Beryllium Science & Technology Association

BeST comments to RoHS Annex II Dossier Version 3
for Beryllium and its compounds.
5 May 2020

Summary

BeST continues to endorse and support the recommendation of the Öko-Institut not to include Beryllium and Beryllium Oxide ceramics in Annex II of RoHS. We have, however, the following comments for further consideration:

1. The recommended "selective restriction" of copper beryllium alloys is unsupported by the references to possible consumer exposure due to copper beryllium use in electric motors with sliding contact brushes in consumer EEE products (i.e. vacuum cleaners and electric tooling) and should be removed from the report.

2. The recommendations on Page 50 about directing all EEE manufacturers to voluntarily reduce the beryllium content in covered EEE should be removed completely because it is inappropriate, overreaching, potentially damaging to the industry and could have significant international trade implications.

3. The report does not include a summary of the highly relevant actions and conclusions of the Risk Management Options Analysis (RMOA) conducted for beryllium by BAuA. Furthermore, it does not include the Advisory Committee on Safety and Health (ACSH) recommendations issued during the development of a binding Occupational Exposure Limit (OEL) for beryllium.

4. Chronic Beryllium Disease (CBD) is the only adverse health effect associated with occupational overexposure to beryllium airborne particulates. The largest and most recent scientific studies have demonstrated that the insoluble forms of beryllium are not carcinogenic. Therefore, when assessing the human health hazard profile of beryllium, the report should refer to CBD as the only associated adverse health effect.

5. In Section 3.2, the existing guidance values included in the Report for OELs should not include recommendations that were never implemented into actual regulations.

6. The report should only use information and statements that can be supported by sound scientific evidence. Statements that are theoretical, speculative, or inaccurate should be removed.

7. The report contains misinformation in Section 2.1 Function of the substance, which should be corrected.

8. The report incorrectly uses "BeCu" as the acronym for copper beryllium alloys which should be changed to the correct acronym, CuBe. The report also contains typographical errors which should be corrected.

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Beryllium Science & Technology Association

Introduction

The Beryllium Science and Technology Association (hereafter BeST) would like to thank the European Commission and the Öko-Institut for conducting the stakeholder conference on April 27, 2020 and providing us the opportunity to again comment, for the record, on the RoHS Annex II Dossier for Beryllium and its compounds – Report No. 5, Version 3, 25/03/2020 (hereinafter Report).

BeST represents the suppliers of beryllium metal, beryllium-containing alloys and beryllium oxide ceramics in the EU market and has the objective of promoting sound policies, regulations, science and actions related to the use of beryllium as well as promoting good practices in the workplace, in order to better protect workers handling beryllium-containing materials. One of our key objectives is to assure that promulgated rules and regulations are based on verifiable scientific evidence and not on speculative and unsupported information. This is particularly relevant in the case of RoHS. Authorities, companies and workers deserve appropriate, scientifically supported information as the basis for important rules and regulations that impact their lives.

BeST fully endorses and supports the recommendation of the Öko-Institut not to include beryllium and BeO in Annex II of RoHS. Indeed, BeST is strongly supportive of the conclusions of the Report which demonstrates the "*high technical importance of the substances [beryllium and BeO]*" and the "*medium risk*" during WEEE treatment and disposal. These conclusions are consistent with the outcome of the Risk Management Option Analysis (RMOA) conducted by the German Federal Institute for Occupational Safety and Health (BAuA) in 2016 which concluded that the societal impacts of a general or even partial ban of beryllium would be disproportionate.

We note that the Öko-Institut has incorporated many of our previous comments and suggested changes into the Report. We appreciate these actions by the Öko-Institut as this indicates a desire on the part of Öko-Institut to provide accurate and correct information. We note, however, that the Report still contains several incorrect and speculative statements and information.

The comments below include discussions, recommendations and suggested specific changes by BeST on the Report prepared by Öko-Institut for beryllium and its compounds in the frame of the Study for the review of the list of restricted substances and to assess a new exemption request under Directive 2011/65/EU (RoHS 2) – Pack 15. These comments are in addition to and/or supporting the BeST comments submitted on 7 November 2019 during the stakeholder consultation on Version 2 of the Report but not addressed in Version 3 of the Report and are included by reference.

