lead to the disappearance of lead batteries in the longer term. However, lead batteries will continue to be very much the dominant area of use for lead for a long time to come.

The Swedish Chemicals Agency and the Swedish Environmental Protection Agency nevertheless consider it important to follow developments both in Sweden and the EU closely. If the interim target of newly manufactured finished products being free of lead is to be attained, there is a need for extensive technical development of lead-free battery alternatives. Lead is an element that is extracted as a by-product in a large number of mines around the world. Even if the pure lead mines were to be closed throughout the world as a result of a successful policy to phase out lead in new articles, most of the lead production from ore raw material would remain. This is due to the fact that a large proportion of deposits consist of complex sulphide ores where lead ore concentrate is a by-product principally in the production of zinc. The continued demand for zinc is thus the underlying reason for the market’s access to lead.

There is therefore a risk of lead in the future being used in new articles if the need for lead in the battery sector declines, and it is important that the authorities then have powerful instruments at their disposal with which to safeguard health and the environment.

12.6 Iron sand

12.6.1 Exposure

Iron sand is dispersed in the same way as other blasting material or other material for road-building and construction purposes and can reach the environment directly or indirectly. It is difficult to establish where the iron sand ends up after the road or construction has reached the end of its life. The lead-containing leachate/leakage may reach springs, ditches or streams. The exposure situation is thus unclear.

12.6.2 Alternatives

Iron sand is a residual product from metal smeltworks, and is not produced for a particular use. It has been found, however, that iron sand can be used for certain purposes, for example road-building and construction or blasting. It is a benefit from the point of view of resources to be able to re-use residual products and waste as it saves newly produced products, but there may a risk of a conflict of aims between saving of resources and the objective of a non-toxic environment. Iron sand is an inexpensive alternative to other blasting or construction material.

12.6.3 Justification of further measures

It is difficult to propose measures to limit iron sand at present as the prospects of doing so are dependent on whether iron sand is a product (raw material, substance, preparation) or waste material.

REACH covers raw materials, substances and preparations, but not waste. When all titles in REACH comes into force, requirements for registration and risk assessment will gradually also come to apply to iron sand, provided iron sand has ceased to be waste. If iron sand is still to be regarded as waste, it is the rules under the Framework Directive on Waste and its national implementation in Sweden that apply.

The rules on waste are also the object of adjustments at EU level. One of the areas in which revision is relevant is the protective measures and requirements that should apply to different types of recycling of waste. Another area in which revision at EU level is relevant is the criteria that are to be fulfilled it to be possible for waste to be regarded as having ceased to be waste.

At national level the Swedish Environmental Protection Agency is now pursuing work on behalf of the Government aimed at establishing criteria to utilise waste for construction purposes. The aim is to draw up guidance for the assessment of the circumstances under which it is appropriate or inappropriate to re-use a waste material such as iron sand for construction purposes.

In view of the fact that many activities are in progress both nationally and in the EU with regard to increased requirements for risk assessment of both products and waste, the Swedish Chemicals Agency and the Swedish Environmental Protection Agency do not consider there to be reason within the framework of this commission to propose further measures for iron sand.

The example of iron sand makes it clear, however, that the objective of the strict policy in relation to lead in articles (phasing out lead in newly manufactured articles and handling existing articles that contain lead in such a way that nothing leaks into the environment) will not be successfully met unless the rules on waste also have the same orientation and level of ambition.

13. THE SWEDISH CHEMICALS AGENCY'S ANALYSIS OF LEGAL OPTIONS FOR RESTRICTIONS

Restricting rules can be introduced either as national rules or as joint rules for the whole of the EU. The legal conditions to be met for restriction are analysed in this chapter.

13.1 Harmonised legislation in the EU

With regard to free movement of goods, this secondary law is often based on Article 95 of the Treaty, which signifies approximation of the legislation and other statutory instruments of the Member States with the object of the establishment and functioning of the internal market. If there is such as an act that covers the relevant area, the individual Member States do not have the option of introducing stricter national rules, with the exception of the 'environmental guarantee' as described more closely below. Chapter 6 and Annex 3 describe various secondary legislation that regulates lead in a harmonised manner.

In the judgement of the Swedish Chemicals Agency this means that it is possible for Sweden to introduce restrictions on lead in articles nationally if the content of lead in the product concerned is not explicitly restricted in the restrictions section of REACH or in other harmonising European Community legislation.

13.1.1 Environmental guarantee

The environmental guarantee means that a Member State after a harmonisation measure according to Article 95 has a certain limited opportunity to either maintain previous stricter national rules or to introduce *new rules* in the harmonised area. The environmental guarantee is described in Article 95(4) and (5).

The possibility of maintaining existing national rules that have come about prior to the harmonisation measure is described in paragraph 4. A substantial need in accordance with Article 30 of the Treaty must be concerned, for example relating to the environment or the working environment. The Member State has to notify these provisions to the Commission according to the environmental guarantee and state reasons for retaining them.

The possibility of creating *new* rules is substantially more restricted. Under paragraph 5 the stricter rules have to be based on new scientific evidence related to environmental protection or protection of the working environment. The rules have to be introduced to solve a problem that is specific to the individual Member States and that has arisen *after* the harmonisation measure was adopted. If this is the case, the Member State has to notify the Commission of the planned provisions and the reasons for them.

The Commission then, under paragraph 6, has to approve or reject the national rules within six months (which may be extended to twelve months). The rules are rejected if they can be considered to be a means of arbitrary discrimination or a disguised restriction on trade. If the Commission has not taken a decision within six months (which may be extended to twelve months), the national rules are deemed to have been approved.

The Commission or another Member State may bring the case against the country before the European Court of Justice if it is deemed that the national rule represents arbitrary discrimination, for example by protecting the country's own market.

13.1.2 Safeguard clauses

Another way in which the individual Member State can act, in addition to the environmental guarantee, is by taking provisional measures in the harmonised area pursuant to safeguard clauses in relevant European Community legislation, for example the safeguard clause in REACH (Article 129). The criterion for measures is that the Member State has justifiable grounds for believing that urgent action is essential to protect human health or the environment.

The provisional measures have to be reported to the Commission, which will take a decision on whether these measures are to be adopted. The Commission may, if appropriate, initiate a restriction procedure at community level.

13.2 Restrictions in the EC Treaty on national rules

In cases where there is no regulation at EU level or where the regulation that exists is not aimed at harmonisation, it is possible for the Member States to introduce national rules. However, the possibility is not unlimited as account always has to be taken of the rule contained in Article 28 of the EC Treaty concerned with free movement of goods. Article 30 lays down exceptions to Article 28, and national regulations are thus permitted if they are based for example on environmental concerns[163].

Account must be taken of the principle of proportionality when introducing national rules (this also applies in use of the environmental guarantee). The principle of proportionality means that no public interventions may go further than is actually needed to fulfil the underlying purpose. The measure involving the least intervention is to be chosen if there are alternative solutions. The regulation must not be more burdensome or far-reaching than can be regarded as necessary to fulfil the purpose. Balance must prevail between ends and means and it must be probable that the end can be achieved with the means employed. The restriction must be in reasonable proportion to the purpose.

If a prohibition which for natural reasons is highly obstructive to trade is proposed, the country must show that the prohibition is necessary to attain the purpose, i.e. to safeguard health or the environment. The broader the prohibition is, for example a general prohibition of all articles containing lead, the more of an obstacle to trade the measures become. This means that it may be more difficult to defend the prohibition if the assessment of risk does not point to the same risk for all types of articles containing lead.

Nor, under Article 30, may the national rule represent a means of arbitrary discrimination or contain a disguised restriction of trade between the Member States.

13.3 National prohibition pursuant to the Environmental Code

The Swedish Environmental Code contains fundamental environmental provisions aimed at promoting sustainable development, which means that present and future generations are assured of a healthy and sound environment, Under Chapter 1 Section 1 of the Environmental Code human health and the environment must be protected against damage and detriment, whether cased by pollution or other impacts.

In Chapter 2 of the Environmental Code there are general rules of consideration, with requirements to be met by persons who pursue activities in relation to knowledge, precautions

[163] For further information, Examine the EC Court of Justice, case 120/78 Cassis de Dijon.

and choice of less dangerous products. Section 2 requires everyone to acquire the knowledge needed to protect human health and the environment against damage or detriment. The precautionary principle (Section 3) requires all persons who pursue activities to take precautions that are necessary in order to prevent, hinder or combat damage to human health or the environment. The principle of substitution (Section 6) stipulates that products that may involve harm to human health or the environment must be avoided if less dangerous products can be used instead. The principle of substitution applies to everyone, both traders and consumers.

Chapter 14 of the Environmental Code regulates chemical products and certain articles. Under authorisation contained in Chapter 14, the Swedish Government may provide that the provisions that relate to chemical products shall be applicable to articles that contain or have been treated with a chemical product. Such special provisions apply, for example, to articles that contain cadmium and mercury. Under authorisation contained in Chapter 14 Section 24 the Government may issue additional rules for instance concerning the rules of consideration in Chapter 2 Sections 2, 3 and 6. This authorisation enables the Government to prohibit a chemical product in the form of an ordinance if this is necessary from the points of view of the environment and health. Examples of such prohibitions within the framework of the Environmental Code are contained in the Chemical Products (Handling, Import and Export Prohibitions) Ordinance (1998:944). Some examples of such prohibitions are those relating to cadmium, certain articles containing mercury, ammunition containing lead and decaBDE (decabromodiphenyl ether, a flame retardant).

National prohibitions are conditional on the area not already being covered by harmonised European Community legislation, i.e. secondary law (directives and EC regulations) which is harmonising. The new chemicals legislation (REACH) does not signify any change with regard to the scope for national measures.

A national prohibition in the non-harmonised area, i.e. an area that is not covered by existing harmonised European Community legislation, must be notified under Directive 98/34/EC. The notification procedure is described in more detail in section 13.5.

13.4 National prohibition pursuant to the Product Safety Act

The Product Safety Act (2004:451), with the associated Product Safety Ordinance (2004:469) is intended to ensure that goods provided to consumers do not cause personal injury. This Act, with the associated Ordinance, implements the General Product Safety Directive (2001/95/EC)[164].

The Product Safety Act lies completely outside the scope of the Environmental Code, but is nevertheless relevant to chemical products if they cause damage to the health of consumers. The Act applies to both acute and more long-term damage. Under the Government Bill[165] account is also to be taken of adverse effects on health that become apparent after a long time in assessing whether an article is safe. The Bill mentions damage that may be due to a dangerous chemical substance as an example of more long-term risks.

[164] Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety

[165] See Swedish government proposal 3003704:121 New product safety law s. 96 ff

The precautionary principle has to be applied under the Product Safety Act, as well as the Environmental Code. The Bill[166] describes the principle as signifying that a lower requirement of proof can be set for the causal connection between the properties of an article and damage when there is uncertainty in science on the existence of risks to human health or the environment or the extent of such risks. The precautionary principle is also a principle in European Community law and is expressed in Article 174.2, first paragraph, of the EC Treaty. The Government Bill refers to a communication on the precautionary principle from the Commission[167], in which the Commission has stated that the precautionary principle is also applicable to harmful effects in the long term.

Under Section 36 of the Product Safety Act, the Swedish Government may issue regulations prohibiting the supply and export of a particular type of article if the article poses a serious risk to the health and safety of consumers. Under this provision the Government may implement decisions from the Commission that are taken pursuant to Article 13 of the Product Safety Directive, i.e. the Commission may under the Directive adopt a decision to prevent an article that may pose a serious risk to the health and safety of consumers being placed on the market. Such a decision by the Commission may mean that a certain article is prohibited throughout the EEA area, as the decision has to be implemented in the individual countries.

