

**Oeko-Institut e.V.**  
PO Box 17 71  
79017 Freiburg  
Germany

**Response to Joint Revaluation of Two Requests for Exemption,  
First Reviewed in 2013-2014, Related to Cadmium Quantum Dot Applications**

*8<sup>th</sup> January 2016*

Dear Ms Baron

Please find attached our response to your public consultation questionnaire. I hope that this will be helpful for you in preparing your final report to the European Commission.

We would also like to take this opportunity to summarise some of what we believe are the key points in our response:

**RoHS Directive is being misused to support innovation of Cadmium technology**

Cadmium is a human carcinogen, reproductive toxin and mutagen. In the environment, Cadmium is toxic to plants, animals and micro-organisms, with both acute and chronic effects. The use of Cadmium presents serious risks throughout the life cycle of display and lighting products, including manufacturing, distribution, consumer use and particularly waste disposal/recycling.

Accordingly, Cadmium and other toxic heavy metals in electronic and electrical equipment are restricted in the EU under Directive 2011/65/EU (RoHS 2). The RoHS Directive further contributes to its objectives by subjecting any exemptions from those restrictions to the fulfilment of stringent conditions and by limiting them in time, progressively eliminating these substances from products in the EU market, while supporting innovative substitutes.

The further extension of RoHS Exemptions 39 (Exemptions 39a and 39b) would reverse the spirit and purpose of the RoHS Directive. The purpose of RoHS is to restrict the use of Cadmium and other listed substances from use in electrical and electronic equipment (EEE) because of the hazards they are known to pose to consumers, workers and the environment. In particular, RoHS Recital (5) states that “the use of Cadmium should be limited to cases where suitable alternatives do not exist.”<sup>1</sup> Thus, the intention of the Exemption system is to allow for these materials to continue to be used in existing essential products where no suitable alternatives have yet been developed. However, this is not the case with quantum dot materials because Cadmium-free alternatives do exist and are already leading the markets for both display and lighting products – please see further below.

In addition, as follows from its Article 5(1)(a), RoHS should not negatively impact on future efforts for developing possible substitutes.

Cadmium-free QD technology should be promoted and the industry should be encouraged to use and further develop Cadmium-free technology solutions. Any extension of the exemption for Cadmium quantum dot displays simply deters sustainable innovation and hampers scientific efforts to develop new, safer technology.

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<sup>1</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32012R0835>

## **Cadmium QD lighting products do not exist and display products are limited; Cadmium-free has leapfrogged Cadmium technology**

We believe that Exemption 39 requests should be dismissed on the basis of the availability of RoHS compliant, safer and cleaner alternative technology. Cadmium-free quantum dot technology is a fine example of cutting edge science that puts European innovation in a leading position amongst producers of quantum dots worldwide. Yet, the requests for Exemptions 39 are at odds with this proposition - despite overwhelming evidence that safer, market-ready and proven alternatives exist.

By early 2015, televisions using Cadmium-free quantum dots were already widely available across Europe, while the single Cadmium-based TV and single tablet launched in 2013 had both been withdrawn from the market since 2014. The wide availability of commercial Cadmium-free QD 'SUHD' displays from Samsung, the world's leading display manufacturer with 22.8% share of the total LCD TV market<sup>2</sup>, clearly demonstrates that this alternative technology is practical. This technology has been a commercial success with rapid sales growth, and now has the leading market share for high colour gamut displays in the EU and globally. 2<sup>nd</sup> generation displays from Samsung are already being brought to the market, as announced this week at the CES show<sup>3</sup>. On the other hand, Cadmium QD technology TVs were not available for purchase in Europe in 2014, and in fact did not become available until late 2015. Today there are few of these products on the market, they have limited availability and they have a much smaller market share than Cadmium-free QD displays. However, one may conclude that the further development and re-introduction of Cadmium QD technology in televisions and displays in 2015 was caused by the European Commission's decision to reassess the extension of the Exemption 39. This decision encouraged manufacturers of Cadmium QD technology to launch some of their products in the European market in response to the success of Cadmium-free QD TVs.

