Questionnaire Exemption Request No. 19

“Handicraft luminous discharge tubes (HLDT) used for signs, decorative lighting and light-artwork, in fixed or portable installations”

Background

The Öko-Institut together with Fraunhofer IZM has been appointed for the technical assistance in reviewing the requests for exemptions from the requirements of the RoHS Directive 2011/85/EU (RoHS II) by the European Commission. You have submitted the above mentioned request for exemption which has been subject to a first completeness and understandability check.

As a result we have identified that there is some information missing and a few questions to clarify before we can proceed with the online consultation on your request. Therefore we kindly ask you to reformulate your request taking the following points into consideration.

Questions

1.Please explain the technological difference between HLDT and regular fluorescent tubes, CCFLs, CFLs and other known light sources based on the discharge technology and using mercury.

Regular fluorescent lamps and CFLs are usually a "hot cathode" technology, based on thermal electron emission, while CCFLs and HLDT (colloquial: Neon tubes) are based on a cold cathode (physical: electron emission on secondary ion impact).

Lit: Samuel Miller, D. Fink:"Neon Signs", McGraw-Hill, New York 1935, p. 52

Lit: Samuel Miller:"Neon Signs and Cold Cathode Lighting" 2nd ed., McGraw-Hill, New York, 1952, p. 38ff (Cold Cathode), p. 292ff (hot cathode/difference to Cold Cathode)

Lit: Gerhard Gut: "Handbuch der Lichtwerbung", Deutsche Verlags-Anstalt, Stuttgart 1974, p. 49 ff. (Cold Cathodes/ Hot cathodes)

In contrast to fluorescent lamps, CFLs and CCFLs, which are mass produced on industrial machinery, each single HLDT is an individually handcrafted item, made by Neon glassbenders (Deutsch: Leuchtröhren-Glasbläser) , a registered profession (2 1/2 year apprenticeship) who only make HLDT and no other product. HLDT exist in

an extreme variety, some examples are: a portable beer neon sign (ex.: "Budweiser", see www.brightneonsigns.com/budweiser-neon-signs.html for examples), a high class neon art piece (ex.:"5 marching man" by Bruce Nauman, Flick Collection, Zürich, www.**youtube.com**/watch?v=-4GQlGQPi6M), Individual architectural illumination (ex.: ca.27km total individually hand made HLDT in the "Emirates Palace Hotel" in Abu Dhabi, see www.emiratespalace.com, executed 2004) to special light emitters in the chemical analytical research (the "Grantzel thin film reactor", see www.doc-labor.de).

To all of these examples annex1, clause 3 applies in full if we take the wording as is.

Lit: Miller/Fink, ibid, p. 93ff (Sign making procedure) Lit: Gut, ibid, p.53 (education and profession of the Neon glassblower)

This is to understand the reason for the need to use up to 100 mg mercury whereas the other technologies mentioned above use only up to 15 mg mercury. Also, please indicate why you do not consider HLDT to fall under one of the current exemptions (1-4) of Directive 2011/65/EU (RoHS Directive). If so, please explain how you could market HLDT until now, as – if they are not covered by one of the exemptions – they would have been brought onto the EU market illegally. Or did you consider them to fall outside the scope of the RoHS Directive? If so, please provide corresponding argumentation and evidence.

Until the document 2010/571/EU was published it was commonly accepted that HLDT fell under ‘other lamps’ as (now) per 4f. Hence there was no problem.

The problem of requesting this exemption explicitly was raised by an ambiguous and unclear definition in document 2010/571/EU, annex1, part 3, reading *"Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for special purposes not exceeding (per lamp):"* , which by it's physical definition of technology, can include from it's wording miniature machine-made CCFLs as well as individually handcrafted HLDT for a completely different field of application. Thus, it is unclear, if HLDT fall under exemption 4f or 3 of said directive. The levels permitted in exemption 3 have been proven absolutely unfunctional for HLDT because of the variety of physical conditions HLDT are used in (outdoors, unprotected from ice, wind, etc.) compared to very well defined indoor conditions for CCFL's. The present legal situation for Architects, signmakers and especially Neon glassbenders is critical: if HLDT would clearly be included under excemption 4f with no limit as "discharge lamps for special purpose" there would be no problem, but if

exemption3 applies, with a limit of 15mg, at which HLDT are not functional, the whole profession of Neon glassblowers would be prohibited to work.

The EU commission was asked to fine tune the wording of exemption 3, thereby explaining the difference between CCFL and HLDT with their different mercury level requirements, but the commission told ESF that they are unable to alter an existing definition and recommended to apply for an additional exemption for HLDT- hence the present application.

2.Would it be possible to provide EN50107-1 (2002) or at least a copy of the corresponding paragraph defining HLDT? Same applies to prHD60364-7-719 number 719-1 as we do not have access to these documents.

From both definitions it will be clear that HLDT are no consumer products, they are not to be handled by the consumer, but only by trained electricians:

EN50107-1 reads:

1. SCOPE

This European Standard specifies the requirements and method of installation for signs and luminous-discharge-tube installations operating from a no-load rated output voltage exceeding 1 000 V but not exceeding 10 000 V, including the electrical components and wiring.