However, under Section 36 the Government does not just have the option of implementing a Commission decision, it can also introduce a national prohibition on an article that may pose a serious risk to the health of consumers. Such a prohibition must also be notified under Directive 98/34/EC in the same way as a national prohibition under the Environmental Code (see 13.5). It may possibly be easier for Sweden to assert a national prohibition under the product safety legislation than under the Environmental Code, as the Commission and other EEA Member States are well aware of the area which is based upon a directive. However, Sweden has not yet introduced any prohibition pursuant to Section 36 of the Product Safety Act, other than implementation of a Commission decision that entails prohibition of certain novelty lighters[168], under Directive 2001/95/EC. In addition to the Commission decision on novelty lighters the Commission did, however, take some temporary decisions under the Directive to prohibit certain dangerous phthalates in toys intended for children under 3 years of age before such a prohibition of phthalates was included in the Limitations Directive (76/769/EC).

A national prohibition under the Product Safety Act must identify a particular type of article where there is a serious risk. It is therefore not possible, in the judgement of the Swedish Chemicals Agency, to introduce a general prohibition applicable to all consumer products containing lead under the Product Safety Act. One or more products for which it can be shown directly that the particular product can pose a serious risk to health must be chosen instead. The typical example should be lead in jewellery, where it is known that several fatal accidents have occurred, see for example the RAPEX notification[169] that the Reebok company had voluntarily recalled an item of jewellery containing large quantities of lead. The lead content attracted attention in connection with a fatal accident in the United States when a child unintentionally swallowed the item of jewellery.

There are thus two routes that can be taken under product safety legislation. Either Sweden can put the issue of the need to prohibit a particular article on the Commission's agenda and

[166] See s. 89 ff
[167] COM (2000) 1 final
[168] See Swedish government ordinance (2006:1085)
[169] Notification number 0191/06

in so doing cause the Commission to work towards prohibition at EU level through a decision under Article 13 of the Product Safety Directive, or it can introduce a national prohibition. A national prohibition in the non-harmonised area, i.e. an area that is not covered by existing harmonised European Community legislation, must be notified under Directive 98/34/EC. The notification procedure is described in more detail in section 13.5.

Different ministries deal with the different legislations in the Swedish Government Offices, either the Ministry of the Environment or the Ministry of Integration and Gender Equality (which covers consumer issues).

13.5 Notification procedure for national rules under 98/34/EC

Under Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations[170], Member States intending to introduce a national rule must immediately submit all drafts of technical regulations (e.g. laws and other statutory instruments prohibiting the manufacturing, importation, marking or use of a product[171] to the Commission.

An exception is made for national rules that only represent implementation of international or European standards. The Member State also has to state the reason why it is necessary to issue such a technical regulation unless the reason is already apparent from the draft. If the intention of the draft is, for example, to limit the sale or use of a chemical substance in consideration of environmental protection concerns, the Member States have to submit either a summary of or references to all relevant data on the substance, known and available replacement products and indicate what effects the measure is expected to have on public health and consumer and environmental protection. An analysis of risk also has to be submitted in accordance with the general principles of risk assessment of chemical substances stated in Article 10.4 of Council Regulation (EEC) no. 793/93[172] if an existing substance is concerned or in Article 3.2 of Council Directive 67/548/EEC[173] in the case of a new substance[174]. The notification procedure has to provide a basis for other Member States and the Commission to assess whether the envisaged national measure is compatible with European Community law. The Member State may not apply the measure against individuals without notification under the procedure.
The Member State as far as possible has to take account of opinions on the notification from the Commission or other Member States. Time limits for when the proposed measure may be implemented are indicated depending on whether Commission or other Member States have expressed opinions[175]:

- If neither the Commission nor a Member State presents a detailed communication, the measure may be implemented no earlier than three months from the date of receipt of the draft by the Commission.

[170] Implemented in the Swedish legislation through ordinance (1994:2029).
[171] article 1 in directive 98/34/EG[172] Council Regulation (EEC) No. 793/93 on the evaluation and control of the risks of existing substances.
[173] Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances
[174] For further information, see article 8 in directive 98/34/EG.
[175] For further information , see article 9 in directive 98/34/EG.

- If the Commission or any Member State presents a detailed communication, the measure may be implemented six months from the date of receipt of the draft by the Commission.
- If the Commission announces that it intends to propose or adopt a directive or regulation in the area, the Member State must wait for 12 months before implementing the draft.
- If the Council has adopted a common position on a draft directive or regulation, the Member State must wait for 18 months before implementing the measure.

13.6 Economic instruments

Under the Environmental Code all users (including consumers) of chemicals must possess knowledge of the substances used and choose chemicals with the least possible environmental impact, but this is not always sufficient. Environmental taxes can be used to influence behaviour in a more environmentally appropriate direction. The idea is for the cost of negative environmental effects to which a particular form of behaviour or particular consumption gives rise to be reflected in the price. Despite the difficulty of assessing the economic value of clean air, for example, it is perfectly possible to introduce an environmental tax that encourages cost-effective measures.

An expected result of economic control in the area of chemicals is that new technology and alternative substances are developed. The existence of alternative substances is crucial to the prospects of reducing risks to health and the environment. Technical development may mean that smaller quantities of a dangerous substance are required to attain the same function. How rapidly such development proceeds is influenced by economic incentives.

14. SWEDISH ENVIRONMENTAL PROTECTION AGENCY AND SWEDISH CHEMICALS AGENCY PROPOSALS FOR THE RESTRICTION OF LEAD IN CERTAIN PRIORITISED PRODUCT GROUPS

Based on the conclusions of the previous chapter we propose rules in this chapter for the product groups which it is most essential to deal with on the basis of the environmental quality objective of A Non-Toxic Environment.

The underlying principle is that measures should primarily be introduced in the EU, but national measures may be justified in certain cases. Prohibition throughout the EU is far more effective than prohibition in Sweden alone. Prohibition in European Community legislation also becomes far better known to exporting countries outside the EU, such as China, than a Swedish national ban. Compliance is consequently improved. The function of the internal market is also promoted by harmonising European Community rules, rather than national special rules.

14.1 Lead in fishing tackle

A summary of justification for the proposals is contained in 12.1.4 and 12.2.4.

One way of restricting lead is to introduce a prohibition of lead in fishing tackle in the Limitations Directive. The Commission has previously discussed similar restrictions under the Limitations Directive, but to date this has not resulted in any regulation of lead in fishing tackle. In the short term it is uncertain what prospects there are of raising the issue of restricting lead under the Limitations Directive again, as the process of introducing REACH is in progress and the Limitations Directive is due to be incorporated into REACH in two years. It is therefore unclear how substances will be prioritised for restrictions in the directive. A factor favouring the possibility of a restriction procedure in REACH for lead in fishing tackle in the short term is that the lead industry has procured material for risk assessment and restriction measures through the voluntary work it has undertaken in the current programme for existing substances[176]. If these data can be used as a basis, it might be possible to commence a restriction procedure under the REACH system. The principal factor running counter to this is the possible delay referred to above. Under the REACH regulation an Annex XV dossier must be prepared as a basis for a restriction procedure under the REACH legislation.

The Swedish Environmental Protection Agency and the Swedish Chemicals Agency therefore principally propose a national prohibition as it can be expected to be implemented in a shorter period of time.

It is proposed that a national prohibition will apply to all fishing tackle, e.g. leisure fishing tackle for angling and subsistence fishing and commercial fishing gear. The fishing tackle and fishing gear must not contain lead at a concentration exceeding 0.1 per cent by weight. The sale and use of the fishing tackle and gear is prohibited under the proposal. Certain transitional rules adapted to the availability of alternatives are also proposed. Fishing tackle and gear that is in use prior to entry into force may continue to be used. A proposed statutory instrument is contained in Annex 5.

[176] Regulation (EC) no 793/93 and (EC) no 1488/94, Existing substances

Predominant environmental reasons for regulation apply to fishing tackle. Special prohibition of the melting of lead for fishing tackle, which poses a danger to health, has been considered but as the prohibition of both the marketing and use of fishing tackle containing lead is proposed, such regulation is unnecessary.

14.2 Lead in other consumer products

A summary of justification for the proposals is contained in 12.3.3.

As a possible prohibition can be expected to be most effective at EU level, the Swedish Chemicals Agency and the Swedish Environmental Protection Agency propose that Sweden presses for the issue to be put on the Commission's agenda. Major changes are currently taking place in chemicals legislation. REACH comes into force on 1 June 2007, and the Limitations Directive (76/769/EEC) will be incorporated into REACH on 1 June 2009. It is uncertain how many new restrictions on substances/preparations/articles can be incorporated in the next few years and how priorities will be set.

In the consultant report mentioned earlier which has been produced on behalf of the Commission with the purpose of examining the benefits and disadvantages of restriction under the Limitations Directive of lead in ammunition, fishing sinkers and candle wicks (see 12.1.3), the Commission (DG Enterprise) comes to the conclusion with regard to lead wicks that prohibiting lead in candle wicks would be disproportionate as there is hardly any manufacturing in Europe.

An alternative to restriction under the Limitations Directive may be to introduce restrictions into the Product Safety Directive. As these regulatory proposals apply to consumer products where there are health risks, the Product Safety Directive may be a suitable legal route to follow. The Commission can take decisions under Article 13 of the Product Safety Directive. This Directive has been in force for a number of years and is considered to work well. Consumer products that contain lead have also been the subject of attention previously in the RAPEX system, for example in 2006 when a voluntary recall applying to lead in an item of jewellery was reported following a fatal accident in the United States (notification number 0191/06).

If this is not judged to be possible, alternative measures can be considered. Such alternatives might be a national prohibition under the Product Safety Act, or a prohibition under Chapter 14 of the Environmental Code, which also covers health aspects for consumers.

With regard to choice of legal route, the Product Safety Act or the Environmental Code, for national prohibitions of consumer products that pose a danger to health, the Swedish Chemicals Agency considers there to be advantages in pursuing the prohibition under the Product Safety Act, which also applies to health risks, rather than the Environmental Code. The purpose of the Product Safety Act is to ensure that only safe articles may be placed on the market – this is a well-known and established principle in the EU and is based on a directive that has been implemented in all the EU Member States.

The Swedish Chemicals Agency considers it is preferable, however, particularly from the point of view of time, for the measures to be accommodated within the Product Safety Directive.

The Swedish Chemicals Agency and the Swedish Environmental Protection Agency propose that Sweden presses for prohibition under the Product Safety Directive 2001/95/EC of certain consumer products where there is a marked and serious risk of harm to health (13.2). The

consumer articles which, in the opinion of the Swedish Chemicals Agency, should be regulated, are:

- Soldered and cast jewellery and accessories containing lead
- Crayons containing lead
- Candles containing wicks of lead
- Alloys that contain lead and are supplied to consumers for casting for example of tin soldiers.

It is reasonable for any prohibitions to contain some form of minimum concentration limit, to prevent the prohibition applying to products in which lead is present as an impurity and has not been actively added. A concentration limit also increases the proportionality of the proposal. The Swedish Chemicals Agency proposes a concentration limit of 0.1 per cent lead by weight. The concentration limit for functional metal parts in jewellery should be 0.3 per cent lead by weight.

