

Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Sub-Committee of Experts on the Transport of Dangerous Goods

25 May 2012

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Geneva, 25 June – 4 July 2012

Item 5 (d) of the provisional agenda

Miscellaneous proposals of amendments to the Model Regulations on the Transport of Dangerous Goods: miscellaneous

Lamps containing small quantities of dangerous goods

Transmitted by the expert from the United Kingdom

Introduction

1. At the fortieth session of the Sub-Committee the expert from the United Kingdom presented informal document INF.12 which raised various questions relating to the transport of light bulbs containing small quantities of dangerous goods. The United Kingdom advised that it had been asked to issue a competent authority approval for the transport of sodium lamps containing up to 3g of sodium as UN 3363 DANGEROUS GOODS IN APPARATUS. However, the United Kingdom does not feel that this is the correct approach to deal with such lamps in the longer term. As a generality it seems that lamps containing various dangerous goods do not readily fit under other entries in the Dangerous Goods List.

2. The discussion which was prompted by the questions in INF.12 is summarised in the formal report (ST/SG/AC.10/C.3/80) as follows:

“29. The Sub-Committee acknowledged that the transport of light bulbs containing dangerous goods, including waste light bulbs, was an issue to be addressed. Most experts were in favour of a comprehensive approach. The representative of GLF was invited to provide the expert from the United Kingdom with detailed information on the dangerous substances contained currently in these light bulbs and those likely to be contained in the future taking account of technology developments, so that she may prepare a formal proposal for the next session.”

3. Various points were raised during the discussion but the expert from the United Kingdom believes that the overall opinion of the Sub-Committee was that these articles do not pose a significant risk during transport and therefore should not be subject to the full scope of the Model Regulations. This is due to the manner in which the dangerous goods are contained within the lamps in order to reach the customer in working order. Lamps containing dangerous goods are however transported in significant quantities which would justify the creation of new provisions in the Model Regulations.

4. The United Kingdom expert has noted the following main comments from the fortieth session of the Sub-Committee and took them into consideration when preparing this paper:

- a) The existing exemption for light bulbs containing gases of Division 2.2 (in 2.2.2.4) is not an ideal solution and presents concerns for some competent authorities particularly with regard to waste bulbs. The exemption for gases of Division 2.2 can only be utilised if “they are packaged so that the projectile effects of any rupture of the bulb will be contained within the package”. It was argued that in reality, waste lamps are not usually packaged in this way and therefore waste lamps should be subject to the full provisions of the Model Regulations. Examples of how waste lamps are being collected and transported can be found at Annex III. Any provisions developed for lamps should therefore include waste, damaged or defective lamps.
- b) Opinions were divided on whether a new UN entry would be required for lamps containing dangerous goods. It was suggested that the use of limited or excepted quantity provisions for lamps containing dangerous goods would not be appropriate. A special provision allocated to selected UN entries may be the solution instead.
- c) The ICAO Technical Instructions use special provision A69 to exempt articles containing limited amounts of mercury, gallium or inert gas from the provisions of the Technical Instructions when carried as cargo. This special provision was amended at the twenty third meeting of the Dangerous Goods Panel in 2011 to include provisions for lamps containing mercury. It is worth noting that the quantity of mercury permitted in lamps is greater than the quantity permitted in “articles”, i.e. 1 g of mercury per lamp, 30 g mercury per package whereas articles are limited to 100 mg each and limited to 1 g of mercury per package. This implies that the air mode has accepted that the intrinsic construction of a lamp affords greater safety than other articles containing mercury. The new text of A69 can be found as an annex to this paper.

Background Information

5. The United Kingdom expert has received extensive information from the Global Lighting Association (GLA), formally known as Global Lighting Federation (GLF) on the various types of lamp which contain dangerous goods and would like to thank the GLA for their support in helping to produce this paper.
6. We have been advised by the GLA that the term used in our previous paper ‘light bulb’ does not mean the same thing when translated into all languages. A more accurate term to cover all lighting which contain dangerous goods is ‘lamps’ and the draft proposal contained in this paper therefore uses the term ‘lamps’ rather than ‘light bulbs’. An amendment may therefore be required to the existing text in 2.2.2.4 to change the term ‘light bulbs’, to the more accurate term ‘lamps’.
7. The IAEA has recently revised the provisions relating to radioactive materials contained within instruments or manufactured articles (which would include lamps) which will be published in the next publication of TS-R-1 (see ST/SG/AC.10/C.3/2012/58 and the new text for paragraph 2.7.2.2.2 (b)). Essentially the IAEA have now concluded that the Competent Authority may exempt consignments of consumer goods with small quantities of radioactive material from transport regulation, but they are not obliged to, as this may conflict with national law. The IAEA did not however consider lamps which contain a mixture of Class 7 with dangerous goods of other Classes with dangerous goods of other Classes. Therefore this paper will not address lamps which contain only radioactive materials.

