“11. Adaptation to scientific and technical progress of exemptions 2(c)(i). 3 and 5 of Annex II to Directive 2000/53/EC (ELV)”

To: Consultant Consortium of Bio Innovation Service (biois) and The United Nations Institute for Training &Research (UNITAR) and Fraunhofer Institute for Reliability & Microintegration (IZM))

Via Email to: elv@biois.eu

Cc: DG ENV	Ms. Artemis Hatzi –Hull,	Mr. Mattia Pellegrini
DG GROW	Ms. Joanna Szychowska,	Mr. James Copping
Via Email		

Submission of ACEA, CLEPA, JAMA, KAMA et al. representing the affected automotive industry including the supply chain to the stakeholder consultation published by Biosis on 15.Sept. 2020 on the review of three entries in EU ELV Directive Annex II. 08. December 2020

Foreword

This set of documents provides the consolidated stakeholder submissions of the automotive industry associations ACEA, CLEPA, JAMA, KAMA, and associated industrial stakeholders to the “11th adaptation to scientific and technical progress of exemptions 2(c)(i)., 3 and 5(b). of Annex II to Directive 2000/53/EC (ELV)”. In the entry specific submissions, the names of the participating associations are listed separately.

The consultation was announced on 15 September 2020 and concludes on 08th December 2020 and addresses the following entries (exemptions) to be reviewed:

Under category Lead as an alloying element following entries are in our scope:

- 2(c)(i). ”Aluminium alloys for machining purposes with a Lead content up to 0,4 % by weight“
- 3 ”Copper alloys containing up to 4% Lead by weight“

And under category Lead and Lead compounds in components we address:

- 5(b).”Lead in batteries for battery applications not included in entry 5(a).“

ACEA and the joint associations welcome the opportunity to provide submissions to the stakeholder consultation of reviewing the three entries of ELV Annex II 2(c)(i). , 3 and 5(b). and are pleased by outlining technical requirements to address the necessity to continue these exemptions.

For meeting the antitrust conditions in prospects into the future and to support the evidence of our applications we mandated also studies at independent consultants. Their findings and opinions may differ from our direct views. Where appropriate, critical reviews by third parties were conducted.

The summaries of the studies mandated for entry 5 topics are published on the websites of ACEA (www.acea.be/publications) and EUROBAT. The detailed studies can be requested via the EU Commission for taking a look. The rights remain at disposition of the associations.

Introduction

The automobile industry actively supports environmental policy efforts to design products free of hazardous substances and as environmentally sound as possible. All car manufacturers and actors in the supply chain have set up internal goals and environmental guidelines relating to products as well as production processes.

As self-responsible partners of the manufacturers, the suppliers are affected in a special way, having to deal with their global supply chain, sometimes down to the raw material basis and missing availability of specific materials due to import restrictions. The automotive industry and their associations fully accept their product responsibility, but emphasize the need for proportionate actions or initiatives. The represented industry stakeholders agree upon the minimization of negative environmental impacts during all phases of a vehicle life.

In order to reach this common goal to manufacture, market, operate service and recover products with the lowest possible impact on environment or human health, the environmental impact, the relevance of certain substances and their technical and economic implications need to be understood prior mandating substance restrictions. In addition, at our opinion, interference with EU flagship initiatives like circular economy[1] resp. critical resources strategy[2] or the EU general safety regulation and the new waste framework directive needs to be considered. E.g. Bismuth, which is under consideration to replace Lead in some applications, is part of EU critical resources strategy[2] and is recommended to be used with preference in essential applications and has today challenges in recycling.

Achieved progress in heavy metals reduction

The automotive industry has been continuously reducing the amount of heavy metals including Lead necessary for the production of vehicles since the year 2000. Cadmium, hexavalent chromium and mercury have no more meaning in actual car production. As concluded in previous submissions the statement remains valid that – battery excluded because of being used in closed loop - the intentional use of Lead per vehicle is now in the range of background level concentration of all the raw materials used therein. Based on the fact that the potentials for significant and impacting Lead reduction have been realized, any further measures with real benefits for the environment are missing in our opinion.

Further comments to stakeholder contribution

The enclosed entry specific contributions reflect the work of our industry expert groups since the last review of these exemptions in 2014. With high effort we took the challenges addressed to our industry within the consultant report from 2016. In general, technical information given in the course of previous consultations, is seen still as valid and not all times reproduced explicitly in the current submissions.

Where possible and necessary our search for Lead-free alternative metal alloys was supported by external expertise but without public funding over the last few years.

Our working groups are supported by well-educated and excellent experts with external acknowledged expertise in the vehicle and material producing industry.

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[1] https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf; last accessed 04.12.2020

[2] COM(2020) 474 final Brussels, 3.9.2020 Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0474&from=EN Annex I last accessed 04.12.2020

We ask to keep wording for the entries and in addition to avoid any further split into new subentries. The total amount in the alloys for Copper resp. Aluminum applied alloying Lead sums up for around 185 t resp. 13 t related to the volume of vehicles placed on the EU market in 2019. This Lead is bound physically in the metal matrix and during use there is no significant release by corrosion, friction or wear observed. Even recycling is feasible without challenges and realized since decades.

For all the submissions the following data for vehicles new placed (registered) on the EU market and the year 2019 were used as basis for quantity calculations[3] :

Vehicles (passenger cars and light commercial vehicles) new registered in year 2019 in EU (28) including EFTA.

Registrations 2019	Passenger cars	Light commercial vehicles up to 3,5 t	Total
EU28 (without Malta)	15,340,188	2,115,650	
EFTA	465,564	73,674	
EU + EFTA	15,805,752	2,189,324	17.995.076
(Malta sales 2019)			8495
			18.003 571

Table 1: registration figures 2019; 2019 new registrations figures for Malta were not yet available in ACEA pocket guide so we added the corresponding OICA sales figures instead as new registrations. (OICA reports total vehicle sales in 2019 of 8495 vehicles)

As ACEA et al. do not have access to technical data of vehicles in some specific markets, worldwide figures on applications would be incomplete and therefore we concentrate on figures of EU market only. This matches also with EU ELV legislation.