14.3 Authorisation of the Swedish Chemicals Agency regarding lead in consumer products

The proposals that have just been made apply to specific articles. An alternative method could have been to introduce more general prohibition of articles that contain lead with exceptions, similar to the prohibition in Denmark. The Swedish Environmental Protection Agency and the Swedish Chemicals Agency have chosen to restrict the prohibitions to those articles for which we have good knowledge of risks today. A more general prohibition requires a careful examination of necessary exceptions.

There may be a need to regulate further consumer products of which we are not currently aware. This need is reinforced by the fact that zinc production controls availability of lead (see 12.5) on the market and if the use of lead in batteries decreases new applications may become relevant. Although Ordinance 1998:944[177] can be extended to include new prohibitions, a simpler and quicker way may be to authorise the Swedish Chemicals Agency to decide on prohibitions at the level of regulations if there are serious environmental and health reasons for doing so and if the product is not covered by another restriction rule. This means that batteries and ammunition, for example, would not be covered by the authorisation as the lead content of these products is already regulated. Any such prohibitions obviously have to be notified under 98/34/EC. It is therefore proposed that authorisation of the Swedish Chemicals Agency is incorporated into Section 14 of Ordinance 1998:944 to issue regulations prohibiting lead in consumer products where there are serious environmental and health-related reasons for doing so.

A general authorisation of this type would also send a signal to the market that lead must not be present in consumer goods.

Annex 5 shows how such authorisation might be formulated.

[177] The Chemical Products (Handling, Import, and Export Prohibitions) Ordinance

14.4 Aviation gasoline

Under the Energy Tax Directive 2003/96/EC[178] the EU Member States have to grant tax relief for energy products supplied for use as aviation fuel for aviation other the private pleasure flying. Private pleasure flying is consequently covered by standard taxation under national tax rates. Sweden has been granted exemptions from the Energy Tax Directive with regard to the taxation of aviation gasoline for both commercial and private flying. However, these exemptions expired on 31 December 2006.[179]

Sweden has applied for continued exemption and has referred to the country's extensive territory. It is additionally emphasised that tax relief for aviation fuel for private flying leads to increased use of flying, which has positive effects on the flying skills of pilots. It would also impose a large burden on the tax authorities to have to administer the taxation of fuel for private pleasure flying. Administration is further complicated by the same aircraft being able to alternate between use for private and commercial purposes several times a day.[179]

In order to make Community policy in the areas of transport, the environment and taxation more uniform, the Commission proposed abolishing the national exemptions as long ago as 1996. The Commission then initiated a gradual phase-out of these exemptions in 2000 when it stated that the exemptions ought to cease by 31 December 2002. Ultimately the exemptions were extended until 31 December 2006. The arguments put forward by Sweden are not sufficient in the Commission's judgement for continued exemption from legislation that has already been adopted unanimously in the EU on two occasions. [177]

Against this backdrop it is reasonable to assume that Sweden will need to introduce standard taxation for aviation gasoline that is used in private pleasure flying. In conjunction with investigation of the formulation of this tax, the Swedish Environmental Protection Agency and the Swedish Chemicals Agency consider this to be an appropriate time to also investigate ways of making it advantageous to use the alternative unleaded aviation gasoline through differentiation.

14.5 Other proposals

14.5.1 Batteries

The Swedish Environmental Protection Agency will press for increased collection and recycling of lead batteries in the EU and internationally when the opportunity arises. Swedish experience and results in this area can serve as good practice in international forums.

Battery development should be monitored with the aim of identifying at an early stage when it is possible to produce batteries without lead as a replacement for lead batteries. This can be done for example through the implementation committee of the ELV Directive, where a study with the focus on car batteries is now planned. The Swedish Chemicals Agency can assist the Swedish Environmental Protection Agency in this work.

[178] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity (Text with EEA relevance)

[179] Communication from the Commission to the Council in accordance with Article 19(1) of Council Directive 2003/96/EC (private pleasure-flying), COM/2006/0742 final

14.5.2 Iron sand

A discussion is under way in the EU on the interpretation of what is waste, and the Commission has recently published a communication concerning waste and by-products[180]. Iron sand is an example of the problems concerned with residual products containing lead. In view of the discussion that is in progress it is difficult at present to propose measures to restrict *iron sand* as the prospects of doing so are dependent on whether iron sand is a product (raw material, substance, preparation) or a waste material.

REACH covers raw materials, substances and preparations, but not waste. When all titles in REACH comes into force, its requirements for registration and risk assessment will gradually also apply to iron sand, provided iron sand is no longer classified as waste. If iron sand is still to be regarded as waste, it is the rules under the Framework Directive on Waste and its national implementation in Sweden that apply.

In view of the fact that many activities are in progress both nationally and in the EU with regard to increased requirements for risk assessment both of products and of waste, the Swedish Chemicals Agency and the Swedish Environmental Protection Agency do not consider there to be reason within the framework of this assignment to propose further measures for iron sand.

The example of iron sand makes it clear, however, that the aim of the strict policy in relation to lead in articles (phasing out lead in newly manufactured articles and handling existing articles that contain lead in such a way that nothing leaks into the environment) will not be attained unless the rules on waste also have the same orientation and level of ambition.

14.5.3 Crystal glass

The EC Directive that regulates lead in crystal glass (69/493/EEC) is not restrictive in nature and instead prescribes the use of lead, as the Directive does not permit crystal glass to be referred to in marketing as “full crystal” in category one or two or “crystal” in category three and four unless the glass contains a certain quantity of lead. The Swedish Government notes in its bill on the marketing of crystal glass[181] that the provisions in the directive clash with the environmental policy conducted in Sweden. The Government will therefore raise the issue of amendments to the Crystal Directive when a suitable opportunity arises.

It is also apparent in the government bill that the Swedish Consumer Agency greatly questions the suitability of implementing the Crystal Directive in Swedish law as it runs directly counter to Swedish efforts in the area of protection of the environment and health.

The Swedish glass industry in particular has objections to the Crystal Directive, as it is possible to produce at least semi-crystal glass of the same lustre and quality without lead.

Despite crystal glass having been placed in prioritisation group two as Swedish industry has already phased lead out voluntarily, the Swedish Chemicals Agency and the Swedish Environmental Protection Agency consider it essential for Sweden to press for amendment of this Directive so that the definition in the EU of crystal is based on its function and performance instead of specifying that crystal glass must contain a certain quantity of lead.

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[180] Communication from the Commission to the Council and the European Parliament on the Interpretative Communication on waste and by-products, 6868/07

[181] 1995/96:225

15. ASSESSMENT OF THE IMPACT OF THE PROPOSALS

This chapter contains an assessment of the impacts of the proposals presented in chapter 14. Nutek's template for Impact Assessment under the Government Agencies Ordinance (1995:1322) and under the Simplex Ordinance (1998:1820) has been used as a basis for this work.

15.1 Fishing tackle for leisure fishing, i.e. angling and subsistence fishing

15.1.1 Environmental consequences

If the new supply of lead sinkers to rivers and streams ceases, the lead poisoning of seabirds in Sweden will decrease. The lead content of household waste should also decrease as a result of regulation of lead in angling tackle. Tungsten, bismuth and iron do not have any toxic effect on birds, while zinc does. However, zinc is not as toxic as lead and is therefore preferable to lead, but as there are alternatives with less environmental impact than zinc in most cases, these should principally be used. The dispersal of lead from waste facilities decreases if lead is prohibited in fishing gear for subsistence fishing. The reason for this is that there is no policy at present for the disposal of lead from discarded fishing tackle. Prohibiting lead in leisure fishing equipment therefore in the long term means reduced lead contents in ash from incineration plants. This leads in turn to reduced lead levels in soil where the ash is landfilled. The diffuse dispersal of lead from corrosion in the marine environment decreases.

15.1.2 Health consequences

If the sale and use of angling tackle containing lead is prohibited (see 14.1), the possibility of private individuals melting lead and casting their own sinkers is also reduced. This is due firstly to it not being possible for lead to be purchased in angling shops and secondly to use of lead-containing gear not being permitted. Fewer people will consequently be exposed to and harmed by lead oxide. However, it is difficult to supervise individuals in this area. It is therefore important to inform those concerned, for example angling clubs, about the risks of casting and about the prohibition. A prohibition would probably alter the views of the angling clubs and consequently they way they act. This may in turn be reflected by the behaviour of individuals. Limiting the use of gear containing lead is required for the prohibition on marketing lead in angling tackle to be effective. If the use of lead in fishing tackle continues to be permitted, it will provide a motive for casting at home. This may become particularly relevant if the price of gear in angling shops rises. In addition, home-cast lead sinkers have just as great a negative environmental impact as lead sinkers from an angling shop. The angling industry is favourably disposed towards a prohibition that restricts the possibility of casting lead sinkers.

15.1.3 Consequences for society

In the case of a national prohibition the cost of fishing tackle may rise for Sweden’s just over 1.2 million anglers. This is because Sweden is a small market and the manufacturers would face extra costs associated with the change-over. According to experience from Denmark there would be a rise in cost of 20 per cent for the consumer. A supervisory project is due to be carried out in Denmark in the autumn of 2007. Despite Sweden being a small country the percentage of anglers among the population is twice the EU average. Trends and demand in

the Swedish market might therefore nevertheless be of interest to manufacturers of angling tackle. In the United Kingdom prices for the new sinkers made of lead and tin are 25 per cent higher than the lead sinkers that were previously on the market. It can be imagined, however, that prices of lead-free fishing tackle will fall with an increased market. As Sweden intends to pursue this issue in the EU, the increased costs faced by Swedish consumers of angling equipment can be regarded as temporary.

In addition to higher prices for lead-free fishing tackle, it can be imagined that some of the alternatives will not have as a long a life as tackle made of lead. This would mean that larger volumes of lead-free fishing tackle may be needed, which also means a further cost for consumers.[182] The supply of angling tackle may decrease in the event of a national prohibition of lead, but as there are lead-free alternatives for all functions this ought to be a transient problem. Lead-free sinkers and other angling tackle may behave slightly differently in the water as they are larger than tackle made of lead. These changes are not considered to affect the usefulness of the tackle.[183]

Prohibition of lead in gear for subsistence fishing signifies a change for the more than 400,000 people who fish with quantity-catching gear such as nets with lead head ropes. There are already alternatives to lead in head ropes for lake fishing on the market. With regard to net fishing at sea there are no alternatives to lead head ropes today, and prohibition with immediate effect would therefore not be appropriate in the present situation. As alternatives are being developed, it is reasonable that there may be lead-free head ropes on the market within a few years. One way of forcing the lead-free development of head ropes in nets is to set a date from which these are to be covered by the prohibition of lead in leisure fishing tackle.

It is important for resources to be set aside in society to check compliance with statutory requirements. It is the Swedish Chemicals Agency and the individual municipalities that have supervisory responsibility under the Environmental Code. It is easier to check compliance with the prohibition of the marketing of lead in angling tackle than the prohibition of use. However, the prohibition of use is considered necessary to avoid private casting of lead for fishing tackle. Supervision can be imagined to take place principally in the trade. Responsibility for supervision of trade is principally borne by the municipalities.

Consequences of general authorisation of the Swedish Chemicals Agency

The report proposes that the Swedish Chemicals Agency be given general authorisation to prohibit a particular consumer article that poses serious risks to health or the environment at the level of government agency regulations. The authorisation will presumably be used very sparingly, in principle only if new knowledge emerges on environmental and health risks of articles that have not been investigated previously. Prohibition at the level of regulations must be prepared with the stakeholders and government agencies concerned, for example the Swedish Environmental Protection Agency, and investigated as closely as prohibition at government level, and be notified under 98/34/EC by the agency. Very few prohibitions are consequently likely to be issued at government agency level. The authorisation nevertheless fulfils a very important function as the possibility of prohibition exists, which sends a signal

[182] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks

[183] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks

to the manufacturers of articles that lead is not suitable in consumer products. As few prohibitions are to be expected, the consequences of authorisation are marginal for society.