8. The types of substances contained in lamps (excluding radioactive materials) that we are aware of are as follows:

- Mercury Iodides or Mercury Bromides
- Mercury
- Sodium
- Thallium compound
- Gallium
- Alkali metal (Sodium or Potassium)
- Division 2.2 gases

Note: the dangerous goods contained within the lamp could be a mixture of several different substances (including radioactive materials), plus a Division 2.2 gas. The exact composition of this mixture is normally only known by the manufacturer.

9. The lighting industry has advised that it is unlikely that other alternative substances will be added to this list when considering the possible future developments of lamp manufacture. It is more likely that there will be an increase in the quantity of dangerous goods used within the lamps to increase their brightness, colour or life time for example.

10. The lighting industry has advised that the following UN numbers are the most likely classifications for lamps containing the above substances in transport (if contained within a lamp in their pure form):

UN No.	Name	Class /division	Packing Group	Limited Quantity	Excepted Quantity (inner packaging)
1428	Sodium	4.3	I	Not Permitted	Not Permitted
1634	Mercury Bromides	6.1	II	500 g	1 g
1638	Mercury Iodide	6.1	II	500 g	1 g
1641	Mercury Oxide	6.1	II	500 g	1 g
1707	Thallium Compound, N.O.S.	6.1	II	500 g	1 g
1759	Corrosive solid, N.O.S.	8	II or III	1 kg or 5 kg	30 g
2257	Potassium	4.3	I	Not Permitted	Not Permitted
2803	Gallium	8	III	5 kg	Not Permitted
3077	Environmentally hazardous substance, solid, N.O.S.	9	III	5 kg	30 g
3506	Mercury contained in Manufactured Articles	8	III	5 kg	Not Permitted
For mixtures of the above substances the following UN entries could be assigned:					
3131	Water reactive solid, corrosive, N.O.S.	4.3	III	1 kg	30 g
3288	Toxic Solid, Inorganic	6.1	II or III	500 g or 5 kg	1 g or 30 g

11. The quantities of dangerous goods within lamps can vary due to the wattage, light colour, life time and technology used for each lamp. However, 90% of all lamp types contain less than 30 mg of the substances as listed above; 9% contain approximately 30 mg and only 1% of manufactured lamps contain between 3 g and 100 g. You will note from the table above that with the exception of Potassium and Sodium, all substances listed may be transported under the limited quantity provisions. Only Mercury contained in Manufactured Articles, Sodium, Gallium and Potassium are not permitted to be transported under the excepted quantity provisions, the remaining UN entries have exempted quantity limits well above the quantities contained within lamps.

12. Lamps are packaged for transport in robust and specially designed packaging. Annex II of this paper provides illustrations of the kind of packaging in use. In all cases the dangerous substances are initially contained within a glass component called an “arc tube”. By the time the lamps are prepared for transport the dangerous goods within the lamp are in a solid compound state firmly affixed to the inside of the glass which forms the arc tube. If the glass were to break then the dangerous goods contents would remain affixed to the glass. The arc tube is then usually encased within an outer glass bulb.

13. The lamp is then usually placed inside an inner packaging with cushioning material to protect the glass from breakage during transport and then finally placed in a strong outer box. Large consignments of lamps may be transported together in an overpack of a stretch-wrapped pallet. Therefore the dangerous goods contained within lamps are subject to at least four layers of protective packaging.

14. The inner arc tube surrounding the dangerous goods and the outer glass bulb are both made of special glass used specifically for safety purposes. This glass is designed to protect the lamp in high pressure operational conditions (up to 50 bar) and in high temperatures (>1500°C). Lamp manufacturers have quality management procedures in place to ensure the lamps are manufactured correctly. Once a lamp has been subject to the quality management system it is officially certified. The following testing requirements are part of the quality management system:

- Physical pressure test on the whole of the lamp;
- Vibration test; and
- Temperature test.

15. Given that the majority of lamps contain very small quantities of dangerous goods, are subject to a manufacturers’ quality management system and have robust packaging arrangements, the United Kingdom expert believes that a special provision could be developed to exempt them from regulation subject to certain conditions.

16. Presented below is a draft proposal for discussion and the consideration of the Sub-Committee and is not being submitted for decision at this session. This is purely being presented as a possible option for text that could be developed in the Model Regulations based on the background information on lamps presented in this paper. From on the outcome of the discussions of the draft proposal, the United Kingdom expert will submit a formal proposal for the next session and welcomes any further information which other experts may have on lamps containing dangerous goods.