In addition as communicated in previous stakeholder contributions, the development period for implementation of lab validated solutions into production is still 3 to 6 years if no failures occur. The average model cycle is typically around 8 years.

We would like to emphasize that vehicles and their components have to face harsh ambient conditions in Europe. Ambient temperatures from - 40 up to 50°C outside and interior temperatures to above 100°C have to be tolerated and operating temperatures e.g. of some engine components may exceed 800°C. Components e.g. like electronic control units have to be robust against vibrations and acceleration figures above 70 g_0. With more and more electronic assisting driving functions and sensor or camera signals triggered actions of software, also IT related endurance is an important task. - During vehicle use all components and their functions undergo long termed high levels of mechanical and thermo-mechanical stress and dynamic load conditions.

This is valid not only for a short period but over a use period of ten to fifteen years and sometimes longer. That is one of the reasons why development and validation of new components require such long development periods. This ensures that safety and reliability demands are fulfilled.

Furthermore the continued improvement of the overall environmental performance of vehicles and their production processes requires that we also assess the environmental performance of substitute materials in order to allow long lasting decisions for optimized materials in each application.

The entire industry, however, needs a reliable planning basis for these substitute materials for at least one development cycle of a vehicle. This needs to be considered in any future phase out recommendation and plans and EU Commission decisions.

[3] ACEA Pocket guide edition July 2020 p.28, ACEA Brussels and OICA; https://www.acea.be/publications/article/acea-pocket-guide last accessed 03.11.2020

Attached you will find the submissions with technical justifications compiled by expertise of the entire automotive industry (together with the Copper, Lead and battery producers and their organizations) regarding Lead in Copper and Aluminum materials and Lead in batteries, based on the current knowledge.

We ask to recommend a succeeding consultation or review not before a time period of eight years to reflect developments of one product cycle and to enable current research efforts to find their way in a future volume production.

The automotive industry would also like to remind all decision makers in this subject that the still ongoing challenges of COVID 19 is significantly impacting our industry globally. Transformation towards E-Mobility, fulfillment of the very challenging EU CO_2 limits, realizing the General Safety Regulation (GSR) [4] and future autonomous drive modes, consume major parts of the R&D capacities.

We would welcome the opportunity to continue the open discussions with the Commission and the consultants also during the assessment process of the consultation and are willing to answer to further possible questions on the subject.

Should you need any further information, please address your requests in writing to the listed contact person below Cc'ing the listed associations representatives.

In conclusion, the automotive industry requests the extension of the exemptions as specified in the attached documents.

We would appreciate it if you could confirm the receipt of the present document.

We thank you in anticipation.

With best regards,

Amelie Salau & Reinhard S. Hoock

On behalf of the Joint Industry Associations and the Associated Industry Stakeholders

Enclosures: ./.

[4] EU General Safety Regulation (EU) 2019/2144 of the European Parliament and of the Council of 27 November 2019

Enclosures:

Submission for entry 2(c)(i): ACEA et al response 11th SC_entry_2ci_08_12_2020

Submission for entry 3: ACEA et al response 11th SC_entry_3_08_12_2020

Submission for entry 5(b): ACEA et al response 11th SC_entry_5(b)_08_12_2020

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Contact details of the representatives of the associations
(for details on the associations see next page)

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Associations [5] (Registration ID number listed in EU transparency register can be found below)

Association of European Automotive and Industrial Battery Manufacturers (EUROBAT)

EUROBAT is the association for the European manufacturers automotive, industrial and energy storage batteries. EUROBAT has more than 50 members from across the continent comprising more than 90% of the automotive and industrial battery industry in Europe. The members and staff work with all stakeholders, such as battery users, governmental organisations and media, to deve- lop new battery solutions in areas of hybrid and electro-mobility as well as grid flexibility and renewable energy storage.

The European Automobile Manufactures Association (ACEA)

The European Automobile Manufacturers' Association (ACEA) represents the 16 major Europe-based car, van, truck and bus makers. BMW Group, CNH Industrial, DAF Trucks, Daimler, Ferrari, Fiat Chrysler Automobiles, Ford of Europe, Honda Motor Europe, Hyundai Motor Europe, Jaguar Land Rover, PSA Group, Renault Group, Toyota Motor Europe, Volkswagen Group, Volvo Cars, and Volvo Group.

ACEA works with a variety of institutional, non-governmental, research and civil society partners - as well as with a number of industry associations with related interests.

ACEA has permanent cooperation with the European Council for Automotive R&D (EUCAR), which is the industry body for collaborative research and development.

ACEA has close relations with the 29 national automobile manufacturers' associations in Europe, and maintains a dialogue on international issues with automobile associations around the world

Japan Automobile Manufacturers Association, Inc. European Office (JAMA)

Japan Automobile Manufacturers Association, Inc. (JAMA) is a non-profit industry association which comprises Japan's fourteen manufacturers of passenger cars, trucks, buses and motorcycles. JAMA works to support the sound development of Japan's automobile industry and to contribute to social and economic welfare

Korea Automobile Manufacturers Association (KAMA)

The Korea Automobile Manufacturers Association (KAMA) is a non-profit organization representing the interests of automakers in Korea. We are promoting the sound growth of the automobile industry and also the development of the national economy.

International Lead Association (ILA)

ILA is the only global trade association dedicated to representing lead producers and companies with a direct interest in lead and its use. The Association's team of technical, regulatory, environment and health experts work with stakeholders to promote the benefits of lead and the safe and responsible use of the metal in manufacturing and other applications.