15.1.4 Consequences for businesses

The proposed regulations affect a small number of businesses that manufacture, import or sell angling equipment. There are around 3400 shops selling sports and leisure articles in Sweden[184]. It can be imagined that this figure roughly reflects the sale of angling tackle as not all sports shops supply fishing tackle, while some supermarkets do so. The regulations apply to everyone in the angling industry in Sweden. Regulation favours the development of alternatives and consequently businesses that are working on the substitution of lead. EU-wide prohibition has the greatest impact, but a national prohibition should also be effective while this is awaited. There are examples where companies that have developed alternatives have not achieved a breakthrough in the market despite functional material and a competitive price.

There are also examples of an angling shop having decided to remove lead from all the products in its range. This signified a loss of both customers and sales due to the alternative being more expensive and having lower density. When the European Commission then decided not to prohibit lead in fishing tackle it became impossible to refrain from selling lead for competition reasons. The dealer now supplies a number of items of fishing tackle containing lead.[185]

The proposed rules require importers of angling tackle to check and have knowledge of the articles bought in to ensure that no lead is present in the products. Swedish manufacturers have to reorganise their production to phase out lead from products intended for the Swedish market. The time taken largely depends on how far each individual company has progressed with regard to manufacturing and marketing lead-free angling tackle. As alternatives to lead already exist today, the Swedish Environmental Protection Agency and the Swedish Chemicals Agency have considered it possible for the ordinance to come into force on 1 January 2009.

In the short term the proposed measures may adversely affect Swedish manufacturing companies as consumers can buy cheap angling tackle containing lead on the Internet, However, under our proposal it is prohibited to use new angling tackle containing lead. It can therefore be imagined that serious anglers will purchase lead-free tackle in angling shops around Sweden. In the long term the proposal can promote the competitiveness of Swedish manufacturing firms as it will force the development of lead-free alternatives and Swedish manufacturers will have a lead in the event of EU prohibition of lead in fishing tackle.

National restrictions may obstruct free trade in the EU as this type of fishing tackle is used throughout Europe. A national prohibition entails a risk of private individuals buying fishing tackle containing lead on the Internet or of private individuals buying fishing tackle abroad. If this happens it will have an adverse effect on domestic sales. Sweden also intends to pursue this issue in the EU. But as the use of lead in angling tackle is prohibited, this should provide an incentive not to buy tackle containing lead abroad or on the Internet. Two other EU Member States have already introduced restrictions, and further national regulation means that manufacturers in the EU have to know about three different sets of rules with regard to the lead content of fishing tackle. As the Commission wishes to promote a common approach

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[184] http://www.scb.se/Grupp/Foretagsregistret/_Dokument/050111alfabetisk.pdf and http://www.scb.se/Grupp/Foretagsregistret/_Dokument/BranscherSNI2002.pdf 20/3-07

[185] Per-Henrik Bengtsson, Fladen Fishing AB, Written Document 16/2-07

in the EU, Sweden improves the prospects of restriction throughout the EU by adopting national regulation. In the longer term the problem of private individuals buying sinkers and lures on the Internet in that case will also decrease. Prohibition in the EU means that manufacturers are forced to alter design and construction and reorganise production for all types of lures, which is possible from the points of view of production and materials. Such development would be favourable for the environment as an EU prohibition affects a sufficiently large market to have an impact on global production. There is, however, a risk of the national prohibition being followed by an EU prohibition that does not entirely correspond to the national provisions. The ground rules for manufacturers may then change, but national prohibition is regarded as necessary in order to put the issue on the EU agenda. Consideration could be given to setting a later date for entry into force in order to give the EU time to act. But there is then a risk of the incentive for present-day manufacturers of lead-free tackle becoming too weak.

It is relatively easy for a foundry to replace lead with zinc in the production of sinkers. However, the moulds have to be replaced and a large foundry may use around 100 different moulds. Substituting lead with tin also means certain changes in design as tin is harder. The casting or iron or steel is more complex. [186] EFTTA (the European Fishing Tackle Trade Association) represents 80 per cent of manufacturers and wholesalers of fishing tackle in Europe. Two members of EFTTA in Sweden manufacture sinkers, of which Spofa Spöfiske is one that represents both importers and manufacturers of angling tackle. Spofa Spöfiske considers that Sweden should prohibit the use of leaded sinkers and split shot as lead in sinkers is easy to replace and it is these that birds peck and are poisoned by. They therefore consider a prohibition of lead sinkers to be well directed and easy to accept. The consequences of a prohibition are also dependent on how the industry is informed. In consultation early in the investigation it was discussed how information can be provided to the angling industry, for example through angling magazines but also through county administrative boards and municipalities. The consultation also revealed a wish on the part of the industry in the event of a prohibition of lead to also restrict use and consequently reach the private casting of fishing tackle. The Swedish Environmental Protection Agency and the Swedish Chemicals Agency have also taken account of this and made this proposal.
Soft instruments such as advice and information to anglers have not produced the desired result. Voluntary instruments do not appear to work in this case. Measures such as prohibitions in certain watercourses have contributed to local environmental gains, but these are more difficult to track and check, nor does this provide a strong incentive to manufacturing industry to develop lead-free alternatives. Economic instruments such as introducing a tax on fishing tackle containing lead have not been investigated. It can be imagined that such a tax would have provided extra incentives to those private individuals and angling clubs who buy scrap lead themselves and cast their tackle. The positive health effects aimed for would then have been lost.

Most of the companies are in favour of prohibiting lead in angling tackle, provided there is supervision. Serious players may otherwise be hit particularly hard as there is a risk of competition being distorted.

[186] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks.

15.2 Fishing gear for commercial fishing

15.2.1 Environmental consequences

The dispersal of lead from waste facilities decreases if lead is prohibited in commercial fishing gear. The reason for this is that there is no policy at present for the disposal of lead from discarded fishing gear. Prohibiting lead in commercial fishing gear therefore in the long term means reduced lead levels in ash from incineration plants. This leads in turn to reduced lead levels in soil where the ash is landfilled. The diffuse dispersal of lead from corrosion in the marine environment decreases.

15.2.2 Health consequences

Prohibition of the use of lead in newly manufactured commercial fishing tackle means that the casting of lead for fishing gear is also restricted. This means that fewer people will be exposed to and harmed by lead oxide. However, it is difficult to exercise supervision among individual commercial fishermen, although the prohibition may change opinion in the industry and therefore also the actions of individual fishermen.

15.2.3 Consequences for society

If the environmental and health situation is improved, society at large is also favoured, for example through reduced costs and losses of income as a consequence of environmental pollution and health problems.

Reduced quantities of lead in waste also have an impact on society as fewer hazardous substances in waste makes disposal easier and cheaper. With regard to net fishing at sea there are no alternatives to lead head ropes today, and prohibition with immediate effect would therefore not be appropriate in the present situation. As alternatives are being developed, it is reasonable that there may be lead-free head ropes on the market within a few years. One way of forcing the lead-free development of head ropes in nets is to set a date from which these are to be covered by the prohibition of lead in commercial fishing gear.

15.2.4 Consequences for businesses

The businesses principally affected are commercial fishermen and a small number of manufacturers, importers and sellers of commercial fishing gear. There are 1880 commercial fishermen with a commercial fishing licence in Sweden. Total employment is, however, higher as not everyone who works on board fishing vessels holds a licence. With regard to manufacturers it is difficult to estimate numbers. The National Board of Fisheries has contact details for eight fishing gear manufacturers in southern and western Sweden. A rough estimate based on this is that there are around 50 manufacturers of fishing tackle in Sweden of which around ten undertake commercial activity while the other operations represent more of a hobby.

The Swedish fishing fleet can be divided into three groups: fishing with a trawl or purse seine for example for herring and Baltic herring, trawl fishing for cod and other bottom-living species (plaice, shrimp, Norway lobster) and fishing with passive gear such as nets, longliners, fyke nets and cages for example for cod and salmon[187]. One of the most important types of Swedish commercial fishing is fishing for cod in the Baltic, where 40 per cent of the cod catch is taken by nets. With regard to net fishing at sea there are no alternatives to lead head ropes today, and prohibition with immediate effect would therefore not be appropriate in

[187] http://www.fiskeriverket.se/vanstermeny/yrkesfiske.4.1e93312510e313daf128000208.html

the present situation. As alternatives are being developed, it is reasonable that there may be lead-free head ropes for commercial fishing on the market within a few years. One way of forcing the lead-free development of head ropes in nets is to set a date from which these are to be covered by the prohibition of lead in commercial fishing gear. The Swedish Fishermen's Federation is in favour of the development of lead-free nets, provided they have the same good characteristics as the nets used at present without a massive increase in price. The Federation is also in favour of regulation of lead in fishing tackle, provided this is done at EU level[188]. One consequence of lead-free nets may be that they take up more space on board the vessels, the actual impact of this depending on what type of boat is used in the individual case but also on the development of substitutes.

The remaining cod catch, 60 per cent, is taken by trawls. As lead-free trawls are already used today, the prohibition should not have a major impact on fishing. A trawl maker even states that it is difficult to get hold of lead for trawls today and that the lead-free alternatives cost the same as gear made of lead[189]. It may therefore be assumed that there will not be a great impact on manufacturers, importers and sellers of trawls. The situation with regard to purse seines appears to be that new purse seines bought into Sweden from Norway are already lead-free today, and regulation of lead in commercial fishing gear ought therefore not to have a major impact on purse seine fishermen in Sweden.

The ground rules for manufacturers change in the case of a national prohibition which is followed by prohibition at EU level, but national prohibition is regarded as necessary in order to put the issue on the EU agenda.

The information meetings on lead-free fishing in the 1990s did not have the desired effect. Voluntary instruments thus do not appear to be sufficient. A requirement for disposal of the lead could also be proposed, but as the lead can be substituted this alternative has not been considered.

The proposed rules require importers of commercial fishing gear for example to check and know about the articles bought in to ensure that no lead is present in any of the products. Swedish manufacturers must phase out lead from products intended for the Swedish market. The time taken largely depends on how far each individual company has progressed in manufacturing and marketing lead-free angling tackle. As alternatives to lead already exist, the Swedish Environmental Protection Agency and the Swedish Chemicals Agency have considered it possible for the ordinance to come into force on 1 January 2009 except with regard to head ropes in nets, where we consider it reasonable to adopt the same date of entry into force as Denmark has proposed, that is to say 1 June 2012. Industry associations have not expressed a wish for special information efforts for small businesses affected. Affected businesses should, however, be informed in order to increase compliance.

The Swedish Fishermen’s Federation and the National Board of Fisheries have taken part during the course of the investigation. They were also invited to attend a reference group meeting; unfortunately they were prevented from attending but submitted written comments. The National Board of Fisheries was also consulted by telephone.

[188] Fredrik Lindberg, Sveriges Fiskares Riksförbund, Written Document 6/3-07
[189] Jan Olof Andersson, Fiskeföreningen Norden, Personal Communication 6/3 -07

15.3 Other consumer products (see 14.2)

15.3.1 Environmental consequences

The risks of lead in consumer products are principally related to human health. However, there are also risks to the environment in connection with the discarding of consumer products containing lead. If consumer products containing lead end up in household waste, a large proportion of them go to incineration. Most of the lead thus ends up in the ash and in most cases goes to landfill. Prohibiting lead in certain consumer products might contribute to reduced lead levels in the ash in the longer term.