As for lighting products, there are still no Cadmium QD products available, while Nanoco has launched 2 cadmium-free QD products with several more due to be launched in 2016. Again, the decision of the Commission to overrule the recommendation of the last review and propose an extension for lighting products (Ex.39a), and to now fully reassess the extension of Exemption 39, are clearly encouraging innovation in Cadmium technology and the potential launch of new products to displace Cadmium-free alternatives.

## **Cadmium-free products are competitive with Cadmium products in terms of reliability, energy performance, colour gamut, economic benefit, and support for SMEs**

Cadmium-free technology has already met the reliability standards required by the device manufacturers and is now meeting the reliability expectations of consumers and retailers in the EU market. This is abundantly clear in the case of Cadmium-free QDs for displays, where this technology has been applied by Samsung, the world's number one display company. Another world-leading display company, Apple, has also announced that it would not use toxic cadmium QDs in its new iMac range and is using cadmium-free phosphor technology to deliver wide colour gamut to the DCI-P3 standard<sup>4</sup>.

In our submission, we provide you with data that clearly demonstrates that 1<sup>st</sup> generation Cadmium-free QD displays can already deliver high colour performance to effectively meet current standards and compare favourably with 2<sup>nd</sup> generation Cadmium QD displays.

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<sup>2</sup> <http://www.flatpanelshd.com/news.php?subaction=showfull&id=1424154204>

<sup>3</sup> <http://www.koreaherald.com/view.php?ud=20160105000966>

<sup>4</sup> <https://medium.com/backchannel/exclusive-why-apple-is-still-sweating-the-details-on-imac-531a95e50c91#.zadzbp28j>

By comparing manufacturers' published test data for products to European standards it is clear that commercial Cadmium QD displays do not offer the significant energy savings claimed by the applicants when compared to Cadmium-free QD and conventional LED technology in LCD displays. Hence there is no possible argument that alleged life-cycle benefits from reducing energy consumption can be used to justify a continued Exemption for Cadmium QDs in display product.

Lastly, in addition to Cadmium-free QD technology from Nanoco and Samsung, other alternative Cadmium-free QD and non-QD technologies continue to be developed and are increasingly available commercially. Some of these (including OLED and improved non-QD phosphors) are already on the market, while several others are expected to be launched during 2016 to 2018. This growing competition will only bring better quality and cheaper products to consumers.

In the case of lighting products, there are simply no available Cadmium QD product to assess and compare to available Cadmium-free QD and Cadmium-free non-QD technologies. Given that Cadmium-free alternatives are available and being rapidly developed and improved, the introduction of Cadmium QD technology into lighting cannot possibly be justified.

### **Conclusion**

Cadmium-free QD displays are already widely available with high performance and reliability, while lighting products are also becoming increasingly available. The number one manufacturer of televisions (Samsung<sup>5</sup>) and other leading display providers (Apple<sup>6</sup> and Sony) have already adopted a no-Cadmium policy, while the largest chemical company in the world (Dow) has invested in Cadmium-free technology as its sole technology in this space. Also, European customers have willingly displayed (through purchases) their desire for Cadmium-free products. We believe there is clear evidence and proof that the industry has already refocused on the development and manufacture of Cadmium-free quantum dot materials that are RoHS compliant and toxic heavy metal-free, as well as other Cadmium-free non-QD technologies. Therefore, we conclude that Exemption 39 is no longer justified. Extending Exemption 39 would be against RoHS criteria set out in Article 5(1)(a) and would damage the legitimate expectations of EU companies providing sustainable innovation and alternatives. The use of toxic substances and their possible exposure to human life and the environment would be perpetuated without any justification.

We believe that there is no justification to exempt Cadmium-based QDs from RoHS restrictions for displays or lighting products under RoHS. Such an Exemption would be against the principles and purpose of RoHS, and would weaken the environmental and health protection of the European Union.

Best regards



**Andrew Gooda**  
**Supply Chain & Compliance Director**

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<sup>5</sup><http://www.samsung.com/us/aboutsamsung/sustainability/environment/chemicalmanagement/policyontargetsubstances.html>

<sup>6</sup> <https://medium.com/backchannel/exclusive-why-apple-is-still-sweating-the-details-on-imac-531a95e50c91#.zadzbp28j>