The standard covers installations used for publicity, decorative or general lighting purposes, either for external or internal use. Such signs or luminous-discharge-tube installations may be either fixed or portable supplied from a low-voltage (L.V) or extra-low-voltage (E.L.V) source by means of a transformer, inverter or converter.

further in EN50107-1:

3.1 luminous-discharge tube: tube, or other vessel or device, which is constructed of translucent material, hermetically sealed, and designed for the emission of light arising from the passage of an electric current through a gas or vapour contained within it.

Note: The tube may be with or without a fluorescent coating.

And prHD 60364-7-719 reads: ...

719.3.2.2 luminous-discharge tube : tube, or other vessel or device, which is

constructed of translucent material, hermetically sealed, and designed for the emission of light arising from the passage of an electric current through a gas or vapour contained within it.

NOTE The tube may be with or without an internal fluorescent coating.

[EN 50107-1:2002, 3.1, mod.]

3.Are HLDT covered by 347/2010/EU, 244/2009/EC or 245/2009/EC?

According to our research, 347/2010/EU deals with the harmonized standards for civil explosives and has nothing to do with HLDT.

The same counts for 244/2009/EC: *"Commission Decision of 16 March 2009 concerning the placing on the market, in accordance with Directive 2001/18/EC of the European Parliament and of the Council, of a carnation (Dianthus caryophyllus L., line 123.8.12) genetically modified for flower colour (notified under document number C(2009) 1673) (Only the Dutch text is authentic)*

(Text with EEA relevance) (2009/244/EC)

HLDT are not covered by 245/2009/EC, because they are not consumer products, not intended for general lighting, nor produced in any standard shape or fixture, nor marketed as a standard product - each HLDT tube is individually designed and manufactured.

4.Please provide exact data on the mercury content of single HLDT lamps with concrete examples: are there differences in the mercury content depending on the lamp type?

Each HLDT tube is individually designed and made by hand, so there is no "lamp type" which could be defined. The smallest have 6mm diameter and are only 4-5cm in length; here a mercury content can be as low as 5-10 mg. The large tubes can be up to about 38mm diameter with (unfolded) lengths of 12 meters and more - for such large tubes 100 to 150mg of mercury are necessary for proper operation in outdoor environments like signs.

Lit: Gut, ibid, p. 47ff (dependence of light output and mercury vapor pressure on ambient temperature)

5.Can you provide any evidence on the high lifetime of 130.000 hours of HLDT? Are there any corresponding test results available? Is there any third party verification on this?

Lit: Rudi Stern:"The new let there be Neon", ST publications, Cincinnati, OH, 1996, p. 19 right top. The "Packard" sign was installed in Los Angeles in 1923 and still in operation in 1974. At typically 14 -18 hours a day, this would be 51 years or 18615 days or 260610 hours (at 14 hours/day). This literature citation shows only one example.

6.You claim that you have promoted several programmes to reduce the amount of mercury per HLDT in the last 10 years. Please provide evidence on this (test results, road maps etc.).

These programs were proprietary by raw material suppliers and are not published or published only in parts. For example:

http://www.tecnolux.com/index.php?option=com_content&task=view&id=95&Itemid=92

Lit: Marcus Thielen in "Signs of the Times", issue October 2007, ST Media Group, Cincinnati OH, p. 26ff.

Within the European Sign Federation we have technical seminars twice a year. During these seminars we provided methods to reduce the quantity of mercury per HLDT and recommended calibrated tools to achieve this. Based on this the member associations have successfully been able to reduce the mercury volume to 100 mg per tube, down from 300 mg at the end of the 90's when we started the educational program. This was confirmed by the respective companies selling mercury.

7.You state that the total quantity of mercury used per year by all European HLDT is less than 0.4% of the quantity of mercury sold per year in CFLs. How much would this be in absolute numbers? How many HLDT are sold per year in the EU?

The total number of HLDT sold is very difficult to determine as they are manufactured by many individual neon glassbenders who are no longer required to save records.

The only way to get an idea on the amounts is to take the number of parts, i.e. electrodes sold, as there are only 4 major manufacturers. Their combined quantities sold in Europe totals 160000 electrodes per month, corresponding to 79700 HLDT per month, or 956400 HLDT per year. at 0.1grams of mercury at maximum, the total absolute maximum of mercury used in Europe per year for HLDT is 95.6 kilograms (or 7.02 liters), all recycleable. It is common knowledge that in France alone 130.10+6 'energy saving lamps are sold yearly. With 15 mg per lamp it would mean 1950 kg of mercury is brought into consumer homes and installed by those consumers, exposing themselves to any risk involved. Extrapolating this to Europe we assume the total quantity brought into consumer homes in Europe (not including ordinary fluorescent tubes) must be well over 20000 kg. Hence HLDT only carry 0.4% compared to the 'energy saving lamps', and these are highly promoted by all governments.