15.3.2 Health consequences

Lead vapour that reaches the lungs by inhalation is released in the casting of tin soldiers and in the use of soldering tin and candles with wicks containing lead. This exposure and therefore also the risks to human health would be reduced by a prohibition of lead in these consumer products.

The health risks with regard to crayons and jewellery principally consist in the possibility of children swallowing parts of these products. Such risks and consequently also the risk of more fatalities would be reduced by prohibiting lead in these consumer products.

Information on the risks associated with lead, for example labelling on products, might reduce the risks to some extent. On the basis of the environmental quality objective of A Non-Toxic Environment and in view of the fact that alternatives to lead exist for all relevant uses, however, a prohibition is judged to be the most effective measure.

The effect ultimately aimed at is for the designated harmful products to disappear from the Swedish market. This leads to reduced health risks for consumers who have previously been exposed to these unhealthy products.

15.3.3 Consequences for society

An improvement in the environmental and health situation also benefits society at large, for example through reduced costs and losses of income as a consequence of environmental pollution and health problems.

The environmental quality objective of A Non-Toxic Environment is an example of the Swedish Parliament driving a change in society aimed at promoting human health and safeguarding the external environment. Certain product groups where work on the environmental objective has not been sufficiently effective have been identified in this report. Further instruments are needed in these cases to deal with certain serious health and environmental effects that use of these products entails. There is also broad support from many stakeholders to implement these regulatory measures.

Consumers are directly affected by the prohibition. This applies in particular to those who cast tin soldiers in that they no longer have access to leaded grades. However, lead-free alternatives exist. With regard to candle wicks, an EU investigation[190] finds that it is barely possible to identify any drawbacks for consumers in a prohibition. The risk of lead exposure is regarded as limited as lead in candle wicks only occurs in a limited quantity of imported goods. However, regulating lead in candle wicks would completely eliminate this risk. With regard to prohibition of jewellery containing lead, the only negative effect for consumers

[190] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks

would be that the supply of cheap jewellery might be slightly reduced. No negative effects for consumers can otherwise be identified with regard to either jewellery or crayons.

Supervision of compliance with the rules will principally take place in the trade. The principal responsibility for supervision will therefore be at municipal level. Supervision signifies a further task for the municipalities, but it should be possible for it to be exercised in conjunction with other supervision of consumer products in retail trade.

Consequences of authorising the Swedish Chemicals Agency as proposed in 14.3

The consequences of general authorisation from the point of view of society are less significant, as a very limited number of articles are likely to come into consideration for prohibition at the level of government agency regulations. A consumer product that entails a serious risk to the environment or health must be involved. The authorisation in practice will only be relevant if new knowledge of risks emerges for certain articles. The area is also limited by the fact that consumer articles must be involved and that the area must not be covered by harmonised special legislation for that particular article, as for example in the case of batteries. Any prohibition at government agency level must also be discussed with stakeholders and government agencies affected, for example the Swedish Environmental Protection Agency, before a prohibition is adopted. In addition, the prohibition must be notified to the Commission under 98/34/EC by the government agency in the same way as is done with a prohibition contained in a government ordinance. Although the number of prohibitions will probably be small, the authorisation is important as it is possible to prohibit the article at government agency level, while the authorisation also sends signals to manufacturers and importers that lead must not be present in consumer products.

The supervision of any prohibition would principally be the responsibility of the municipalities, in addition to the supervision exercised by the Swedish Chemicals Agency with regard to manufacturers and primary suppliers. If the Swedish Chemicals Agency utilises the authorisation to decision on prohibitions, the agency will hand over supervisory guidance to the local authorities to an adequate extent.

15.3.4 Consequences for businesses

Shops that sell alloys for the casting of tin soldiers, candles, crayons and non-precious jewellery are affected by the prohibition. The attention of shop owners must be drawn to the fact that they must not sell the alloys containing lead, i.e. that they must cease to have such grades in their range. This may mean an increased administrative burden and that time has to be spent formulating environmental requirements to be met by suppliers. For players who have not previously dealt with environmental requirements in procurement, the time spent is greater and the cost therefore increases. There are, however, free support and aids that the authorities can provide, for example guidance on setting environmental requirements in procurement (the Swedish Environmental Management Council, the EKU (Committee for Ecologically Sustainable Development) tool) and guidance on prioritisation of hazardous substances in procurement (Swedish Chemicals Agency, the PRIO tool). Those players who already set strict environmental requirements in procurement today will not be affected to any major extent by the proposed rules as these already make similar requirements.

As imported products are almost exclusively concerned, the regulation means that players who bring the products into the country to place them on the Swedish market must impose requirements on their supplies for the imported products to be free of lead, that is to say compatible with the Swedish legislation.

Soldering tin that does not contain lead has been on the market for many years. According to the leading importer, the alternatives hold around 90 per cent of the market. Prohibiting the sale of soldering tin containing lead for hobby use should therefore not entail any decisive readjustment for most sellers.

Almost all the crayons on the market are lead-free and work just as well as, or better than, crayons that contain lead. Prohibiting the sale of crayons containing lead should therefore not entail any decisive readjustment for most sellers.

According to an EU investigation[191] there are no significant technical obstacles to changing technology in the production process of candles that need firmness in the wick. Prohibiting lead in candle wicks for the whole of the EU would not have an adverse effect on the producers concerned as no producer in the EU markets candles with leaded wicks. Prohibition at EU level would benefit all parties concerned except for the companies that import candles with leaded wicks. Nor would any national prohibition entail significant negative effects for companies.

The regulation may indirectly mean reduced income for companies as a result of being forced to stop marketing certain products. Small companies that have specialised in cheap jewellery and only import from Asia risk losing market shares and, in the very worst case, being eliminated.

A negative side-effect may be that products that do not contain lead but lack documentation may be prevented from entering the Swedish market.

The consumer products referred to here are sold by both large retail chains and smaller shops. However, most of the businesses are one-man or small firms.[192]

Industry associations affected have been given an opportunity to take part in the reference group and to submit both written and verbal comments on the contents of the report. Industry associations have not expressed wishes for special information efforts for affected small businesses. Affected businesses have, however, been informed in order to improve compliance with rules. Nor is it certain that all businesses are aware that their products contain lead, and information is therefore also important in order to clarify which objects may be covered by the regulation.

15.4 Lead in aviation gasoline

The consequences a differentiated tax on aviation gasoline would have must be investigated more closely. It is not possible at present to analyse in detail the consequences of differentiated taxation as the formulation of such a measure has not been investigated and specified. Some general possible consequences are, however, presented below.

Environmental consequences

Around 4.5 million litres of aviation gasoline are sold annually in Sweden. Most of this volume is leaded, which means that around 2 tonnes of lead annually are dispersed in the environment from this use. If the cost of refuelling with leaded aviation gasoline becomes higher than with unleaded, it is reasonable to assume that the use of leaded aviation gasoline would decrease to the benefit of unleaded. This would mean from an environmental

[191] European Commission Enterprise Directorate-General (2004). Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks

[192] Statistics Sweden (SCB is a central government authority for official statistics in Sweden), Business Register, http://www.scb.se/templates/Listning1____19852.asp

perspective that a smaller quantity of organic lead is dispersed through the use of aviation gasoline than is the case today. This signifies less deposition of lead over soil and water and a smaller contribution form the use of aviation gasoline to the cumulative quantity of lead in the environment.

The unleaded gasoline emits a smaller quantity of particles in use than leaded, nor does it contain the ozone-depleting additive bromine, as leaded aviation gasoline does.

Health consequences

Reduced use of leaded aviation gasoline is favourable from the point of view of health as organically bound lead is the most dangerous form in which lead occurs for human health. Organic lead is readily taken up in the blood through inhalation, and reduced presence would signify a lower health risk.

Consequences for society

An improvement in the environmental and health situation also benefits society at large, for example through reduced costs and losses of income as a consequence of environmental pollution and health problems.

Extra taxation on leaded aviation gasoline, in addition to the tax that will be introduced on all aviation gasoline, would mean some extra revenue for the treasury. This revenue is expected to be small, however, as the effect of introducing a tax would be that most consumers change over to unleaded fuel.

Measures to reduce the use of lead in aviation gasoline are favourable for society insofar as they are line with the aspiration contained in the environmental quality objective of A Non-Toxic Environment.

Differentiation of tax on aviation gasoline would not generally involve extra costs for consumers, in this case leisure flyers. In most cases it is possible to use unleaded aviation gasoline, and a differentiated tax would mean in particular an incentive to choose the alternative with the least environmental impact. A differentiated tax would signify an extra cost for leisure flyers who have aircraft with engines that cannot run on unleaded aviation gasoline.

LFV (Swedish Airports and Air Navigation Services) and the Swedish Civil Aviation Authority have not presented any objections to the proposal.

Consequences for businesses

The company that manufactures and sells unleaded aviation gasoline would benefit from a differentiated aviation gasoline tax. The large oil companies that sell leaded aviation gasoline will not be significantly affected as the trade in aviation gasoline is so limited. A differentiated tax only on the Swedish market would probably not be sufficient reason for the major oil companies to introduce unleaded aviation gasoline into their range. A Swedish initiative might, however, send a signal to the major oil companies that there is demand for unleaded aviation gasoline and that future regulations can also be expected in other countries and thus provide an incentive for these market players to introduce unleaded aviation gasoline into their range.

For some larger propeller aircraft choosing unleaded fuel is not an option at present. This type of aircraft is principally used for what is known as utility flying, such as taxi flights. In a scenario in which only aviation gasoline for private pleasure flying is taxed, these businesses

would not be affected. On the other hand, if the tax covered all use of aviation gasoline a differentiated tax would entail increased costs for these businesses.

A differentiated tax might create increased demand for aircraft engines that can run on unleaded aviation gasoline. The tax might thus provide an incentive for environmentally sound technical development.

To summarise, the environmental effect is judged to be noticeable and the net cost to society to be low.

16. GLOSSARY

AECM	Association of European Candle Manufacturers
CE mark	Communauté Européenne (European Community)
CEN	European Committee for Standardization
CEPE Industry	European Council of the Paint, Printing Ink and Artists' Colours
CLRTAP	Convention on Long-Range Transboundary Air Pollution
CMR	Carcinogenic, mutagenic and toxic to reproduction
ELV Directive	End-of-Life Vehicles Directive
Leisure fishing	Fishing undertaken for enjoyment and recreation where the catch is not sold. Swedish leisure fishing comprises subsistence fishing (quantity-catching gear) and angling (rod, hook and line). A distinction is made between subsistence fishing and angling in this report.
IQ	Intelligence Quotient
HELCOM	Helsinki Commission
Subsistence fishing	Fishing for household needs with quantity-catching gear
ILO	International Labour Organisation
KOVFS	Swedish Consumer Agency regulations
KIFS	Swedish Chemical Agency regulations
LIVSFS	National Food Administration regulations
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
Pb	Lead
PbS	Galena
PE plastic	Polyethylene plastic
ppm	Parts per million
PSL	Product Safety Act
PTWI	Provisional tolerable weekly intake
RAÄ	National Heritage Board
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RoHS	Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
PVC	Polyvinyl chloride
SCB	Statistics Sweden.

