



June 18, 2015

Öko-Institut e.V.  
Carl-Otto Gensch  
P.O. Box 17 71  
D - 79017 Freiburg , Germany

Dear Carl-Otto Gensch,

3M Company ("3M") supports the request for renewal of Exemption 13b ("Cadmium and Lead in filter glasses and glasses used for reflectance standards") of Annex III of Directive 2011/65/EU by SPECTARIS.

3M is a recognized leader in the development and manufacture of large format precision optical quality films, including backlight films for LCD displays, and has proved our ability to develop and scale multiple "new-to-the-world" enhancement films to supply the entire electronic industry.

3M validates the data supplied by SPECTARIS and can confirm from our own research that no substitutes are available for purchase by manufacturers that provide both the performance and energy efficiency of quantum dot technology based on cadmium and its use as a color filter.

3M's response to Oeko-Institut and Fraunhofer IZM stakeholder consultation questions are listed below. 3M's response is in the red font.

**Question 1: The applicant has requested an exemption for "*Cadmium and lead in filter glasses and glasses used for reflectance standards*" specifying that such glasses are in use in products falling under various categories of Annex I. Should an exemption be granted it is to be added to Annex III of the RoHS Directive.**

3M concurs that the exemption renewal request should be granted. 3M agrees with the analysis and conclusions of the contribution letter from Fraunhofer Gesellschaft, submitted 15 June 2015 which provides strong support for granting this exemption.

**a. Do you agree with the scope of the exemption as proposed by the applicant?**

3M is in agreement with the scope of the exemption. 3M shares interest in the renewal of this exemption for quantum dot (QD) technologies that are being developed to enable liquid crystal displays (LCD) to give a technically superior image with a much higher range of colors than is currently possible from other commercially available LCDs. The quantum dots filter by color converting all incident light into light of different wave lengths. 3M is submitting three independent confirmations that the quantum dot technology used in the display industry today does fit within the scope of exemption 13b.

- Attachment I – United Kingdom NMO Opinion on QDEF
- Attachment II - Fraunhofer IZM Department Environmental and Reliability Engineering
- Attachment III – ERA Technology RoHS Assessment

- b. **The applicant has only provided argumentation as to why Cd and Pb should further be exempted for use in filter glasses. If you support the renewal of this exemption for glasses used for reflectance standards, please provide detailed technical argumentation / evidence in line with the criteria in Art. 5(1)(a) to support your statement.**

3M does not have a position on the use of this exemption for glasses used for reflectance standards

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

No alternative wording is needed; the proposed exemption wording is acceptable. However to alleviate the concern over lack of a limitation value for cadmium, as identified in the recommendation report "Report for the European Commission DG Environment under Framework Contract No ENV.C.2/FRA/2011/0020" (in italics below), **3M would be amenable to the addition of a limit value and would provide input and assistance if needed in the determination of the value and precise wording.**

*"Furthermore, the possibility that the scope of Ex. 13(b) includes the use of Cd in QD applications has been raised, the main concern being that it provides no limitation for the use of Cd and could thus be interpreted by manufacturers as permission to use more Cd in QD applications as compared to the allowances prescribed in Ex. 39. Though it may be argued, how the Ex. 13(b) wording formulation is to be understood, the fact remains that this exemption existed in the RoHS 1 legal text with an even wider scope, at the time that the request leading to the current Ex. 39 was submitted and evaluated. . . ."*

- d. **Please explain your support of the applicant's request or your objection, supporting your views with detailed technical argumentation / evidence in line with the criteria in Art. 5(1)(a) to support your statement.**

3M has provided detailed technical argumentation and evidence showing that the conditions of RoHS Article 5(1)(a) are met in conjunction with our exemption request 2013-5. Links to the supporting documentation can be found at:

<http://rohs.exemptions.oeko.info/index.php?id=185>

The technical arguments and favorable recommendation from the Oeko-Institut (Report for the European Commission DG Environment under Framework Contract No ENV.C.2/FRA/2011/0020) that support the exemption request are still valid. 3M's summary below:

1. The net environmental benefit of reduced energy consumption associated with cadmium-based QDs over non cadmium-based solutions remains valid.
2. There is not a viable non cadmium-based solution on the market today that can act as a color converter that meets customer expectations for performance, efficiency, and life time in all display segments. The cadmium-based quantum dots act as a conversion filter by re-emitting the light at a different wave lengths.
3. 3M's research into mining and extraction of cadmium came to the same conclusion as SPECTARIS that cadmium is not mined as a primary ore and recovered during the metal refining process and that metal refining should not pose risk to human health or the environment when the Industrial Emission Directive 2012/75/EC is followed and effectively enforced.