8.You claim that no other light source can match the performance of these HLDT in terms of ratio of light output versus energy absorption, colour spectrum, aesthetics and longevity. Please provide detailed technical evidence why there is no LED-technology-based alternative as LEDs are known to work well in outdoor environment and to have a high efficiency as well as a very long lifetime.

The electrical low pressure mercury vapor discharge is -because of the electron structure of the mercury atom- the most efficient way to convert electrical energy into light (resonance line emission, Lit: Robert W. Pohl:"Einführung in die Physik", 3rd vol."Optics", 4th ed. Springer, Berlin 1943, p.207 ff.), the so-called quantum efficiency (Lit: W. Elenbaas:"Leuchtstofflampen und Ihre Anwendungen", Philips technische Bibliotheek, Eindhoven 1962, p. 102ff.)

The colour spectrum of a HLDT can be individually tuned by the manufacturer as he usually mixes the fluorescent components according to the customer's request of colour and spectrum. This tuning is impossible in an industrial production.

This "spectrum engineering" is -at the present time- impossible with LEDs because LEDs are narrow-band emitters with fixed wavelengths (given by the quantum band structure of the atoms in the semiconductor, Lit: Charles Kittel:"Einführung in die Festkörperphysik", R.Oldenbourg Verlag, München 1988). Thus, even by using three "RGB"-LEDs not all colours can be generated, as only the intensity of three fixed peaks can vary. For "white" LEDs there is always a blue LED used in combination with yellow/orange fluorescent materials, resulting in a very intense blue radiation which can not be reduced. As HLDT light generation is based on deep UV excitation

of fluorescent materials, this problem of blue peaks is non-existent. At present, there is no LED illumination which has an acceptable colour rendering index that it is permitted for general lighting of workplaces or locations where human beings are over prolonged periods of time.

Lit: U.S. dept. of Energy: "Caliper" test series on solid state lighting, for example:

http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/caliper_round-10_summary.pdf

Lit: Marcus Thielen in "Signs of the Times", issue January 2010, ST Media group, Cincinnati OH, p.40ff ("Human" white light)

Lit: Marcus Thielen in "Signs of the Times", issue Feb 2009, ST Media group, Cincinnati OH, p.38ff (Thermal management in outdoor signs).

9.You mention continuous R&D with a view to reducing the mercury content. Please provide corresponding evidence.

Most R&D programs are proprietory carried out by parts manufacturers, which are only published in product related items. For example, see:

http://www.egl-lighting.com/documents.html

Further:

Lit:(not yet published, will be printed in the January issue of "Werbetechnik", WNP Verlag, München): Rüdger Hennig, F. Schubert:"Wie viel Quecksilber braucht ein Neonrohr in der Lichtwerbung" (attached)

Lit:Marcus Thielen in "Sign+" No.7,2011, Eisma Businessmedia, NL-Leeuwaarden, p.24 "Verbod op Neon dreigt"

10.Same applies to the mentioned waste recycling programme: please provide detailed figures on the amount of lamps recovered, the amount of mercury recovered and the general material flow of mercury from HLDT in the waste treatment paths.

HLDT are no consumer goods, each repair or work on the lamps must and can only be carried out by trained personnel. Neon glass shops are strictly observed by work safety organizations due to other hazards beside mercury. That means workers are constantly monitored on mercury.

The total amount of recycled HLDT is impossible to put in numbers, as there are too many small Neon glassblowing shops.

In general, when HLDT are to be repaired (or an old installation is dismantled), the complete tubes are taken back to a Neon glass shop. Qualified staff collect these tubes and put them in dedicated containers, with closed lids. Licensed recycling companies collect these containers and recycle the materials including mercury in the same way as they do with ordinary fluorescent lamps and energy saving lamps, as the materials used are the same.

In some dedicated glass shops the electrodes are cut off - and collected under water until an amount qualifies for recycling at a special mercury refinery. The fluorescent layer (containing also mercury after lamp operation) is washed out with diluted hydrofluoric acid in another special equipped workplace. The used acid and the solved material is collected, neutralized and then directed towards a mercury refinery. Remaining is bent, mercury free glass tubing, which can be coated again with fluorescent powder and refilled with gas+mercury after new electrodes have been welded on.

11.You also bring forward economic argumentation which as such can only be used for a decision on the duration of an exemption. Should you want to use socio-economic arguments for the duration of the requested exemption, please provide detailed figures to support your argumentation.

The sign industry as well as the architectural linear lighting industry can only produce HLDT if the exemption is granted. The livelihood of several thousand people is at stake.

12.You have not provided a wording proposal for the exemption. We would suggest the following: “Mercury up to 100 mg in HLDT used for signs, decorative lighting and light-artworks, in fixed or portable installations.” Would you agree to this proposal? If not, please provide an alternative wording. The mentioned HLDT applications would possibly have to be defined more precisely depending on the technical definition given in the standards.

We suggest :

"Mercury up to 100 mg in handicraft luminous discharge tubes (HLDT) used for signs, decorative lighting and light-artworks, in fixed or portable installations as per definition in

EN50107-1(2002) “1 Scope” and in prHD60364-7-719 number 719-1 shall be permitted to contain up to 100mg of mercury per tube."