SFR	Swedish Fishermen’s Federation
SGU	Geological Survey of Sweden
Angling	Fishing with rod, hook and line
Sveff	Swedish Paint and Printing Ink Makers Association
SVHC	Substances of very high concern
Head ropes	Long ropes in fishing nets in which lead is encapsulated
UNEP	United Nations Environmental Programme
WEEE	Waste Electrical and Electronic Equipment
WHO	World Health Organisation

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ANNEX 1: INTERIM TARGETS FOR A NON-TOXIC ENVIRONMENT

The environmental objective of A Non-Toxic Environment is written in a quite visionary way. The direction of travel can be broadly understood, but precisely what is to be implemented and what stops there are along the journey requires clarification. The Swedish Parliament has therefore formulated nine interim targets for A Non-Toxic Environment. The authorities at regional and local level have also been encouraged to devise targets with a regional or local character. It can be noted that the nine interim targets in the area of chemicals emphasise knowledge of the health and environmental properties of chemical substances, users obtaining information on these properties and substances of very high concern being phased out. In particular, newly produced articles are not to contain such substances. These are ideas we recognise from the overall chemicals legislation.

The interim targets also indicate that health and environmental risks in production and use are to decrease and that indicators are needed to track progress and backward steps. There is also a need for guide values for a number of substances. Finally targets are indicated for the remediation of contaminated soil.

Knowledge
Interim target 1: By 2010 data will be available on the properties of all deliberately manufactured or extracted chemical substances handled on the market. For substances handled in larger volumes and for other substances which, for example after initial general tests, are assessed as being particularly dangerous, information on their properties will be available earlier than 2010. The same information requirements will apply to both new and existing substances. In addition, by 2020 data will be available on the properties of the most important unintentionally formed and extracted chemical substances.

Information on products
Interim target 2: By 2010 finished products will carry health and environmental information on any dangerous substances they contain.

Phase-out of substances of very high concern
Interim target 3: Newly manufactured finished products will as far as possible be free from:

- new organic substances that are persistent and bioaccumulating, new substances that are carcinogenic, mutagenic and toxic to reproduction, and mercury, as soon as possible, but no later than 2007,
- other substances that are carcinogenic, mutagenic and toxic to reproduction, and endocrine disrupting substances or highly allergenic substances, by 2010, if the articles that contain them are intended to be used in such a way that they will enter natural cycles,
- other organic substances that are persistent and bioaccumulating, as well as cadmium and lead, by 2010.

Nor will these substances be used in production processes unless the company can prove that health and the environment will not be harmed. Already available finished products containing substances with the properties listed above, or mercury, cadmium or lead, will be handled in such a way that the substances in question are not released to the environment. The spread to Sweden by air or water of substances covered by this interim target will decrease continuously. This interim target applies to substances that are man-made or extracted from the natural environment. It also applies to substances giving rise to substances with the above properties, including those formed unintentionally.

Risk reduction
Interim target 4: Health and environmental risks associated with the manufacture and use of chemical substances will be reduced continuously up to 2010, as measured by indicators and ratios to be established by the competent authorities. Over the same period, the occurrence and use of chemical substances which impede recycling of materials will decrease. This target applies to substances not covered by interim target 3.

Guideline values for environmental quality
Interim target 5: By 2010 guideline values will be established by the competent authorities for at least 100 selected chemical substances not covered by interim target 3.

Remediation of contaminated sites
Interim target 6: Studies will have been carried out and, where necessary, appropriate action will have been taken by the end of 2010 at all contaminated sites that pose an acute risk on direct exposure, and at contaminated sites that threaten important water sources or valuable natural environments, today or in the near future.

Interim target 7: Between 2005 and 2010, measures will be implemented at a sufficiently large portion of the prioritised contaminated sites to ensure that the environmental problem as a whole can be solved by 2050 at the latest.

Dioxins in food
Interim target 8: By 2010 clear action programmes will have been established to bring about a continuous decrease in levels in food of dioxins harmful to humans.

Cadmium
Interim target 9: By 2015 the dietary and occupational exposure of the population to cadmium will be at a level that is safe from a long-term public health point of view.

ANNEX 2: MINE PRODUCTION TOGETHER WITH EXPORT AND IMPORT OF LEAD

Table 4. Mine- and metal production in Sweden (tonnes lead/year)

Year	Mine prod. in Sweden[I]	Boliden Totally[II]	Tara (Irland)[III]	Garpen-Berg[IV]	Boliden-Territory[II]	Lais-vall[IV]	Los Frailes[II] (Spain)	Zinc mine Lundin mining[VII]
2004	54300	54458	31590	19148	3270	-	-	31500
2003	51000	18658	(29502)	16002	2656	-	-	32900
2002	43000	18240	(8280)	15022	3218	-	-	25900
2001	86000	85991	(27420)	14081	3162	44200	-	25200
2000	106600	121324	(35129)	14384	2963	63700	40312	24500
1999	116400	110334		15891	2838	74259	17346	23100
1998	114400	102535		16637	3251	72314	10333	21600

Year	Metal prod in Sweden[V]	Boliden Totally[II]	Rönnskär[II]	Bergsöe[II]
2004	82000	73548	27962	45586
2003	76100	73340	24208	49132
2002	69700	63451	17753	45698
2001	83300	75608	31313	44295
2000	77859	78098	30699	47399
1999	86000	78853	34734	44119
1998	92600	87264	40566	46698
1996	84100	84000[VI]	42000	42000

[I] Statistics from the Swedish Mining Industry 2004, Swedish Geological Survey (SGU)
[II] Boliden Annual report 2000-2004
[III] Boliden owner from January 2004
[IV] Laisvall closed 2001
[V] European Association of Mining Industries/ U.S Geological Survey Minerals Information. These references give a larger metal production than what was reflected in the Boliden Annual report. The reason is unclear.
[VI] KemI PM Nr 8/98
[VII] Karlsson, Thomas, Zinkgruvan, Personal Communication

Table 5. Figures on import and export of articles, sorted by groups of articles (KN –combined nomenclature, 6 digits) concerning lead in the years 2000 and 2004 in Sweden. Main flow, tonnes/year. Source: SCB´s database on statistics

KN	Article	Import 2000 (I)	2004	Export 2000 (E)	2004	Net flow 2004 (I – E)	Amount of Lead 2004 (tonnes) (I – E)
260700	Lead ore[I]	0	25468	125300	60139	-34671	-24200
282410	Lead oxide[II]	240	306	0	28	278	260
701321+ 701331	Lead Crystal Glass[III]	790	867	848	666	201	60
780110+ 780191+ 780199	Lead[IV], unworked	7330	6113	67804	68279	-62166	-59060
780200	Waste and scrap[V]	2189	4125	99	562	3563	2850
780300+ 780411+ 780419	Poles, thread, profiles, band etc[VI]	232	399	720	445	-46	-44
850710	Lead accum. Starter Batteries.[VII]	38345	46881	17209	14176	32705	19600
850720	Lead accum. Used up	24118	19787	6360	6460	13327	8000
Totally							-52500

[I] Lead content 70 %
[II] Lead content 93 %
[III] Lead content 30 %
[IV] Lead content 95 %
[V] Lead content 80 %
[V] Lead content 95 %
[VII] Lead content 60 %

ANNEX 3: EU RULES ON LEAD IN ARTICLES

Lead is found in a large number of uses, and regulations on lead can therefore be found in a number of different European Community directives. The account given below of secondary law that governs lead does not claim to be exhaustive but should cover most of the directives and European Community regulations that are relevant in this context. However, the review only covers those regulatory instruments that explicitly govern lead, either as a substance or in articles. This means that rules governing lead in emissions, waste, the working environment, air quality, transportation or the like are not covered by the review. The selection has been made by studying the directives that govern known uses of lead and searches in EurLex and elsewhere.

A review of the directives and regulations that govern lead and that have been identified in this assignment follows below.

- The General Product Safety Directive (2001/95/EC)

Directives that restrict the presence of chemical substances in chemical and other products

- Limitations Directive
- Cosmetics Directive
- Directive on Petrol
- Directive on the Restriction of the use of certain Hazardous Substances
- Batteries Directive
- End-of-Life Vehicles Directive
- Toys Directive
- Directive on Ceramic Articles Intended to Come into Contact with Foodstuffs
- Packaging Directive

Directives restricting substances in food and sludge

- Directive on Sewage Sludge in Agriculture
- Regulation on Contaminants in Foodstuffs
- Directive on Quality of Water Intended for Human Consumption
- Directive on Extraction Solvents in Foodstuffs
- Directive on Flavourings for Use in Foodstuffs etc.

Directives that advocate use of lead

- Crystal Directive (69/493/EEG)

3.1. The General Product Safety Directive

Directive 2001/05/EC of the European Parliament and of the Council of 3 December 2001 on general product safety

The Product Safety Directive means that only consumer products that are safe from the point of view may be placed on the market. Both acute health risks and more long-term health risks are taken into account in assessing what is a safe product. A product can be stopped if it is not sufficiently safe. If information is judged to be a sufficient measure (safety information, warning information), this will be used instead of prohibition. A prohibition of sale may be combined with recall of the products, for example from a wholesaler, a retailer or a consumer

who has already bought the product. There is an information system in the Community known as RAPEX in which the Member States can inform one another (through the Commission) if they have taken any measure pursuant to the Product Safety Directive. The Swedish Consumer Agency is the "mailbox" responsible for this system in Sweden.

The Product Safety Directive may be of relevance with regard to lead in articles. In 2006 the United Kingdom informed the RAPEX system (notification number 0191/06) that the Reebok company had voluntarily recalled an item of jewellery that accompanied a pair of children's shoes. The jewellery contained high levels of lead. The lead content attracted attention in connection with a fatal accident in the United States when a child unintentionally swallowed the item of jewellery. The child died as a result of lead poisoning.

3.2. Limitations Directive

Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations

Under the Limitations Directive, lead carbonates and lead sulphates may not be used as substances or ingredients in preparations intended to be used as paints. The Member States may, however, permit use for the restoration and maintenance of historic buildings and structures and their interiors in accordance with ILO convention no. 13 on the use of lead white in paints.

The Limitations Directive also contains a provision that the substances that have been classified as carcinogenic, mutagenic and toxic to reproduction may not be soled to the public. Lead[193] is included as toxic for reproduction in category 1 and lead hydrogen arsenate as carcinogenic in category 1.

This regulatory provision has been transposed into Swedish legislation through Chapter 10 of KIFS 1998:8 following authorisation in the Chemical Products and Biotechnical Organisms Ordinance (1998:941). The Swedish regulation of lead in paint contains a prohibition and the possibility of exemption for the uses stated in the Directive.

3.3 Cosmetics Directive

Directive 76/768/EEC on the approximation of the laws of the Member States relating to cosmetic products

Under the Cosmetics Directive a cosmetic product means any substance or preparation intended to be placed in contact with the various external parts of the human body or with the teeth and the mucous membranes of the oral cavity with a view exclusively or mainly to cleaning them perfuming them, changing their appearance and/or correcting body odours and/or protecting them or keeping them in good condition.

[193] Lead compounds are adopted as toxic to reproduction, category 1, according to the directive on Classification and Labelling of Dangerous Substances, 67/548/EEC, in the following way. Lead hexafluorosilicate, Lead alkyls, Lead acide, Lead chromate, Lead diacetate, Lead acetate (basic), Lead(II) methanesulphonate, Lead sulfochromate yellow, Lead chromate molybdate sulfate red, Lead hydrogen arsenate, Lead styphnate and Lead compounds with the exception of those specified elsewhere in this Annex

The Directive states that cosmetic products put on the market within the Community must not cause damage to human health when applied under normal or reasonably foreseeable conditions of use. The Member States have to prohibit cosmetic products being put on the market if they contain substances that are included in an annex to the Directive. The annex includes, for example, lead and its compounds.