Critical Comments

1. **The recommended "selective restriction" of copper beryllium alloys is unsupported by the references to possible consumer exposure due to copper beryllium use in electric motors with sliding contact brushes in consumer EEE products (i.e. vacuum cleaners and electric tooling) and should be removed from the Report along with the references.**

The statements regarding the use of copper beryllium alloys for sliding contact brushes in electric motors being used to support the recommended selective restriction of copper beryllium alloys are incorrect and not substantiated by the evidence presented. A careful read of the Weiland, et. al. Patent Document referenced on Page 40 reveals that although the quote used in the Report is correct, the Patent Document indicates that copper beryllium alloys are not generally used as the sliding contact body itself but are normally the electrically conductive spring pressing the contact body against the spindle and transmitting the signal or electricity "because of their good elastic properties". It also states that the copper beryllium wires are generally plated, coated or clad with a noble metal (i.e. gold) thus improving electrical conductivity, reducing potential surface oxidization, minimizing surface abrasion on the copper beryllium and minimizing the potential generation of beryllium-containing particulate.

Additionally, the statement and quote cited on Page 40 in the Report from the Argibay et al (2010) experimental study have been taken out of context and are not reflective of the use of copper beryllium in electric motor applications in consumer EEE products such as vacuum cleaners and electric tooling. This reference is an experimental study for a high voltage application in a commercial application, not a consumer product. Interestingly, even in this worst case non-consumer high voltage experimental application, the Argibay study concluded that copper beryllium has excellent abrasion resistance and added that "*the use of copper–beryllium (UNS C17200) was demonstrated as a low wear, highly compliant material for the construction of high current density metal fiber brushes*.

It is also important to note that the superior properties and significantly higher cost of copper beryllium versus other materials used as the sliding contact motor brushes (such as low-cost graphite) is not needed in consumer applications such as vacuum cleaners and electric tooling. In fact, after several inquiries of very knowledgeable personnel by every major beryllium supplier to the EU, we have been unable to identify any use of copper beryllium as sliding contact motor contacts in consumer applications such as vacuum cleaners or electric tooling.

Given the above, the recommendation for "selective restriction" of copper beryllium on Page 50 and references to possible consumer exposure due to copper beryllium use in electric motors with sliding contact brushes in vacuum cleaners and electric tooling on Pages 7, 20, 28, 40, 43 and 44 should be removed because there is no applicable information to support its inclusion.

2. **The recommendations contained on Page 50 of the Report directing all EEE manufacturers to voluntary reduce the beryllium content in covered EEE should be removed completely because it is inappropriate, overreaching, potentially damaging to the industry and could have significant international trade implications.**

On page 50, the Report states "*EEE manufacturers should commit to a voluntary reduction of beryllium in products. The beryllium content in many EEE products can be lowered to below 1,000 ppm as numerous large EEE manufacturer in the sector of consumer electronics have demonstrated (see Table 8-2). The voluntary measures should be adopted by the whole EEE sector, OEM should require their suppliers (components manufacturers) to indicate the concentrations of Be in weight of their intermediary products".*

In light of the recommendation of the Öko-Institut not to include beryllium and beryllium oxide in Annex II of RoHS, the recommendation contained on Page 50 directing all EEE manufacturers to voluntary reduce the beryllium content in covered EEE is inappropriate, overreaching, potentially damaging to the industry and could have significant international trade implications.

In addition, the reference to the policies of various EEE manufacturers should not result in a speculation that beryllium can be reduced in all EEE products in that the majority of named large manufacturers are cell phone makers who have removed beryllium content primarily because of cost controls and the real fact that they don't want cell phones to last a long time. The typical scenario for beryllium materials is that they are used to prove a concept or innovation, then manufacturers try not to use it, often due to cost. The long-term reliability of copper beryllium would greatly reduce the need to replace EEE which has failed due to the use of less reliable materials which in-turn would be a huge environmental benefit by lengthening the life cycle of the EEE thereby reducing greatly the need to consume more natural resources and energy. However, the reliability of copper beryllium is in direct contrast with most EEE manufacturers who prefer short product cycles and reduced material costs. This marketing decision has led to the phase out of beryllium from select EEE products and the reality is that presumed environmental and health issues has little or no impact on their marketing strategies.