Draft Proposal

16. Add new special provision 3XX in Chapter 3.3 to the following UN entries: [1428, 1634, 1638, 1641, 1707, 1759, 2257, 2803, 3077, 3131, 3288, 3506]

“3XX Lamps each containing not more than 1 g and packaged so that there is not more than 30 g of substance per package are not subject to these Regulations under the following conditions:

- a) The lamps are subject to a manufacturer’s quality management system and are certified as meeting the requirements of that quality management system; and
- b) Each lamp is individually packed in an inner packaging or surrounded by adequate cushioning material which is designed to protect the lamp from damage during transport; and
- c) Inner packagings (when present) or lamps shall be packed into strong outer packagings so designed and constructed such that they are capable of passing a drop test of not less than 0.5 m. The packages shall still be fit for transport and there shall be no damage to the contents.

For waste, damaged or defective lamps each containing not more than 1 g and packaged so that there is not more than 30 g of substance per package are not subject to these Regulations under the following conditions:

- a) Lamps shall not be transported together if the dangerous goods they contain may react dangerously with each other; and
- b) Lamps shall be packed in strong packagings which shall be constructed and closed so as to prevent any loss of contents when prepared for transport which may be caused under normal conditions of transport; and
- c) Packages shall be so designed and constructed such that they are capable of passing a drop test of not less than 0.5 m. The packages shall still be fit for transport and there shall be no damage to the contents”.

17. Add new special provision 3YY in Chapter 3.3 to the following UN entries: [1428, 1634, 1638, 1641, 1707, 1759, 2257, 2803, 3077, 3131, 3288, 3506]

“3YY Lamps each containing more than 1 g and not more than 3 g and packaged so that there is not more than 30 g of substance per package are not subject to these Regulations under the following conditions:

- a) The lamps are subject to a manufacturer’s quality management system and are certified as meeting the requirements of that quality management system; and
- b) Each lamp is individually packed in an inner packaging or surrounded by adequate cushioning material which is designed to protect the lamp from damage during transport; and
- c) Inner packagings (when present) or lamps shall be packed into strong outer packagings so designed and constructed such that they are capable of passing a drop test of not less than 1.8 m. The packages shall still be fit for transport and there shall be no damage to the contents.

For waste, damaged or defective lamps each containing more than 1g and not more than 3 g and packaged so that there is not more than 30 g of substance per package are not subject to these Regulations under the following conditions:

- a) Lamps shall not be transported together if the dangerous goods they contain may react dangerously with each other; and
- b) Lamps shall be packed in strong packagings which shall be constructed and closed so as to prevent any loss of contents when prepared for transport and which shall meet the packaging provisions of 4.1.1 except that 4.1.1.3, 4.1.1.4 , 4.1.1.12 and 4.1.1.14 do not apply; and

- c) Packages shall be so designed and constructed such that they are capable of passing a drop test of not less than 1.8 m. The packages shall still be fit for transport and there shall be no damage to the contents”.

Justification

17. The special provision 3XX will permit 99% of manufactured lamps to be exempt from the Regulations due to the very small quantities of dangerous goods they contain. The quantity limits specified are in line with those already accepted for the transport of lamps containing mercury which have been adopted by the air mode in A69.

18. The requirement for the lamps to meet a manufacturer’s quality management system assures that the lamp has been manufactured to a quality which is sufficient for placing on the consumer market.

19. The United Kingdom expert believes that it is not necessary to specify UN approved packaging for lamps as the quality of the packaging already in use must be sufficiently robust for the lamps to reach the consumer in working order. The text presented in SP 3XX b) is taken from 4.1.1.1.

20. The requirement for the package to be capable of passing a drop test of 0.5 m in special provision 3XX is carried over from the provisions specified for air transport in A69. This drop test is less stringent than the 0.8 m required for Packing Group III substances. The Sub-Committee may wish to consider whether this should be changed to meet the drop test requirements for PG III.

21. The proposed conditions for the transport of waste, damaged or defective lamps seeks to standardise the existing procedures which may vary from country to country. The draft proposal aims to concentrate on the most significant risks during transport given that the lamps may not be in their original packaging and may already be broken. A pragmatic approach would be sensible as waste, damaged or defective lamps are already being transported safely in varying methods. Consequently the only provisions specified for waste, damaged or defective lamps is that the dangerous goods they may still contain do not react dangerously with each other, the packaging must be able to contain any leaked dangerous goods and the packaging must be capable of meeting the same drop test as if the lamps were in full working order.

22. Larger and significantly rarer lamps (only 1% of manufactured lamps) which contain higher quantities of dangerous goods (between 1 g and 3 g) are covered by the more stringent provisions of the proposed special provision 3YY. Lamps which contain dangerous goods in quantities in excess of 3 g would be subject to the full regulations.

