Consultation Questionnaire Exemptions 6(a) & 6(a)-I

Exemption 6(a) for "Lead as an alloying element in steel for machining purposes and in galvanised steel containing up to 0,35 % lead by weight", and

Exemption 6(a)-I for „Lead as an alloying element in steel for machining purposes containing up to 0,35 % lead by weight and in batch hot dip galvanised steel components containing up to 0,2 % lead by weight"

Abbreviations and Definitions

EEE	Electrical and Electronic Equipment
Pb	Lead
REACH	Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), […]
RoHS	Directive 2011/65/EU on the Restriction of Hazardous Substances in Electrical and Electronic Equipment
UP	Umbrella Project (Applicant)

Background

The Oeko-Institut has been appointed by the European Commission, within a framework contract[1], for the evaluation of applications for exemption from Directive 2011/65/EU (RoHS), to be listed in Annexes III and IV of the Directive.

Röhm GmbH as well as the European Steel Association (EUROFER) and European General Galvanizers Association (EGGA) on behalf of the "RoHS Umbrella Industry Project" (hereafter referred to as "Umbrella Project" or UP) have submitted requests for the renewal of the above-mentioned exemptions, which have been subject to an initial evaluation. A summary of the main argumentation for justification is provided below. The applicant has been requested to answer additional questions and to provide additional information, available on the request webpage of the stakeholder consultation (https://rohs.exemptions.oeko.info/index.php?id=355).

For further details, please check the exemption requests and additional information submitted by the applicants on the request webpage of the stakeholder consultation.

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. 5 (1) (a) of Directive 2011/65/EU (RoHS 2), which can be found under:

[1] The contract is implemented through Framework Contract No. ENV.B.3/FRA/2019/0017, led by Ramboll Deutschland GmbH.

https://eur-lex.europa.eu/legal-content/en/ALL/?uri=celex:32011L0065

If you would like to contribute to the stakeholder consultation, please review the summary of the argumentation provided and answer the questions that follow.

1. Summary of argumentation of applicant on the justification of the exemption

1.1. Background

The Umbrella Project (UP) applies for a renewal of exemption 6(a) and for exemption 6(a)-I with regards to EEE categories 1-10. The application covers both lead in steel for machining purposes and for lead in hot dip galvanised steel. The applicant proposes that all EEE Categories covered under Ex. 6(a) – EEE categories 8,9, and 11 - would be merged into Ex. 6(a)-I in the future (then covering all EEE categories). The applicant refers to the wording of Ex. 6(a)-I as the requested wording and requests the maximum validity periods foreseen in the RoHS 2 Directive (which means 7 years for Cat. 8 and Cat. 9 EEE and 5 years for all other categories).

Röhm GmbH applies for exemption 6(a). Given that this exemption is only applicable to EEE categories 8, 9 and 11, and that the applicant clarifies that relevant EEE for which the exemption is applied for are power tools (some of which fall under category 6), the consultants conclude that the application is actually for renewal of Ex. 6(a)-I with regards to lead in steel for machining purposes. It still needs to be clarified whether drill chucks are also applied in other EEE categories. The applicant has not provided any alternative wording for the exemption, however, lead in steel for hot dip galvanized steel is not referred to in the Röhm application. The requested duration of the exemption is 5 years.

Volume of Lead to be placed on the EU market through the exemption

In 2020, Röhm GmbH placed ~ 1.2 tons of lead on the market worldwide through their specific application (drill chucks in power tools, EEE category 6).

Based on the input of the Umbrella Project, it is understood that 146 to 255 tons of lead are placed on the market through all types of leaded steel applications for machining purposes (all EEE categories). Thereof, EEE (in addition to automotive applications) is only a part and the Umbrella Project cannot specify the share of steel used in EEE compared to other applications. For batch galvanised steel, it is assumed that less than 1 ton per annum is intentionally used, the amount of Pb in recycled zinc is not calculable.