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[5] The associations are registered at the EU Transparency register as follows:

European Automobile Manufacturers Association (ACEA) Identification No. 0649790813-47

European Association of Automotive Suppliers (CLEPA) Identification No. 91408765797-03 Japan Automobile Manufacturers Association, Inc. (JAMA) Identification No. 47288759638-75

Korea Automobile Manufacturers Association (KAMA

Association of European Automotive and Industrial Battery Manufacturers (EUROBAT) ID. No. 39573492614-61

International Lead Association (ILA) Identification No. 311414214793-82

European Copper Institute (ECI) Identification No. 04134171823-87

The European Association of Automotive Supplier (CLEPA)

CLEPA, the European Association of Automotive Suppliers, represents over 3,000 companies supplying state-of-the-art components and innovative technologies for safe, smart, and sustainable mobility.

CLEPA brings together over 120 global suppliers of car parts, systems, and modules and more than 20 national trade associations and European sector associations. CLEPA is the voice of the EU automotive supplier industry linking the sector to policy makers.

- The automotive sector accounts for 30% of R&D in the EU, making it the number one investor.
- European automotive suppliers invest over €30 billion yearly in research and development.
- Automotive suppliers register over 9,000 new patents each year.
- Automotive suppliers in Europe generate close to five million direct and indirect jobs.

For entry •2(c)(i). ”Aluminium alloys for machining purposes with a Lead content up to 0,4 % by weight“

For entry 3 ”Copper alloys containing up to 4% Lead by weight

Japan Auto Parts Industries Association (JAPIA)

The Japan Auto Parts Industries Association (JAPIA) is an industry organization that was established in August 1969, when its predecessor, the Auto Parts Industries Association was reorganized as an incorporated association with a higher level of public interest. Today, the value of shipments of auto parts from member companies has reached approximately 20 trillion yen, supporting the manufacture of automobiles not only in Japan but also around the world.

Each and every one of these high-quality parts makes a significant contribution to the safety and comfort of automobiles. The environment surrounding the automotive parts industry is becoming more and more severe, and the industry is facing many challenges such as responding to structural changes, dealing with environmental issues, and promoting international cooperation.

JAPIA will continue to develop proactive business activities to contribute to the growth of the Japanese economy and society while promoting the sound progress of the "motorized society" through the automotive industry.

For entry •3 ”Copper alloys containing up to 4% Lead by weight“

European Copper Institute (ECI)

The European Copper Institute (ECI) is the voice of the International Copper Association (ICA) in Europe. The International Copper Association, with its 35 members, represents a majority of the world’s primary copper producers, and some of the largest mid-stream smelters/refiners, and 10 of the world’s largest copper fabricators. It aims to bring together the global copper industry to develop and defend markets for copper and to make a positive contribution to society’s sustainable development goals.

“11. Adaptation to scientific and technical progress of Annex II to Directive 2000/53/EC (ELV)”

Exemption Evaluation under Directive 2000/53 EC

ACEA et al. Response to Stakeholder Consultation Questionnaire
of Bio Innovation Service, UNITAR and Fraunhofer IZM dates 15.9.2020

ENTRY 2(c)(i). Aluminium alloys for machining purposes with a lead content up to 0.4 % by weight

Application for an extension of Annex II EU ELV exemption No. 2(c)(i).
(Aluminium alloys for machining purposes containing up to 0.4 % lead by weight)

This application is supported by the following associations:

- ACEA, the European Automobile Manufacturers Association, Brussels (transparency registration ID number 0649790813-47)
- JAMA, the Japan Automobile Manufacturers Association, Tokyo / Brussels (transparency registration ID number 71898491009-84)
- CLEPA, the European Association of Automotive Suppliers, Brussels (transparency registration ID number 91408765797-03)
- JAPIA, the Japan Auto Parts Industries Association, Tokyo
- KAMA, the Korea Automobile Manufacturers Association, Seoul

Foreword

0. Scope

Aluminium is an essential construction material for vehicles and their components. Aluminium is the mainly used lightweight material in transportation applications. Numerous aluminium alloys with specific properties are in use to optimize material efficiency and part functions as well as to fulfil component specific ambient conditions, like automotive fluids or corrosion load. All Aluminium used in a car is recyclable and contributes to circular economy by closing the loop from metal to metal. The use of recycled alloys saves resources.

For aluminium alloys containing Lead, an exemption from the Lead ban is required to enable use of secondary aluminium and for the production of some specific components. The vast majority of intentional used of Lead in Aluminium in vehicles could be substituted over the years from vehicle generation to vehicle generation. The situation and the need were yet explained in previous stakeholder consultations. We would like to state that this information is still valid and therefore indirect part of this application.

1. Description of applications

Most of the uses with intentional Lead addition have been now substituted. However, in a small amount of quite challenging parts, the specific properties of Lead are important for the function (e.g. anti-friction effect).and therefore the phase out could not yet be realized.

2. Development of exemptions for Lead in aluminium in vehicles from 2000 to 2020

Beginning with the initial version of ELV directive in the year 2000 a limit of 4% wt. for the use of Lead in aluminium was set. The entry into force date was the 1.7.2003