23. The packaging specifications of 3YY have been taken from the requirements of P907 which is allocated to UN 3363 ‘Dangerous Goods in Machinery/Apparatus’. As previously mentioned in paragraph 1 of this paper the United Kingdom has issued a competent authority approval for sea transport for lamps containing up to 3 g of Sodium using these provisions.

24. The requirement for the package to be capable of passing a drop test of 1.8 m for lamps with larger quantities of dangerous goods is the drop test requirement for Packing group I substances. This reflects the fact that these lamps could contain Packing Group I substances and is therefore the worst case scenario for dangerous goods within these lamps. The Sub-Committee may however feel that requiring the drop test for Packing Group I substances is too stringent.

Annex I

Extract of the report for the Twenty-Third meeting of the Dangerous Goods Panel (DGP) (2011)

DGP/23-WP/102

2A-22 Appendix to the Report on Agenda Item 2

“A69 The following are not subject to these Instructions when carried as cargo:

- a) articles such as thermometers, switches and relays, each containing a total quantity of not more than 15g of mercury, if they are installed as an integral part of a machine or apparatus and so fitted that shock or impact damage, leading to leakage of mercury, is unlikely to occur under normal conditions of transport.
- b) lamps, each containing not more than 1g of mercury and packaged so that there is not more than 30g of mercury per package. Packages must be so designed and constructed such that when subjected to drop tests from a height of not less than 0.5 m the packages must still be fit for transport and there must be no damage to the contents.
- c) articles, each containing not more than 100mg of mercury, gallium or inert gas and packaged so that the quantity of mercury, gallium or inert gas per package is 1g or less.

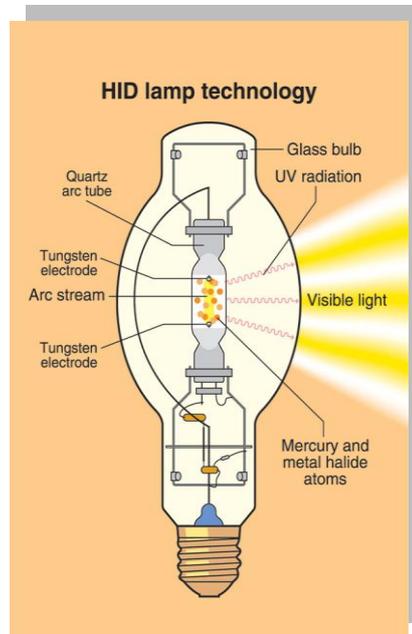
The words “not restricted” and the special provision number A69 must be provided on the air waybill when an air waybill is issued.”

A69 has been assigned to the following UN entries in the ICAO Technical Instructions:

- UN 1006 Argon, Compressed
- UN 1046 Helium, Compressed
- UN 1056 Krypton, Compressed
- UN 1065 Neon, Compressed
- UN 1066 Nitrogen, Compressed
- UN 2036 Xenon
- UN 2803 Gallium
- UN 2809 Mercury in Manufactured Articles

Annex II

Components of a Lamp



Examples of Packaging Used to Transport Lamps

Pos.	Column A	Column B
1	Lamp packaged in a sealed transparent plastic bag	Inner lamp packaged with cushioning material, packed in strong outer box
		

2	Cushioning material within inner lamp package for safety reasons during transport.	Package meeting dangerous goods criteria for “Mercury contained in manufactured articles”, UN (3506)
		
		Lamps packed in strong outer packagings with all seams and joints sealed with self-adhesive, pressure-sensitive tape which will prevent the escape of mercury from the package (to meet the requirements of P003 and PP90)
3	Specially designed package for big lamps for safety during transport	Plastic box used as protection against movement and physical transport effects within inner packaging. Strong fibreboard box used as outer transport package.
		

4	<p>Inner packaging with cushioning material for safety reasons during transport to avoid movement and to protect against breakage during transport.</p>	<p>Components within inner packaging Plastic box protects the arc tube from physical transport effects.</p>
		
5	<p>Inner packaging of small lamp type</p>	
		
6	<p>Inner package as cushioning material for one lamp.</p>	<p>Inner packaging with sealed liner inside fibreboard packaging per lamp.</p>
		

7	Stretch-wrapped pallet, as overpack for lamp packages	 <p data-bbox="874 280 1396 492">For outer packaging of lamps, strong fibreboard boxes are the standard packaging throughout the world. Stretch-wrapped pallets protect against weather conditions and assure security during transport.</p>
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Annex III

Examples of Current Waste Lamp Collection and Transport

Example 1 – Fluorescent lamps (not normally containing dangerous goods)



Example 2 – Larger waste lamps normally transported in their retail packaging.