Additionally, indiscriminate reduction or substitution in EEE and non-EEE and other important applications could lead to regrettable substitution. For example, numerous standard electrical connectors on commercial, military and space craft are copper beryllium because of its high reliability. A typical commercial aircraft contains over 10,000 copper beryllium electrical connectors. An example of a non-EEE substitution resulted in the tragic deaths of several fire fighters in the 1999 Mont Blanc, France tunnel fire when the Self Contained Breathing Apparatus (SCBA) being used failed during the emergency. The root cause of the SCBA failure was determined to be the SCBA manufacturers replacing the copper beryllium alloys normally used in the pressure sensing bellows with non-beryllium-containing alloys. Over time and during repeated use, the non-beryllium-containing experienced stress relaxation resulting in faulty gauge measurements showing ample breathing air reserves in their tanks when in fact the reading was false and the firefighters ran out of breathing air.

The self-limiting use of copper beryllium is fully recognized in the Report on page 45 where it is stated that:

> *"CuBe alloy is only used when high functional reliability is essential to ensure safe operation in the defence, transport or energy sector. High performance EEE products, which contain beryllium in form of alloys or ceramics, are usually designed to be lightweight and slim (e.g. electronic components on printed wiring boards, electric contacts and heat sinks). Other industrial EEE applications may be designed for heavy duty use and long-term reliability. Especially safety related applications contain beryllium alloys to ensure good performance and long-term reliability."*

It is therefore extremely important to note that including subjective reduction or substitution of beryllium recommendations in a document as powerful as this Report will lead to unintended negative consequences for uses in both EEE and non-EEE beryllium applications. This is further recognized on Page 48 of the report which states:

"It is understood that substitution materials exist but their inferior technical performance limits their usefulness to almost all fields of application of beryllium."

Given the above, the recommendations contained on Page 50 of the Report directing all EEE manufacturers to voluntary reduce the beryllium content in covered EEE should be removed from the Report.

3. **The Report does not include a summary of the highly relevant actions and conclusions of the Risk Management Options Analysis (RMOA) conducted for beryllium by BAuA.**

The Report does not include a comprehensive summary of the highly relevant actions and conclusions of the Risk Management Options Analysis (RMOA) conducted for beryllium by BAuA. The RMOA addresses concerns with the results of the previously completed Community Rolling Action Plan (CoRAP) assessment for beryllium, which fails to provide the public important regulatory information on beryllium under REACH. In its 2016 RMOA report on beryllium, BAuA did not identify beryllium as a substance of very high concern (SVHC), consequently not recommending authorisation, and did not propose a restriction under REACH. This information is quite relevant to Section 1.3.1 – Regulation of the substance under REACH and should be included on Page 14 of the Report.

4. **The Report does not include the recommendations of the Advisory Committee on Safety and Health (ACSH) issued during the development of a binding Occupational Exposure Limit (OEL) for beryllium.**

The omission of the recommendations of the Advisory Committee on Safety and Health (ACSH) for an Occupational Exposure Limit (OEL) for beryllium on Table 1-6 on Page 15 leaves the public without important information related to the regulatory situation of beryllium under the CMD. Following the recommendation of SCOEL, the regulatory process for the recommendation of an EU OEL for a specific material includes an assessment and recommendation by the ACSH, a tripartite body representative of the workers, employers and government authorities. In the specific case of beryllium, the opinion adopted by the ACSH recommended a transitional OEL of 0.6 micrograms per cubic meter of air (µg/m3) – inhalable fraction 8-hour Time Weighted Average (TWA) to be reduced to an OEL of 0.2 µg/m3 – inhalable fraction 8-hour TWA after the transitional period. Unlike SCOEL, the ACSH takes into account scientific information as well as socio-economic factors and technical feasibility in its recommendation. That is why the ACSH published opinion and recommendations are of the highest importance in the regulatory process and should be included in the Report.