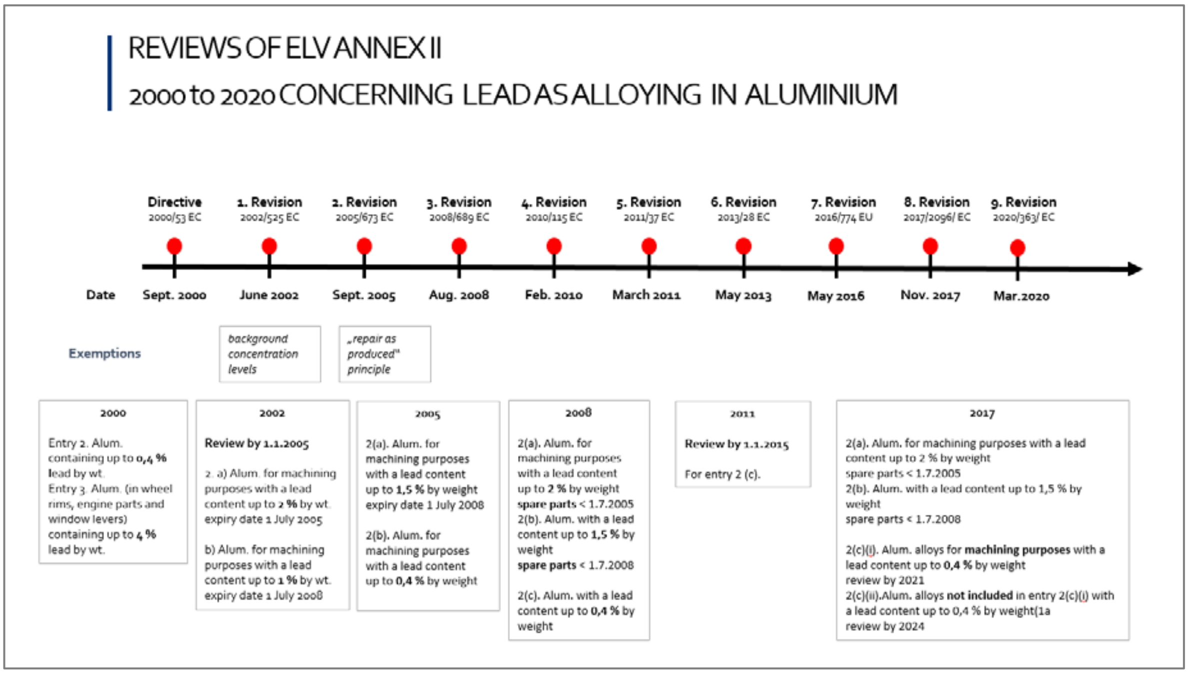

Figure 1: EU Lead limits in aluminium materials defined in Annex II of ELV directive

Since the beginning of the ELV directive the limit values for Lead in aluminium were amended several times as figure 1 outlines.

In dialogue between legislator and industry the necessary limit could be reduced step by step over the years (see figure 2). Even the material volumes for intentional uses of Lead decreased significantly over the years.

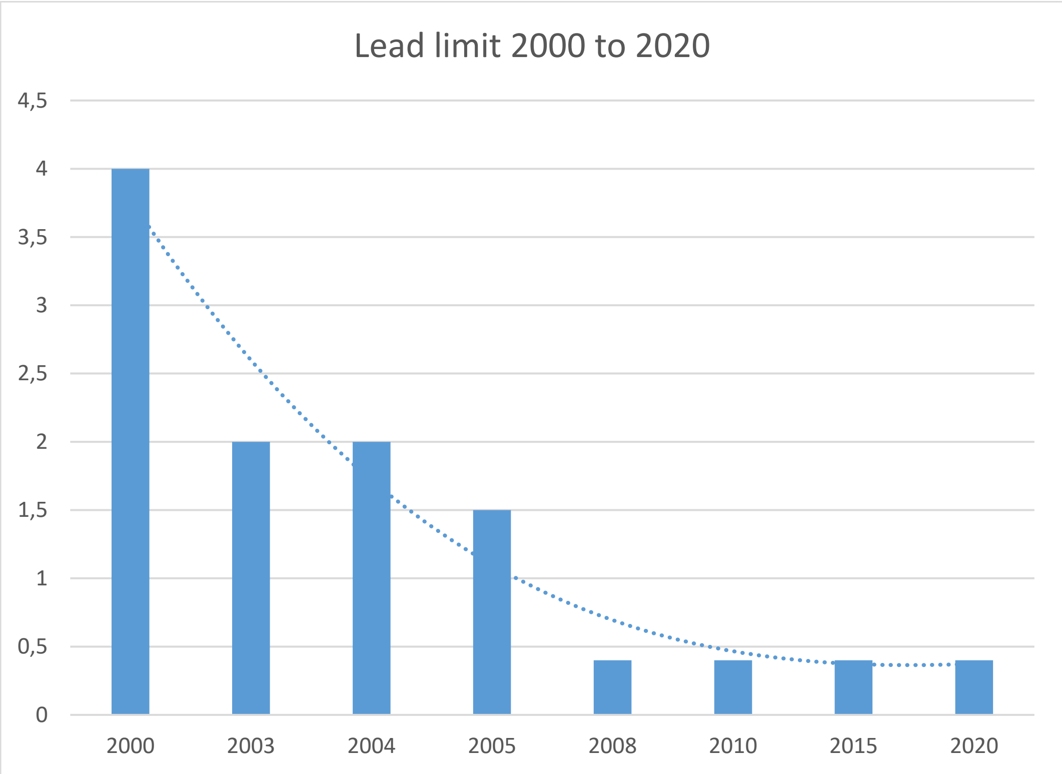

Figure 2: EU Lead limits in aluminium materials for production of new cars.

As of today there is a limit value for secondary aluminium (recycling aluminium), where Lead is in unintentionally as given background concentration and there is a limit for Lead in aluminium for machining purpose where Lead is intentionally applied to specific alloys to realize specific material properties. For both use cases, the given Lead limit is 0,4 wt %. More than 99% of the Lead in aluminium per actual produced cars derives from the use of recycled aluminium.

Around 1/3 of the total global Aluminum demand is for transportation applications. Within the transportation category around 60% of the demand are asked by vehicle resp. car production. So the estimated share of M1/N1 vehicles in the total demand for Aluminum is around 20%. Again around 20 to 25% of vehicle production is located in EU. Within this 20 % demand the major part comes from virgin aluminum production as there is not enough secondary material available to cover all needs. Less than 1 % of the demand is originating from use of aluminum for machining purposes and the amounts decrease from vehicle generation to vehicle generation to very low values.