In addition, the more energy-efficient cadmium-based technology is particularly important for displays used in medical technology where the sharp color contrasts are indispensable, and in order to meet future UHD broadcast TV and next generation Blu-Ray (Rec 2020) standards. Again, 3M supports Spectaris' renewal request of Exemption 13b.

**Question 2. According to the applicant, where alternatives have been developed, they have been implemented to eliminate the need for using cadmium and lead in filter glasses. However, for most applications alternatives still do not exist that could allow fully replacing leaded optical lenses in the full application range.**

- a. Please provide information concerning possible substitutes or developments that may enable reduction, substitution or elimination, at present or in the future, of Cd and Pb in applications for which the exemption renewal has been requested;**

As already described above there is not a non-cadmium based solution on the market today that meets customer's expectations for performance, efficiency, and life time in all display segments. 3M as a leader in the industry of electronic displays has an open invitation to all suppliers of non-cadmium based solutions that can meet the criteria to supply the non-cadmium based quantum dots for immediate use.

In addition the non-cadmium based solutions have not demonstrated the ability to meet the larger color gamuts adopted for future UHD broadcast TV and next generation Blu-Ray (Rec 2020).

- b. In this regard, please provide information as to alternatives that may cover part or all of the applicability range of cadmium and lead in filter glasses;**

Please see our response above.

- c. Please provide quantitative data as to application specifications to support your view.**

Please refer to the information provided above.

**Question 3. Spectaris explains that the important property of Cd relevant for establishing the "wavelength sharp cut-off" performance aspect for which it is used in various applications "is based on the semiconductor electron band gap characteristic of the microcrystals formed by the cadmium compounds." It can be assumed that if other elements exist that have a similar semiconductor electron band gap characteristic, that they could be considered as candidate substitutes, however Spectaris elaborate that "This semiconductor property for its microcrystal lying in the desired energy range and even allowing adjusting the gap width and thus the absorption edge position with a temper process is absolutely unique for the cadmium chalcogenides. No other compounds have been found that perform this function."3. If you disagree with this statement, please explain on what basis.**

3M agrees with the statement. 3M endorses Spectaris' request for an exemption renewal.

**4. Please provide information as to research initiatives which are currently looking into the development of possible alternatives for some or all of the application range relevant for the exemption at hand.**

- a. Please explain what part of the application range is of relevance for such initiatives (in what applications may substitution be possible in the future)?**

3M and 3M's technical partners are actively researching/developing a non-cadmium based solution that can meet for future UHD broadcast TV and next generation Blu-Ray (Rec 2020)

standards in conjunction with being energy efficient. 3M is not a supplier of quantum dots and eagerly awaits a viable solution.

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

While sources of non-cadmium based quantum dots continue to anticipate near-term introduction of non-cadmium based technologies, 3M is not confident that the time frame for non-cadmium based sources meeting customer performance requirements will be met. In fact, one company whose expertise is the non-cadmium based solution has missed projected commercialization dates. Please refer to page 65 "Report for the European Commission DG Environment under Framework Contract No ENV.C.2/FRA/2011/0020",

Nanoco-Dow explains that:

*"Small-scale manufacture is currently undertaken in the UK and larger scale manufacture is scheduled to be online by mid-2014. A pilot launch of the first TVs using CFQD™ cadmium-free quantum dots is planned for the first half of 2014, with full commercial production expected within the following 12 months... We envisage that CFQD™ quantum dot-containing colour-converted LED lighting (SSL) will be available by the end of 2015."*

Again, to date, no cadmium free solution is commercialized and available for purchase by manufacturers like 3M that meet customer's expectations for performance, efficiency, and life time.

To summarize, 3M supports the renewal request of Exemption 13b ("Cadmium and Lead in filter glasses and glasses used for reflectance standards") of Annex III of Directive 2011/65/EU by SPECTARIS. The exemption is needed in light of the need for continued development of technology for non-cadmium based solutions.

3M would like to participate in the exemption renewal process and is willing to provide information so that a comprehensive evaluation can be conducted.

Sincerely,



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