1.2. Summary of argumentation of applicant on the justification of the exemption

1.2.1. Leaded steel for machining purposes

1.2.1.1. Technical description

According to the applications, lead in steel provides a lubricant effect to the host material that results in a good chip crack performance, stability and smooth surface. This allows a higher cutting speed, a higher stability (a lower spindle stress) and a longer tool life. The steel is used in a "*diverse range of final applications within EEE including finished products and fixed installation of which an exhaustive list is not feasible*", states the UP application.

In a late communication, the UP provided clarification as to different relevant types of steel:

- **Low carbon free cutting steel**: the primary property requirement is machinability. They are typically used for manufacturing when a lot of material is removed to obtain machined parts. Therefore, these steels contain machinability enhancer, besides lead, this can be sulphur, oxygen or phosphor. In 2018, 89% of the total supply of low carbon free cutting steel of a European steel manufacturer was the leaded version in contrast to the non-leaded version. This type of steel is the most common use scenario for lead in steel.
- **Steel for quenching and tempering/ heat treatable steel**: the primary property requirement is the ability to maintain or achieve a certain combination of mechanical properties after thermal treatment, and '*Machinability is enhanced primarily through the additions of low levels of sulphur (<0.1%) and, in some grades, Ca, Bi or Pb. Typically, customers only require the highest levels of machinability (ie. leaded variants) where particularly demanding machining operations, such as high tolerance deep hole drilling, are undertaken*';
- **Carburising steel** when high toughness parts with hard surfaces are required. As in the case of steel for quenching and tempering, here too, a machinability enhancer can be low levels of sulphur (<0.1%), Ca, Bi, Te or Pb; as for quenching and tempering steel, mainly leaded variants are used;

1.2.1.2. Applicants' justifications for the requested exemption

With regards to substitution, the UP application outlines the efforts taken by the EU steel industry with regards to alternatives to lead as machinability enhancer in steels. Machinability enhancing additives (lead, bismuth, increased suflur, sulfuric tellurid, tin, phosphorus and calcium) were tested in three different steels (11SMn30, C45 and 16MnCr5) in a project in the early 2000s[2]. It is concluded that lead is preferred in regards to higher production rates, reduced cutting forces, lower tool wear rates, more finely broken chip morphology and improved surface finish; bismuth being the best available substitute so far does not show the same hot workability, which makes it only a theoretical substitute. The aspect of "hot workability" is most important according to the applicant.

Röhm GmbH provides information on two different steel alternatives (11SMn30 & 11SMn30-EM + C) that have been tested in 2019. On the former it was concluded that substitution would technically not be feasible with regards to the required characteristics for the application of drill chucks. The latter shows some technical difficulties in tests (chip fracture behaviour, machine stability, life time), but the main concerns remain with regards to availability and reliability given that the applicant claims to remain as last producer of the drill chucks in Europe: In a later communication, Röhm's explains that there is only one supplier on the market of this alternative lead-free steel, the market acceptance with regards to product quality and price is unclear. "*If this supplier decide to stop the production or delivery problems occur, we […] could not produce the needed volume if we switch to this source*." It was clarified that for the same process, a tool with components from lead-free steel needs more rotations per minute, thus more energy, with also impacts on the lifetime of tool and its components. Röhm GmbH specifies that more technical tests must be carried out once the lead-free material is available on the market from more than one supplier and of comparable quality to the leaded steel.

When asked as to the lead-free alternative 11SMn30-EM + C presented by Röhm GmbH, the UP stated that it could not conclude as to its suitability due to a lack of information.

[2] P.E. Reynolds et al. (2005), Technically and commercially viable alternatives to lead as machinability enhancers in steel used for automotive component manufacture, Report EUR 21912, Office for Official Publications of the European Communities, Luxembourg, 2005. (Download-Link, last accessed 03.02.2021)

Details on the reliability of bismuth and sulphur as alternative machinability enhancing additives are outlined by explaining the disadvantages of these two substances.