Based on figures from global aluminum association for the year 2018 and own estimations, figure 3 summarizes the aluminum uses: starting from global production, volumes are estimated going towards production needs for EU registered vehicles cat M1/N1, then ending with a first top-down evaluation of expected Pb in Al volumes . More detailed figures, according to a bottom-up approach are outlined in the answer to question 5.

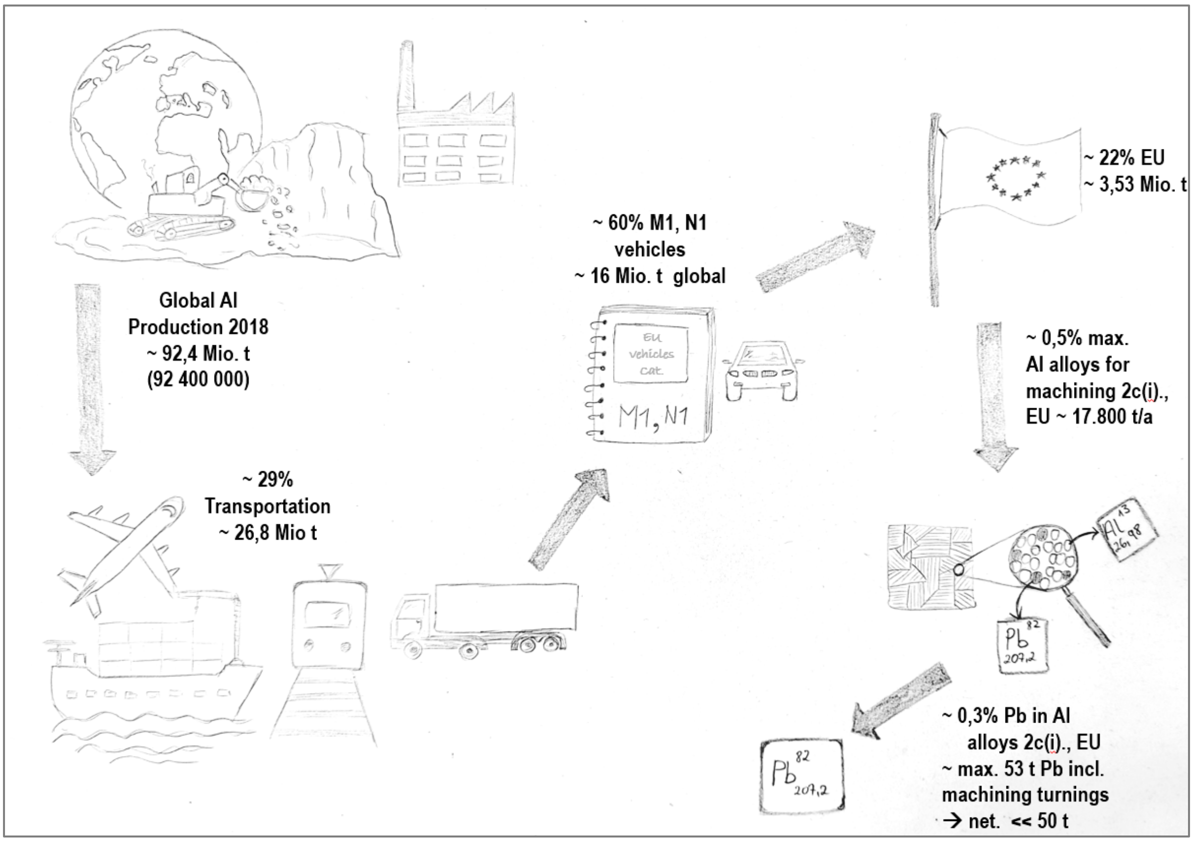

Figure 3: Estimation on Aluminium demand for actual vehicles

Questionnaire 1 (Consultation) Exemption 2(c)-I of ELV Annex II

Aluminium alloys for machining purposes with a lead content up to 0,4 % by weight

1. Acronyms and Definitions

Pb	lead
Al	aluminium

2. Background

Bio Innovation Service, UNITAR and Fraunhofer IZM have been appointed[1] to assist the European Commission in the review of three exemptions currently listed in Annex II of the ELV Directive 2000/53/EC.

The above exemption has become due for review. It was reviewed[2] last time in 2015/2016 under the ELV Directive (see below link), and the consultants concluded that the use of lead was still unavoidable. The Commission therefore granted the exemption in line with the requirements of ELV Art. 4(2)(b)(ii). The exemption is due for review in 2021 in order to evaluate the state of scientific and technological progress.

This questionnaire has been prepared for the stakeholder consultation held as part of the evaluation. The objective of this consultation and the review process is to collect and to evaluate information and evidence according to the criteria listed in Art. (4)(2)(b)(ii) of Directive 2000/53/EC (ELV Directive), which you can download from here:

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0053

Additional background information can be found on the exemption review page accessible through the following link: www.elv.biois.eu

If you would like to contribute to the stakeholder consultation, please answer the following questions:

3. Questions

Introduction

Main Aluminium alloys categories

According to the targeted manufacturing processes, two categories of Aluminium alloys are used in the automotive industry, namely cast alloys and wrought alloys[1].

A majority of casting Aluminium alloys contain and tolerate larger percentages of alloying elements when compared to wrought Aluminium alloys. Consequently, in the past, most Aluminium scrap ended in cast alloys, as these alloys were more 'tolerant' in terms of chemical composition and background concentrations of tramp elements. For this reason, most Lead added to Aluminium alloys in the past can be found in cast Aluminium applications today.

In contrast to these cast alloys, where Lead can be seen as legacy substance originating from the recycling of Aluminium, Lead is intentionally added in wrought alloys to reach specifications regarding properties for machining.