5. **Chronic Beryllium Disease (CBD) is the only adverse health effect associated with occupational overexposure to beryllium airborne particulates. Moreover, as previously commented, the largest and most recent scientific studies have demonstrated that the insoluble forms of beryllium are not carcinogenic. Therefore, when assessing the human health hazard profile of beryllium, the Report should exclusively refer to CBD as the associated adverse health effect.**

The SCOEL recommendation, referenced throughout the Report, erroneously identifies beryllium sensitisation (BeS) as the adverse critical health effect linked to occupational overexposure to beryllium. Indeed, scientific evidence established by medical researchers and government agencies concludes that BeS has no symptoms, no health effects and no illness.

This is also confirmed by the fact that BeS occurs in approximately 1% of the general population that is not occupationally exposed to beryllium and that is able to conduct their lives without any health consequences. Therefore, the critical health effect to be controlled at the workplace, through the recently adopted EU binding OEL, is CBD and not BeS.

On carcinogenicity and genotoxicity of beryllium, BeST would again bring attention to the previously referenced scientific studies by Paulo Boffetta, a preeminent cancer researcher, demonstrating that the insoluble forms of beryllium are not carcinogenic, footnote[1] [2] [3] . In particular, this applies to beryllium metal, its alloys and BeO, the only forms of beryllium commercialized in the EU. This information should be included in section 1.3.1.

6. **In Section 3.2, the existing guidance values included in the Report for OELs should not include recommendations that were never implemented into actual regulations.**

In Table 3-1, Overview of existing OELs for beryllium and beryllium compounds in EU countries, the OEL listed for France (ANSES) was a recommendation which was never adopted as regulation. Similarly, in Table 3-2, Overview of existing OELs for beryllium and beryllium compounds in non-EU countries (expressed as Be), the OELs from NIOSH and ACGIH are also recommendations that were never adopted as regulation. In fact, the ACGIH clearly states that its TLVs should only be viewed "as an expression of scientific opinion". These OELs should be removed from the tables or at the very least be referenced as recommendations and not regulations.

Additionally, the OEL listed for USA (OSHA) in Table 3-2 is incorrect. In January 2017, US OSHA issued a new Beryllium Standard for Beryllium which includes an updated Permissible Exposure Limit (PEL) of 0.0002 mg/m^3 TWA and a Short-Term Exposure Limit (STEL) of 0.002 mg/m^3. This OEL should be revised to correct the information in Table 3-2.

7. **The Report should only use information and statements that can be supported by sound scientific evidence. Statements that are theoretical, speculative, or inaccurate should be removed.**

In section 5.4., the statement "*mechanical-physical shredding and sorting under badly controlled operation regime could distribute traces of Be-alloys and BeO across several output fractions. This may also include fractions that are not usually expected to contain beryllium (such as separated plastics (ABS, PVC).*" is not supported by any of the scientific data referenced in the Report, is speculative and therefore should be removed.

Similarly, in Section 5.5., the statement "*Workers are hardly protected against skin contact to chemicals and residues and airborne fumes. Thus, human and environmental exposure to soluble and insoluble beryllium compounds appears likely to occur. Specific information on quantities of WEEE processed under circumstances described above is not available nor is there any data on releases of beryllium and Be-compounds. It can be assumed that beryllium, among other hazardous chemicals emerging in the course of uncontrolled open burning and*

[1] Boffetta P., Fordyce T., Mandel J. A mortality study of workers exposed to insoluble forms of beryllium. Eur J Cancer Prev. Nov;23(6):587-93 (2014)
[2] Boffetta P., Fordyce T., Mandel J. A mortality study of beryllium workers. Cancer Med. Dec;5(12):3596-3605 (2016).
[3] Boffetta P., Fordyce T., Leonhard M. Evaluation of recent evidence on the solubility of beryllium compounds and cancer risk. Eur J Cancer Prev. Mar;29(2):186-190 (2020).

chemical leaching might be only a relatively small contributor to the serious health and environmental problems related to crude WEEE recycling" are presumptions, not supported by data and highly unlikely given the small amounts of beryllium contained in EEE and that, given the very high melting point of copper beryllium alloys, it is very unlikely that it would be melted in "open burning". This entire statement should be removed.