The Cosmetics Directive is transposed into Swedish legislation through the Ordinance on Cosmetic and Hygiene Products (1993:1283) and the regulations of the Swedish Medical Products Agency[194].

3.4 Directive on Petrol

Directive 98/70/EC of the European Parliament and of the Council relating to the quality of petrol and diesel fuels

This directive does not apply to petrol (gasoline) for aircraft, i.e. the leaded gasoline used for small propeller planes.

Under Article 3 the Member States have to prohibit the marking of leaded petrol within their territory. The Member States have to ensure that unleaded petrol can be marketed only if it complies with certain environmental specifications set out in an annex to the directive. Under these environmental specifications the lead content of the petrol must not exceed 0.005 g/l.

If it is difficult for the refineries in a Member States to fulfil the requirements of fuel specifications due to a sudden change in the supply of crude oils or petroleum products as a result of exceptional events, the Member State must inform the Commission thereof. The Commission, after informing the other Member States, may authorise higher limit values in that Member State for one or more fuel components for a period not exceeding six months. The Commission has to notify the Member States and inform the European Parliament and the Council of its decision.

The Directive is transposed into Swedish legislation through the Exhaust Gas Purification and Engine Fuels Act (2001:1080).

3.5 Directive on the Restriction of the use of certain Hazardous Substances (RoHS)

Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment

The RoHS Directive restricts the use of certain hazardous substances, including lead, in electrical and electronic equipment. Under the Directive, the Member States have to ensure that, from 1 July 2006, new electrical and electronic products put on the market do not contain the hazardous substances.

The RoHS Directive has been transposed into Swedish legislation through the Chemical Products (Handling, Import and Export Prohibitions) Ordinance (1998:944), the Producer Responsibility for Electrical and Electronic Equipment Ordinance (2005:209) and the Swedish Chemicals Agency regulations KIFS 1998:8.

[194] LVFS 1993:2, amended and reprinted by LVFS 2003:5

The background to the Directive is the problematic waste management of electrical and electronic equipment containing hazardous substances. Restricting the substances makes waste management easier and improves opportunities for material recycling. It also contributes to the protection of health and the environment. Article 2.1 of the RoHS Directive indicates the scope of the Directive by reference to Directive 2002/96/EC (the WEEE Directive), which governs waste. RoHS covers electric light bulbs and luminaires in households, as well as the following categories referred to in WEEE: household appliances, IT, telecommunications and office equipment, home equipment (television, audio-visual equipment), lighting equipment, electrical and electronic tools, toys, leisure and sports equipment and automatic dispensers.

The prohibition applies in electrical and electronic equipment at levels above 0.1 per cent by weight in homogeneous materials. For certain applications there are no alternatives to lead at present. Exemptions have been granted in these cases (Table 6). A review of each exemption has to be carried out every four years, or four years after the exemption has been added. The purpose is to consider whether the exemption is still needed. In cases where it is technically and environmentally feasible, the exemptions will be removed. The exemptions apply for instance to lead in certain solders, lead as an alloying element in steel, aluminium and copper alloy and lead in cathode ray tubes, electrical components and fluorescent tubes.

The rules on revision mean for instance that the Commission has to review the provisions of the Directive and take account of new scientific findings. Medical devices and monitoring and control instruments, for example, may come within the scope of the Directive, as well as additional products for which no satisfactory alternatives are yet listed in the annex containing exemptions from the Directive. Further exemptions from the prohibition may therefore be added.

Table 6. Exemptions for lead in the RoHS Directive

Exemptions for lead in the RoHS Directive and transposed in KIFS 1998:8
Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.
Lead as an alloying element in steel containing up to 0.35 per cent by weight, aluminium containing up to 0.4 per cent lead by weight and as a copper alloy containing up to 4 per cent lead by weight.
Lead in - high melting temperature type solders (i.e. lead-based alloys containing 85% by weight or more lead), - solders for servers, storage and storage array systems, network infrastructure equipment for switching, signalling, transmission as well as network management for telecommunications, - electronic ceramic parts (e.g. piezoelectronic devices).
Lead in lead-bronze bearing shells and bushes.
Lead in compliant pin connector systems.
Lead as a coating material for the thermal conduction module c-ring.
Lead and cadmium in optical and filter glass.
Lead in solders consisting of more than two elements for the connection between the pins and the package of microprocessors with a lead content of more than 80% and less than 85% by weight.
Lead in solders to complete a viable electrical connection between semiconductor die and carrier within

integrated circuit Flip Chip packages.
Lead in linear incandescent lamps with silicate-coated tubes.
Lead halide as radiant agent in high-intensity discharge lamps (HID lamps) for professional reprography applications.
Lead as activator in the fluorescent powder (1% lead by weight or less) of discharge lamps when used as sun tanning lamps containing phosphorus such as BSP ($BaSi_2O_5$:Pb) and when used as specialty lamps for diazo printing reprography, lithography, insect traps, photochemical and curing processes and containing phosphorus such as SMS ($(Sr,Ba)_2MgSi_2O_7$:Pb).
Lead with PbBiSn-Hg and PbInSn-Hg in specific compositions as main amalgam and with PbSn-Hg as auxiliary amalgam in very compact energy-saving lamps (ESL).
Lead oxide in glass used for binding front and rear substrates of flat fluorescent lamps used for liquid crystal displays (LCDs).
Lead and cadmium in printing inks for the application of enamels on borosilicate glass.
Lead as impurity in RIG (rare earth iron garnet) Faraday rotators used for fibre optic communications systems.
Lead in finishes of fine pitch components other than connectors with a pitch of 0.65 mm or less with NiFe lead frames and lead in finishes of fine pitch components other than connectors with a pitch of 0.65 mm or less with copper lead frames.
Lead in solders for soldering to machined through-hole discoidal and planar array ceramic multilayer capacitors.
Lead oxide in plasma display panels (PDP) and surface conduction electron emitter displays (SED) used in structural elements, notably in the front and rear glass dielectric layer, the bus electrode, the black stripe, the address electrode, the barrier ribs, the seal frit and frit ring as well as in print pastes.
Lead oxide in the glass envelope of Black Light Blue (BLB) lamps.
Lead alloys as solder for transducers used in high-powered (designated to operator for several hours at acoustic power levels of 125 dB SPL and above) loudspeakers.
Lead bound in crystal glass as defined in Annex I (categories 1, 2, 3 and 4) of Council Directive 69/493/EEC.

3.6 Batteries Directive

Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances

Under this Directive, batteries and accumulators containing more than 0.4 per cent lead by weight are covered by the rules in the Directive. Battery or accumulator means a source of electrical energy generated by direct conversion of chemical energy and consisting of one or more primary (non-rechargeable) or secondary (rechargeable) cells.

The Member States have to take suitable measures to ensure that spent batteries and accumulators are collected separately with a view to their recovery or disposal and that batteries and accumulators and, where appropriate, appliances into which they are incorporated are marked and that batteries and accumulators are only built into appliances if they can be easily removed by the consumer when they are spent (there are certain exemptions from this requirement).

In addition, the Member States have to draw up programmes to achieve certain objectives. One of the objectives is a reduction in the heavy-metal content in batteries and accumulators. There is no prohibition of batteries containing lead.

The Directive was revised in 2006 (OJ 26.09.2006). Collection and recovery targets were quantified in conjunction with the revision. Prohibition of nickel cadmium batteries in certain types of applications was also introduced, but no prohibition of batteries containing lead. The next revision of the Directive is planned for after 2016.

The original Directive has been transposed into Swedish law through the Batteries Ordinance (1997:645). The additional revisions have not yet been transposed into Swedish law.

3.7 End-of-Life Vehicles Directive

Directive 2000/53/EC

Under Article 4.2a the Member States have to ensure that material and components in vehicles put on the market after 1 July 2003 do not contain lead, for instance, except in those cases stated in Annex II to the Directive, see table below. The Directive covers cars and goods transport vehicles with a weight not exceeding 3.5 tonnes. The annex states that lead may be used as an alloying element for instance in steel and aluminium and that lead and lead compounds may be used as metal in components for instance in batteries and vibration dampers. In addition, a level not exceeding 0.1 per cent lead by weight in homogeneous material has to be accepted. Spare parts put on the market after 1 July 2003 and used for vehicles that have been put on the market before 1 July 2003 are exempted from the prohibition in most cases. Re-use of vehicle parts is also exempt. The reason for this exemption from the prohibition is to ensure that vehicles do not have to be scrapped prematurely in the absence of permissible replacement parts. This has never been the purpose of the Directive.

The Commission is assisted by a committee which regularly reviews what changes to the annex are necessary to adapt it to scientific and technical development. Wheel balance weights, for example, are no longer exempt, nor may these be put on the market as spare parts, despite the exemption for spare parts.

The Directive is transposed into Swedish law through the Prohibition of Certain Metals in Cars Ordinance (2003:208).

Table 7. Materials and components exempt from the prohibition in Directive 2000/53/EC under Annex II.

Materials and components	**Range and last date of exemption**
Lead as an alloying element	
1. Steel for machining purposes and galvanised steel containing up to 0.35 per cent lead by weight	
2. a) Aluminium for machining purposes with a lead content up to 1.5 per cent by weight	1 July 2008
b) Aluminium for machining purposes with a lead content of up to 0.4 per cent by weight	
3. Copper alloy containing up to 4 per cent lead by weight	

4. Bearing shells and bushes	1 July 2008
Lead and lead compounds in components	
5. Batteries	
6. Vibration dampers	
7. b) Bonding agents for elastomers in fluid handling and powertrain applications containing up to 0.5 per cent lead by weight	
8. Solder in electronic circuit boards and other electric applications	
9. Copper in friction materials of brake linings containing more than 0.4 per cent lead by weight	1 July 2007
10. Valve seats	Engine types developed before 1 July 2003: 1 July 2007
11. Electrical components which contain lead in a glass or ceramic matrix compound except glass in bulbs and glaze of spark plugs	
12. Pyrotechnic initiators	Vehicles type-approved before 1 July 2006 and replacement initiators for these vehicles

3.8 Toys Directive

Directive 88/378/EEC on the approximation of the laws of the Member States concerning the safety of toys.

The Toys Directive is a "new approach directive". Toys which fulfil the requirements laid down in the Directive are CE-marked. Essential safety requirements are set forth in Annex 2. According to the annex, with regard to chemical properties, in particular for the protection of children's health, bioavailability resulting from the use of toys must not, as an objective, exceed a certain quantity of lead[195].

Nor may toys contain dangerous substances or preparations within the meaning of the Dangerous Substances (67/548/EEC) and Dangerous Preparations (99/45/EC[196]) Directives in amounts which may harm the health of children using them. At all events it is strictly forbidden to include, in a toy, dangerous substances or preparations if they are intended to be used as such while the toy is being used. However, where a limited number of substances or preparations are essential to the functioning of certain toys, in particular materials and equipment for chemistry experiments, model assembly, plastic or ceramic moulding, enamelling, photography or similar activities, they are permitted up a maximum concentration

[195] "In particular, for the protection of children's health, bioavailability resulting from the use of toys must not, as an objective, exceed the following levels per day" (0,5 µg for lead)

[196] There is a reference in the Toys directive to directive 88/379/EEG replaced by 99/45/EEG

level to be defined for each substance or preparation by mandate to the European Committee for Standardisation (CEN).