The UP application considers environmental implications of bismuth. Reynolds et al. (2005) showed that "*of the alternatives, bismuth is able to substitute for lead under certain conditions, although the cost of the addition may take it uneconomic, particularly for large-scale application. Calcium can also substitute in C45 steels for use at higher cutting speeds. Steels containing tin generally did not show good performance. The alternative grades generally showed equivalent fatigue performance to the leaded grades*"[3]. Also, Andrae (2020)[4] calculated an insignificant increase for energy demand and "eco-cost" but very high increases for relative resource scarcity and potential for future sustainable production for the steel type 11S30Mn with 0.35 wt% Bi in contrast to Pb. The LCA provided by Nuss and Eckelmann (2014) comparing impacts at the life cycle stages mining, purification, and refining of different metals is provided to support the argumentation against bismuth and for lead. Furthermore, an LCA on environmental impacts of leaded and non-leaded low carbon free cutting steels including energy used during machining was provided with the application (Coleman et al. 2015). The system boundaries include raw material extraction and production, steel manufacturing, component machining and electricity production. The study concludes that "*for the part considered in the machining trials the global warming potential of the final part was ~9% lower for the leaded steel compared to a non-leaded steel*". Thus, in general, lead-free steels require less energy mainly in component machining, no quantified conclusions can be drawn for steel objects that have not been tested.

Since leaded steels is more expensive than non-leaded versions, according to UP, the manufacturers of parts from steel use leaded steels only where it is economically feasible and where '*significant improvements in machining performance are required'.* An additional advantage for manufacturing is the lower energy consumption during production, especially when a lot of steel has to be removed until a part is manufactured. This is also an advantage for the environment in terms of energy saving compared to the manufacture from non-leaded steel. Furthermore, '*since the energy reduction arising from the use of lead is proportional to the amount of material removed during machining the energy reduction per part from a lead addition is expected to be lower*".

1.2.2. Hot dip galvanised steel

1.2.2.1. Technical description

The galvanization process results in a zinc coating on iron and steel products by immersion of the material in a bath of liquid zinc. According to the applicant (UP), components are batch galvanised for several reasons including highly durable corrosion protection, resistance to mechanical damage, increased durability allowing lighter steel sections and recyclability within existing steel recycling circuits. An exhaustive list of applications is not feasible; components include brackets, fixings, fasteners, ancillary items but also large structural steelwork of up to 25m length and "*lighting units that require high levels of durability in outdoor and aggressive environments*" (UP). A total of 7 million tonnes of steel is batch galvanized in Europe, the volume of components in the scope of RoHS and ELV "is extremely small" (UP).

Lead is present as an impurity related to the use of recycled material for the baths of liquid zinc for the galvanisation process. During the galvanising reaction, zinc-iron alloys are formed on the surface

[3] Op. cit. Reynolds et al. (2005)

[4] Andrae (2020) International Journal of Green Technology, 2020, Vol. 6

of galvanised products. Due to the low solubility of lead in the zinc-iron alloys, lead concentrations within the coating on the product are typically half as much as the lead present in the process bath. Lead has no beneficial (or adverse) effect on the coated product but influences the galvanisation as such: It has a positive effect on the drainage of coating material which is especially good in the case of complex geometries where adverse surface finishes can be avoided through a lead-mediated drainage. The lead content of a coating depends on the steel type's reactivity with molten zinc, on the technical features of the plant (related to the age of the plant) and the concrete galvanisation process.

At present, some plants intentionally add lead to the zinc bath for improvement of drainage of the coating of the galvanised product "*which is rapidly declining due to technical innovation*" (UP).