Recycling and exemptions in the ELV Directive

In order to be able to continue to recycle end-of-life scrap coming from casting applications in the most environmental friendly way and minimising dilution needs, it is important to be allowed to produce casting alloys with a certain impurity background level of concentration amount of Lead. This tolerated amount was 0,4% in the present ELV Directive exemption 2(c)(ii). It reflects broadly the global available material standards for recycled Aluminium since decades (see also figures 1 &2).

However, it is our understanding that this aspect is rather covered by exemption 2c(ii), although Question 3 refers to recycled Aluminium, Still, elements will be given as from the trends regarding Lead content in recycled Aluminium.

1. **Please explain whether the use of lead in aluminium for machining purposes addressed under exemption 2(c)-I of the ELV Directive is still unavoidable so that Art. 4(2)(b)(ii) of the ELV**
   Directive would justify the continuation of the exemption. In the last review of this exemption, it was found that aluminium for machining purposes still required 0.4 % of lead addition.

At first, we would like to inform on identified applications produced with Aluminium alloys complying with the current exemption.

There are around 10 different Lead containing alloys for machining purposes with a content of up to 0,4% wt. Pb applied. This is to enable fulfillment of component specific requirements and their interacting function in complex assemblies under mechanical load, temperature and with fluids impact with different compositions.

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[1] *http://www.aluinfo.de/files/_media/dokumente/Downloads/Technische%20Daten/Merkblaetter/W2_Aluminium Knetwerkstoffe.pdf, last accessed 28.11.2020*

Examples: Valves, pistons, valve tappets, special adjusting screws, pump, cylinders, compressor elements, sensor elements, motor bearing cage, valve pins, separating cylinders rollover system, safety belt system, squib holder, piston brake system, turbo charger, shock absorber element/bearing, cylinder sleeve, HVAC system, valve bushings, axles, magnet valve, plunger, brake power multiplier (brake booster), closing bolt, pistons in automated gearbox system.

The specific characteristic of these components is that they are **mainly small moving parts**, like in valves or pistons where light weight and emergency dry running properties as well as some ductility are important. Small means small size of component, but accuracy of dimensions and wear resistance is important as well as corrosion resistance. There is no major difference to be observed between ICE and BEV variants concerning relevant Lead uses. This sounds reasonable as brake systems or safety belt applications are in use in both variants.

Most relevant properties for such sliding or moving elements are:

- ✓ Fatigue strength (Ability of bearing of permanent mechanical load)
- ✓ Good resistance to fatigue crack growth and damage tolerance even at elevated temperatures
- ✓ Erosion resistance (wear by critical flow of media turbulence)
- ✓ Elution/leaching by fluids /oils
- ✓ Cavitation pitting
- ✓ Resistance against abrasive wear
- ✓ Tolerance against fretting
- ✓ Corrosion resistance
- ✓ Resistance against chemicals

The quality of the surface resp. the fatigue life of the relevant vehicle components is depending on the material properties which are highly influenced by the machinability of the alloy, the machining process parameters and cutting tools used for the procedures.[2]

Based on different combinations of required properties mentioned above different grades of Aluminum alloys are used as time tested materials.

Materials containing up to 0,4 % Pb in Aluminium are reported in the different series (e.g. 2000 = Al-Cu based, Al-Mn, 6000 = Al-Mg-Si…).

So the choice of the material is done to component case specific use profiles e.g. like ductility, surface quality or dry run emergency lubrication ability etc.

a. Which lead-free aluminium alloys have become available meanwhile for machining purposes?

Lead-free alloys i.e. containing a maximum Lead content of 0.1% have been developed in the past years: EN-AW 2007A, 2007B, 2028C, 2033, 2041, 2044, 2045, 2077, 6020, 6023, 6026 (*in its lead-free version '6026 LF'*), 6028, 6065, 6262A (AlMg1SiSn with 0,4 to 0,9 %Bi).

[2] *Muhammad Aamira,, Khaled Giasinb, Majid Tolouei-Rada,Ana Vafadar: drilling performance and hole quality of aluminium alloys for aerospace applications; Journal of Materials Research and Technology Volume 9, Issue 6, November–December 2020, Pages 12484-12500*

New alloy formulations for machining of Aluminum need to keep a low melting element. Tin (Sn) is commonly known as substitute. Bismuth (Bi) is also often mentioned but, in fact, its content stays in the same range as “non-Lead-free” alloys.

Lead-free Aluminium alloys are according the European Aluminum Association (EAA) globally available and Aluminium producers have developed Lead-free alternatives with the aim of obtaining properties range compatible with Lead-containing alloys in use for any applications.

However, actual substitution requires that these Lead-free alternatives meet the technical requirements for the specific automotive parts currently produced from alloys with higher Lead content (0,1 – 0,4%). Actual performances of substituting alloys need to be validated, not only in terms of intrinsic properties but also in functional behaviour, to ensure among others:

- machining properties
- heat treatment options
- corrosion resistance
- strength
- necessary material properties in the final product (e.g. durability / low friction)
- high safety standard (e.g. linked to part precision or corrosion resistance)

This need for validation is demonstrated by the number of parts used in car applications which are still based on Aluminium alloys containing between 0.1 and 0.4% Lead. Moreover, some alloys have been developed more recently and need to be thoroughly evaluated by individual users (data cannot be shared for obvious confidentiality issues and evaluation needs to be realized for specific applications).

NB: other potential alternatives to Pb-free alloys are:

- Copper alloys, machining steel
- Replacement of mechanical systems by electronic functions/ devices
- New developed Aluminum alloys with tin and/or Zr substituting Bismuth.[3]

The automotive industry is not in favour of substitution of Lead with Bismuth, since it would not result in clear environmental benefit.

b. For which machined applications can they be used?

Lead-free Aluminium alloys are intended for automotive parts, but not generally used in safety critical applications, such as brake components, transmission valves, air-conditioning components.