Finally, in Section 6 the statement "*The release occurs usually in form of airborne dust which can cause occupational exposure and environmental pollution of soil and water bodies* is not supported by science and the Report does not refer nor mention any scientific study supporting the above statement. This statement should be removed.

8. The Report contains misinformation in Section 2.1 Function of the substance which should be corrected.

On Page 18, the Report states "For instance, high beryllium copper alloy (BeCu), containing 0.10 – 2.0% beryllium, offer the best possible known combination of mechanical strength, the electrical and thermal conductivity resistance to corrosion and a high modulus of elasticity combined with a low density." This statement is attributed to BeST in our previously provided comments and is incorrectly stated. Our actual comment from BeST was "Copper beryllium alloys (CuBe) offer the best possible combination of mechanical strength and electrical conductivity in EEE, whereas BeO has unique properties as an electrical insulator and thermal conductor." This appears to be related to combining various statements from various sources. To be correct, the statement should be revised to state: "For instance, high performance copper beryllium alloys (CuBe), containing 0.10 – 2.0% beryllium, offer the best possible combination of mechanical strength and electrical conductivity in EEE as well as thermal conductivity, resistance to corrosion and a high modulus of elasticity."

9. The Report incorrectly uses "BeCu" as the acronym for copper beryllium alloys which should be changed to the correct acronym, CuBe.

Throughout the Report, "BeCu" is incorrectly used to refer to alloys containing copper and beryllium. Although it has been referred to "Beryllium Copper Alloy" with the acronym "BeCu" in the distant past, the correct and more currently used term is "Copper Beryllium Alloy" with the acronym "CuBe". Using normal acronym nomenclature procedure, the largest concentration element is stated first, in this case copper, and the lower concentration elements are stated in descending order, in this case beryllium.

It is important to note that the acronym "BeCu" is used 8 times in the Report and "CuBe" is used 14 times in the Report. To be correct and harmonized throughout the Report, the references to "BeCu" should be changed to "CuBe". It is also important to note that this must be corrected in the Abbreviations section as well.

10. The Report contains typographical errors which should be corrected.

The following typographic errors were noted in the Report and should be corrected;

Page 14 – "BEST" should be "BeST"
Page 17 – "BeSt" should be "BeST"
Page 18 – "(BesT)" should be "(BeST)"
Page 30 – "sensitisised" should be "sensitised"
Page 35 – "manifold" should be "many"

14 references throughout the Report to “BAUA” which should be “BAuA”

Conclusion

BeST would again like to thank the European Commission and the Öko-Institut for the opportunity to comment, for the record, on the RoHS Annex II Dossier for Beryllium and its compounds – Report No. 5, Version 3, 25/03/2020. We appreciate that the Öko-Institut has incorporated many of our previous comments and suggested changes into the Report and commend the desire of Öko-Institut to provide accurate and correct information.

We believe that the above recommendations and suggested specific changes are necessary to accurately and scientifically support the overall recommendation of the Öko-Institut not to include beryllium and BeO in Annex II of RoHS. Equally important is making sure that authorities, companies and workers have the appropriate, scientifically supported information as the basis for important rules and regulations that impact their lives.

In past RoHS reviews of beryllium in EEE, BeST was given the opportunity to proactively meet with the Öko-Institut to help ensure a sound scientific basis for its final report. That opportunity was not provided in this review.

We respectfully request that BeST be provided an opportunity to meet with the Öko-Institut to further explain these comments and to provide any additional scientific evidence as needed. We look forward to scheduling such a meeting with the Öko-Institut in the near future.

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