1.2.2.2. Applicant's justification for the requested exemption

The development of a one-to-one substance alternative for the substitution of lead in zinc originating from recycled zinc is not applicable. The applicant states that the intentional use of lead is now limited to a narrow set of processes. Research on "*new zinc-based alloys for general galvanising*" is ongoing. In the clarification questionnaire, UP elaborates on these processes: '*The processes are those operated by galvanizing plants that would process, on a sub-contract basis, EEE products for which the technical features are required (e.g. complex parts requiring fluidity). These plants will not only be processing these EEE products and for trade and open competition reasons the processing of EEE should not be restricted to specific galvanizing plants. Hence, the separate processes are not identifiable as such.'*

The galvanisation sector is an important user of melts from recycled zinc e.g. from roofing applications with Pb-containing solders and galvanizers' ashes. However, "*costumer-driven requirement for lower lead levels in markets outside EEE/ELV and the occasionally higher price of lead than zinc (affecting intentional use)*" are factors reducing the lead in galvanised coating. On the long term, 30-50 years due to the lifetime of products going into recycling, lead in recycled zinc will be diluted. In a later communication, UP stated that the European secondary zinc industry may be able to reduce the Pb levels in recycled zinc available to batch galvanising industry by channelling recycled zinc with high Pb levels into sectors where the technical demand for Pb-containing zinc remains. '*The reductions compared to 2016 levels may as high as 25% although its impact on the exemption threshold is not directly transposed in the same proportions.*

The applicant states that the use of recycled / secondary zinc is more energy efficient than the use of primary zinc, and that there is no technique available to separate Pb in / from the zinc melt of recycled zinc, rather the applicant expects a dilution of Pb over time. Thus, no benefit was identified for changing the existing practice for galvanisation.

2. Questions for stakeholders

1. The applicant requests relate to the renewal of Ex. 6(a)-I for all EEE categories, suggesting that Cat. 8, 9 and 11 currently covered under Ex. 6(a) would be merged into Ex. 6(a)-I. and Ex. 6(a) would cease to be valid:

    a. Do you agree with the scope of the exemption requests?

    b. Please suggest an alternative wording and explain your proposal, if you do not agree with the proposed exemption wording.

c. Please explain why you either support the applicant's request or object to it. To support your views, please provide detailed technical argumentation / evidence in line with the criteria in Art. 5(1)(a) to support your statement.

2. Please provide information concerning possible substitutes, as to research initiatives which are currently looking into the development of possible alternatives or any other developments that may enable reduction, substitution or elimination, at present or in the future, of *exemption 6(a) & 6(a)-I.*;

   a. In this regard, please provide information as to alternatives that may cover part or all of the applicability range of *exemption 6(a) & 6(a)-I*; Please provide quantitative data as to application specifications to support your view.

   b. Please explain in what applications substitution may be possible in the future.

   c. Please provide a roadmap of on-going research (phases that are to be carried out), detailing the current status as well as the estimated time needed for further stages.

3. Regarding the lead-free alternative 11SMn30-EM + C:

   a. Please provide information whether the lead-free alternative 11SMn30-EM + C may cover part or all of the application range of steel containing lead for machining purposes. What performance indicators speak for or against the use of 11SMn30-EM + C? Please differentiate where relevant between application areas that differ in terms of suitability and or in terms of performance.

   b. Röhm GmbH states that there is only one supplier providing the type of lead-free steel which could be used as a substitute in some applications and that there will be market bottlenecks in availability. Please provide further (quantitative) information to substantiate this statement.

4. According to UP, the European secondary zinc industry may be able to reduce the Pb levels in recycled zinc available to the batch galvanising industry.

   a. Please elaborate on any developments in this respect.

   b. Please make a proposal for a lowered Pb-value for hot dipped galvanised steel.

5. Please provide any further information and/or data that you think is of importance to substantiate your views.

In case parts of your contribution are confidential, please provide your contribution in two versions (public /confidential). Please also note, however, that requested exemptions cannot be granted based on confidential information!

Finally, please do not forget to provide your contact details (Name, Organisation, e-mail and phone number) so that Oeko-Institut can contact you in case there are questions concerning your contribution.