In general, the target items for using these alloys are any part that needs to be machined, anodized after machining, in contact with fluids.

In most applications with Lead, the applied amount of Lead is already distinctly below the maximum of 0,4% and a larger number of Lead-free Aluminium alloys are available on the market. Anyway, in few cases, alloys with Lead content between 0.1 and to 0.4% are still applied for technical reasons based on downstream users’ assessment. It is also recognized that some alternatives – previously put on the market - have not met

[3] H. *Antrekowitsch, S. Koch: Alloying Behaviour of Cu, Mg and Mn in Lead-free Al-Cu Based Alloys Intended for Free Machining BHM Berg- und Hüttenmännische Monatshefte volume 156, pages 272 (2011) and S. Koch, Untersuchungen von bleifreien Aluminium-Automatenlegierungen PhD thesis University of Leoben Institute for Nonferrous Metallurgy 2010*

requirements in the past (e.g. toughness at high temperature, behaviour in high-pressure forming …) and may slower the pace of substitution.

c. Can the content of lead be reduced for machining applications where lead-free Al is not viable or available?

For **wrought alloys**, which we understand are the ones in the perimeter of this exemption, Lead is added intentionally and thus directly linked to the requirements of the downstream users. **A reduction in content can be done when a Lead-free alloy is validated in a given application** (i.e. part or set of parts validated by a given customer). Here, <u>timeline is mainly determined by development and validation cycle times.</u>

2. Please explain the efforts your organisation has undertaken to find and implement the use of lead-free alternatives for automotive uses. Please refer to alternatives, which at least reduce the amount of lead applied or eliminate its necessity altogether.

In addition to complying with environmental regulations and standards, the automotive industry is constantly working to minimize environmental impacts of its products and solutions throughout the entire lifecycle.

As demonstrated by the successive adaptations of the Lead in Aluminium exemption (see figures 1 & 2), a continuous effort has been realized by the automotive industry to reduce the overall Lead content.

Moreover, in more than 99% percent of the Aluminium used per actual car, no intentional Lead use is specified.

[NB: Most Lead content comes from recycled Aluminium (cast alloys) – covered by exemption 2c(ii) - The use of alloys based on secondary raw materials contributes to a lower environmental footprint].

At this stage, contributing stakeholders agree that the effort for further Lead content reduction (e.g. 0.3% instead of 0.4%) is equivalent to switching to Lead-free alloys.

3. Please provide a roadmap specifying the necessary steps/achievements in research and development including a time scale for the substitution or elimination of lead in this exemption.

Some innovations regarding substitutes for “conventional” hard alloys containing Lead (over 0,1%) have been put on the market in the recent years. Potential use of these solutions require that they undergo a thorough evaluation against requirements for the specific parts. Timeline for market introduction of parts based on these alloys will have to comply with usual development cycle.

Alloys should be developed and readily available with the suitable combination of characteristics.

Starting point for this approach is the identification and confirmation for availability of a new material in samples from the material manufacturer *(material sourcing with potential multi-sourcing requirements)* and it ends at transition of the whole production to the new material.

Usual steps:

- Materials characterization at coupon level (including ageing tests)
- Machining tests (mechanical behavior, compatibility with machining fluids, durability of tools…)
- Product design (potential modifications to match properties of the alloy)
- Product validation (including bench testing at part or sub-assembly level as well as field testing)

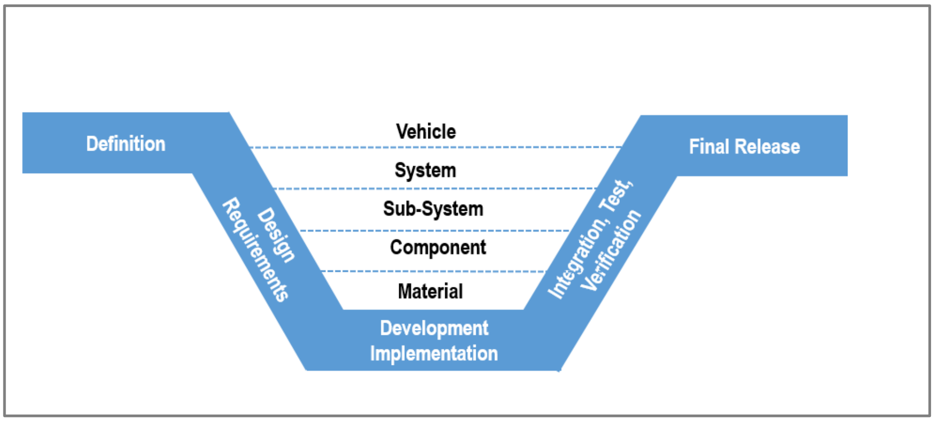

Figure 4: Development stages and levels from material to vehicle

The overall time to pass all development stages takes about **7 years**, if using validated materials. This is only possible in case no general design loops are necessary, sufficient qualification capacity is available, and no new machining tools need to be bought. Depending on the tool complexity, lead time is up to 2 years delivery time which needs to be added to the total time frame.

4. **Aluminium (Al) used in vehicles may consist at least partially from recycled aluminium, which contains lead (Pb) that was not intentionally added. This required the exemption to allow a Pb content of around 0.4 % to enable the use of recycled aluminium even where it is not required, in particular in cast aluminium. In the last review[2], ACEA et al. expected that the Pb content in scrap aluminium (Al) will gradually decrease from around 0.4 % in 2010 to around 0.2 % in 2023.**

   a. **Can you confirm this trend, or do you have substantiated different figures indicating a different trend? What is the actual lead content in Al scrap?**

As explained in the foreword, our understanding is that Lead in recycled Aluminium is covered by exemption 2(c) (ii); the figures will be evaluated in detail for review of this specific entry. For wrought alloys, Lead is only intentionally added.