The Toys Directive exempts fashion jewellery. The restrictions on lead in the Toys Directive therefore did not apply to the item of jewellery described earlier, where a child died as a result of lead poisoning from an item of children's jewellery.

Toys are also regulated under the RoHS Directive. There are thus also rules on lead in toys in this regulatory instrument.

The Directive has been transposed into Swedish law through the Safety of Toys Ordinance (1993:97) and Swedish Consumer Agency regulations (KOVFS 1993:9).

3.9 Directive on Ceramic Articles Intended to Come into Contact with Foodstuffs

Council Directive 84/500/EEC on the approximation of the laws of the Member States relating to ceramic articles intended to come into contact with foodstuffs

This Directive concerns the migration of lead and cadmium from ceramic articles which, in their finished state, are intended to come into contact with foodstuffs, or which are in contact with foodstuffs, and are intended for that purpose.

Under Article 2 the quantities of lead transferred from ceramic articles are not to exceed the limited laid down in the Directive. These quantities of lead and cadmium are to be determined by means of a test carried out under particular conditions using designated methods of analysis. The maximum permitted quantity of lead which may be released from ceramic objects to foods differs depending on the vessel. For articles which cannot be filled and articles can be filled but the internal depth of which, measured from the lowest point to the upper rim, does not exceed 25 mm the limit is 0.8 mg/dm^2. For cooking ware, packaging and storage vessels having a capacity of more than three litres the limit is 1.5 mg/l. For other articles which can be filled the limit is 4.0 mg/l.

However, where a ceramic articles does not exceed the above quantities by more than 50 per cent, that article is nevertheless to be recognised as satisfying the requirements of this Directive if at least three other articles with the same shape, dimensions, decoration and glaze are subjected to a test carried out under the conditions laid down in Annexes I and II and the average quantities of lead and/or cadmium extracted from those articles do not exceed the limits set, with none of these articles exceeding those limits by more than 50 per cent.

The Directive has been transposed into Swedish legislation through National Food Administration regulations (LIVSFS 2003:2).

3.10 Packaging Directive

Directive 94/62/EC on packaging and packaging waste

This Directive covers all packaging and all packaging waste placed on the market within the Community, regardless of the sector in which it has been used and regardless of the materials that have been used.

The Packaging Directive lays down essential requirements for the design of packaging, requirements which are amplified by standards (Article 9 and Annex 2). However, the presence of dangerous substances in packaging has been exempted from the essential

requirements (apart from certain aspects of waste management). The content of substances of very high concern (including lead) is governed by a special article (Article 11). The Member States have to ensure that sum of concentration levels of lead in packaging and packaging components does not exceed 100 ppm.

The Directive has been transposed into Swedish law principally through the Producer Responsibility for Packaging Ordinance (1997:185) and the Chemical Products (Handling, Import and Export Prohibitions) Ordinance (1998:944).

3.11 Directive on Sewage Sludge in Agriculture

Council Directive 86/278/EC on protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture

The purpose of this Directive is to regulate the use of sewage sludge in agriculture. The Member States have to prohibit the use of sludge if levels of lead, for instance, exceed the limit values laid down in the Directive. There must not be more lead than 1000-1750 mg/kg dry matter in sludge intended to be used in agriculture.

Swedish rules on sewage sludge for agricultural purposes are contained in the Chemical Products (Handling, Import and Export Prohibitions) Ordinance (1998:944). The limit value for lead is 100 mg/kg dry matter. Sweden was allowed to retain its stricter rule on sewage sludge on joining the EU.

3.12 Regulation on Contaminants in Foodstuffs

Commission Regulation (466/2001) setting maximum levels for certain contaminants in foodstuffs

Under this Regulation the foodstuffs indicated must not be placed on the market if they contain higher contaminant levels than those specified in an annex to the Regulation. Milk, meat, fish, shellfish, cereals, vegetables, fruit, berries, oils, fats, fruit juice and wine are regulated with regard to lead. The maximum permitted level of lead varies between the different foodstuffs. The foodstuff which has to contain the lowest level of lead is cows' milk (0.02 mg/kg wet weight). The foodstuff out of those regulated which is allowed to contain the highest level of lead is mussels (1.5 mg/kg wet weight). Other limit values are thus between 0.02 and 1.5 mg lead per kg wet weight.

3.13 Directive on Quality of Water Intended for Human Consumption

Council Directive 98/83/EC on the quality of water intended for human consumption

The purpose of this Directive is to protect human health from the adverse effects of any contamination of water intended for human consumption by ensuring that the water is wholesome and clean.

Water for human consumption is wholesome and clean if it is free from any microorganisms, parasites and any substances which, in numbers or concentrations, constitute a potential danger to human health, and meets the minimum requirements set out in the annexes to the Directive. One of the chemical parameters is that the water for human consumption as a

principal rule does not contain more lead than10 µg/l. The Member States have to lay down values for these parameters which are to apply to water for human consumption. However, this value must not be lower than for the minimum requirements.

The Directive has been transposed into Swedish legislation through National Food Administration regulations (SLVFS 2001:30).

3.14 Directive on Extraction Solvents in Food

Council Directive (88/344/EEC) on the approximation of the laws of the Member States on extraction solvents used in the production of foodstuffs and food ingredients

This Directive applies to extraction solvents intended for use in the production of foodstuffs or food ingredients. Extraction solvent means a solvent which is used in an extraction procedure during the processing of raw materials, of foodstuffs, or of components or ingredients of these products and which is removed but may result in the unintentional, but technically unavoidable, presence of residues in a foodstuff.

The Member States have to authorise the use as extraction solvents of those substances listed in an annex to the Directive within the maximum residue limits specified there. However, the Member States have to ensure that the extraction solvents used satisfy certain purity criteria. They must not contain more than 1 mg/kg of lead.

This Directive has been transposed into Swedish legislation through the Food Act (1971:511) and National Food Administration regulations.

3.15 Directive on Flavourings for Use in Foodstuffs etc.

Council Directive (88/388/EEC) on the approximation of the laws of the Member States relating to flavourings for use in foodstuffs and to source materials for their production

This Directive applies to flavourings intended to be used in or on foodstuffs to impart odour and/or taste, and to source materials used for the production of flavourings.

Under the Directive, flavourings must not contain more than 10 mg lead per kg.

This Directive has been transposed into Swedish legislation through the Food Act (1971:511) and National Food Administration regulations.

3.16 Crystal Directive

Council Directive (69/493/EEC) of 15 December 1969 on the approximation of the laws of the Member States relating to crystal glass.

This Directive from 1969 is not restrictive in nature but on the contrary prescribes the use of lead as it does not allow crystal glass in marketing to be called “full crystal” in categories one and two or “crystal” in categories three and four unless the glass contains a certain quantity of lead. The content of lead for full crystal glass in category one must be as high as 30 per cent and in category two the content must be 24 per cent lead for the glass to be called full crystal glass. The Swedish glass industry has objections to this Directive, as it is possible to produce at least semi-crystal glass of the same lustre and quality without lead. This is described in more detail in section 10.2. The Swedish Chemicals Agency considers it essential to press for this directive to be amended in the European Community.

ANNEX 4: CRITERIA FOR CHOOSING PRODUCT GROUP TO REGULATE

In setting priorities among product groups to proceed with in order to propose rules, the criteria listed have provided an importance basis for selection in assessing the need for and prospects of further regulation. The criteria are to be regarded as a form of support in selection and will be discussed broadly. The questions listed under the parameters concerned are examples of relevant issues that should be addressed.

Quantities of lead handled

Groups of articles where large quantities of lead are consumed annually will be given high priority. These quantities will be calculated as the total quantity of lead consumed annually in the group of articles, i.e. present in the articles placed on the Swedish market. However, quantities handled are not the same thing as the quantity to which humans or the environment are exposed.

Emissions in manufacturing

The following questions are examples of questions that are significant in assessing the lead emissions in the manufacturing of the article. Suspected high emissions justify high priority.

Parameters	Examples of questions/comments
Handling of lead	Is lead used in closed or open systems? Is there a risk of leakage or emissions to the environment? Is there a risk of exposure in the event of accidents?
Processing of the article	Does dispersal occur through dust particles (grinding, wear etc.)? Do emissions of lead arise as a result of other processing methods such as melting, welding, cutting etc.?

Emissions during the stage of use

The following questions are examples of questions that are significant in assessing the lead emissions during the stage of use of the article. Suspected high emissions justify high priority.

Parameter	Examples of questions/comments
Emission potential	How is the substance bound in the material (alloy, chemical product etc.)?
Wear of the article	Is the article exposed to wear/abrasion in normal use?
Emissions to the environment	Is it recorded (for example in a scientific article) that the environment is affected by the lead in the article?
Consumer product	Is the product principally used professionally?

User groups	Are there particularly exposed user groups which use the article to a great extent (children, elderly people, patients etc.)?

Emissions at the waste stage

The following questions are examples of questions that are significant in assessing the lead emissions during the waste stage of the article. Suspected high emissions justify high priority.

Parameter	Example of questions/comments
Recovery	Are there recovery systems (producer responsibility) for the article or does a large proportion of the article end up in the general waste stream or in the environment?
Working environment	Is there a risk of exposure in handling the recovered material or destruction of the article?

Existing and future rules

If there are applicable European Community directives or regulations for the product group, these will be analysed carefully regard to the possibility of introducing rules to restrict lead in the product. If there are applicable harmonised European Community directives that contain rules restricting lead, the group groups will be regarded as being dealt with. Product groups for which there are already restriction rules are sorted out by this process. Analysis of the effectiveness of existing restriction rules is beyond the scope of this assignment.

It is necessary to analyse how the forthcoming EU chemicals legislation will affect the prospects of Sweden introducing further regulation of lead. However, the possibility of asserting the environmental guarantee to introduce national special rules always exists.

ANNEX 5: STATUTORY PROPOSAL

Chemical Products (Handling, Import and Export Prohibitions) Ordinance (1998:944)

Present wording	Proposed wording
Ammunition containing lead	*Articles containing lead*
	Section 14 g *Leisure fishing equipment, that is to say angling tackle and subsistence fishing gear, containing lead at a concentration above 0.1 per cent by weight shall not be marketed or used.* Section 14 h *Commercial fishing gear containing lead at a concentration above 0.1 per cent by weight shall not be marketed or used.* Section 14 i *The Swedish Chemicals Agency may, in individual cases, grant exemptions from the prohibitions contained in Section 14 g-h if there are no alternatives and use does not entail marked exposure of humans or the environment.* Section 14 j *The Swedish Chemicals Agency may issue regulations restricting lead in articles for consumer use if the article poses a serious risk to the environment or human health as a consequence of its lead content.*

Transitional provisions

1. The provisions contained in Section 14 g-j come into force on 1 January 2009.
2. An exception applies to Section 14 g-h with regard to nets with lead head ropes, which may be marketed and used until 1 June 2012. Leisure fishing equipment and commercial fishing gear, except for nets with lead head ropes, may also continue to be used if they have been used for the first time before 1 January 2009, Nets with lead head ropes can also continue to be used if they have been used for the first time before 1 June 2012.

KEMI
Swedish Chemicals Agency

SWEDISH CHEMICALS AGENCY • P.O. Box 2 • 172 13 SUNDBYBERG
PHONE +46 8 519 41 100 • FAX +46 8 735 76 98 • www.kemi.se • e-mail kemi@kemi.se