On vehicle level, a higher share of Aluminium use is observed with increased volumes both for virgin and recycled Aluminium. Since there is no closed loop from vehicle to vehicle and, also, vehicles contribute to around 15 to 20 % of Aluminum scrap volume, the content of Lead depends by 80% of non-vehicle scrap. At vehicle level, we see a decrease in the overall average content of Pb in the aluminum fraction from 2010 to 2020 (120 g/car in 2010; 80 g/car in 2014; around 70 g/car in 2020). But, in general, the levels depend on available end-of –life scrap and its quality. The amount of clean production scrap is going down due to material efficiency improvements. As there is more virgin aluminum applied for weight saving reasons, the average content of lead in wt. % in aluminum material per car decreases.

Cast Aluminium contains larger percentages of alloying elements when compared to wrought Aluminium alloys. Consequently, in the past, most Aluminium scrap ended in cast alloys, as these alloys were more ‘tolerant’ in terms of chemical composition. For this reason, most lead added to Aluminium alloys in the past can be found in cast Aluminium applications today.
In order to be able to continue to recycle scrap coming from casting applications in the most environmental friendly way and minimizing dilution needs, it is important to be allowed to produce casting alloys with a certain amount of lead. This tolerated amount was 0,4% in the present ELV Directive exemption 2(c)(ii) and, based on the declining trend being observed for incoming scrap lots, the Aluminium industry is ready to make the next step down to 0,3% of lead.

The recent update of standards EN 1676:2020 'Aluminium and Aluminium alloys. Alloyed ingots for remelting. Specifications' and EN 1706:2020 'Aluminium and Aluminium alloys - Castings - Chemical composition…' will support that move since alloy compositions have been revised with a maximum lead content reduced to 0,29%. But this could also be seen as trade barrier as EU's share in global Aluminium production is only 8 % of global Aluminum production.

Given the field experience and the above-mentioned elements, we can confirm the trend towards its reduction.

However, the previous expected – contribution from ACEA et al. for the last review

- Lead content of 0.2 % in 2023 was not yet achieved, due to the reasons outlined above.

b. **Contaminations in aluminium, for example from shredded end-of-life vehicles, cannot be removed as easily as contaminations from precious metals and copper fractions. Al scrap therefore is diluted with more or less primary Al regularly to achieve the aspired purity and quality of the Al material. The Pb content in secondary Al produced from (diluted) Al scrap must therefore be lower than in the Al scrap. What is the current content of lead in secondary aluminium?**

Concentrations of these "contaminations" are in the range the global alloys standards allowing background concentrations for Lead (0 to 0.4 %).

In secondary aluminum materials, more impurities of elements like Cu, Fe or even Pb are present. To meet customer demands and material specs the required flexibility of using globally different scrap grades in standards for secondary alloys is important. These tolerate certain amounts of Fe, Cu and Pb as background concentration. Dilution with virgin material is one possibility to achieve limit values for background concentration levels, but also processing different grades of production scrap and post-consumer scrap in one refining procedure is a possibility. (see also answer to 4.a)

As aluminum scrap is a global traded product, it is very difficult to estimate general Lead content in secondary aluminum. This is very much depending on age of products entering the recycling route.

5. **What is the amount of lead that would be contained in in vehicles?**

   c. **placed on the EU market**

   d. **worldwide**

   in case the exemption is continued? Please provide a rough calculation or substantiated estimate.

a) Vehicles placed on EU Market

According ACEA[4] and OICA[5] publications, in 2019, 18.003 571 vehicles in categories M1/N1 were newly registered in the EU. Calculated Lead volumes are related to this figure.

Depending primarily on the use of recycled Aluminium in a vehicle we estimate a Lead content in the range of 25 to 200 g in Aluminium materials per car. With an average quantity of 73 g/car, Lead content has been reduced by 8%.
However, most of this Lead (≈ 99%) is contained unintentionally by cast alloys for which secondary Aluminium is used. Lead intentionally added for machining applications represents 0,6-0,7 g per vehicle in total (i.e. 0.9%).

Based on 18.0 Mio vehicles (M1/N1) put on the European Market in 2019, we estimate a total Lead amount per annum for alloys covered by exemption 2(c)(i). of about /10-15 Tons.

b) Worldwide

We regret that detailed worldwide figures are not available. For some countries e.g. we miss accurate data especially on material breakdown in vehicles. Therefore, we restrain from presenting worldwide figures. As ELV directive is a European legislation and available market data are sufficient for EU, we focus on EU data.

6. **Overall, please let us know whether you agree with the necessity to continue the exemption and sum up your arguments for or against the continuation.**

Remind of difference between wrought and cast alloys

The intentional use of Lead for Aluminium for machining purpose has again decreased against last stakeholder consultation. In around 99% percent of the Aluminium used per actual car no intentional Lead use is specified.

For several components, use of Aluminium (wrought) alloys with intentional added Lead is currently specified to enable parts function, with sought properties which are component/ case specific. Currently, around 10 different special alloys containing up to 0,4 % Pb are applied.

However, new alloys have been made available on the market since the last consultation, opening the path towards phase out of Lead in Aluminium with first cases of effective substitution in the automotive sector. To enable necessary validation and parts' development regarding functional and safety requirements,

given technical elements described in this answer, the contributing stakeholders request an extension of exemption 2(c)(i). for seven years and then ending for new vehicles type-approved after 1 January 2028, as well as for spare parts for these vehicles.

[4] ACEA Pocket guide;https://www.acea.be/uploads/publications/ACEA_Pocket_Guide_2020-2021.pdf 29.07.2020 ACEA Brussels; last accessed 29. Sept.2020.

[5] OICA figures http://www.oica.net/ -Vehicles-2019.pdf last accessed 29.9.2020

Consultant note:

Please note that answers to these questions can be published in the stakeholder consultation, which is part of the evaluation of this request. If your answers contain confidential information, please provide a version that can be made public along with a confidential version, in which proprietary information is clearly marked.