AGLV ARBEITSGEMEINSCHAFT LAMPEN VERWERTUNG

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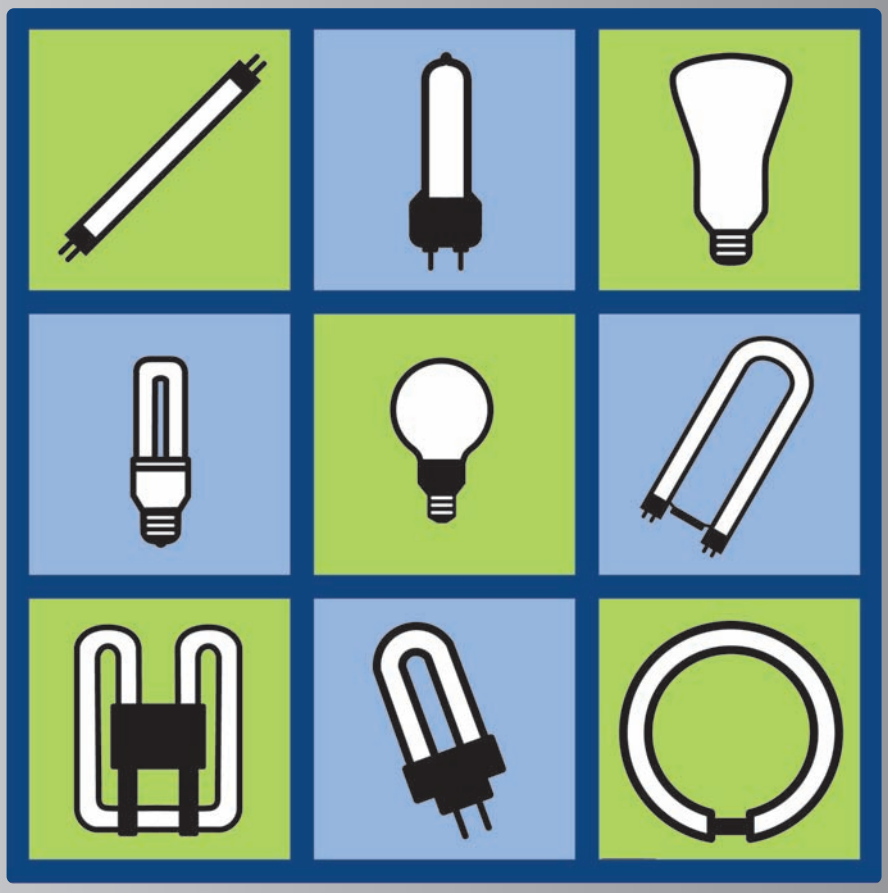

Collection and Recycling of Discharge Lamps

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Collection and Recycling of Discharge Lamps

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1. Foreword

Global climate change, the Kyoto targets, rising energy prices, fuel shortages and the necessary reduction of CO_2 emissions are some of the key issues facing us in the modern world.

The consequences of global warming are already clearly visible today. The main cause of this is the increasing level of CO_2 emissions throughout the world.

Efficient lighting technologies play a decisive role in saving energy and in reducing CO_2.

By selecting the lighting option with the greatest energy efficiency, it is possible to lower the overall costs for lighting and help protect the environment.

Discharge lamps ensure efficient use of energy: this brochure is intended to provide information and assistance regarding the disposal of discharge lamps

2. Introduction

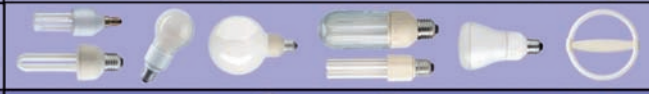
Discharge lamps include fluorescent lamps, compact fluorescent lamps (pin-based and screw bases), high pressure discharge lamps (high pressure sodium vapour lamps, mercury vapour lamps and metal halide lamps).

Compact fluorescent lamps with a screw base are commonly known as energy-saving lamps.

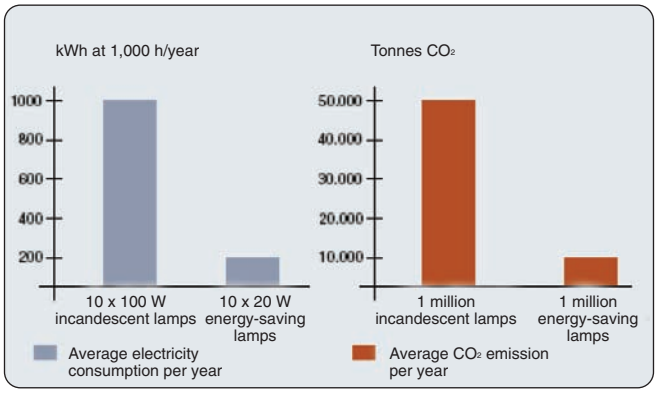
In Germany, lighting accounts for roughly 10% of the electrical energy consumed, with 70% of the light being produced by fluorescent lamps which only, however, consume 50% of the overall energy required for lighting. Today, fluorescent lamps are the main source of light in industry, whereas the incandescent lamps (still) fulfil this function in homes.

Each individual can do something against the greenhouse effect by replacing conventional light bulbs with long-lasting energy-saving lamps, as these consume up to 80% less energy than incandescent lamps.

Based on 1000 hours use per year, each energy-saving lamp used reduces CO_2 emissions (greenhouse effect) by up to 0.5 tonnes

Category	Types	No. of different forms
Fluorescent lamps		> 15
Fluorescent lamps, not tube-shaped		> 5
Compact fluorescent lamps **(CFL-NI)**		> 25
Energy-saving lamps **(CFL-I)**		> 25
High Intensity Discharge **(HID)** lamps		> 50
		> 5

Overview of gas discharge lamps as defined in Waste Electrical and Electronic Equipment (WEEE) directive



Incandescent lamps vs. energy-saving lamps: power consumption and CO_2 emissions

Energy-saving lamps are of course extremely economical as they last up to 10 times longer than conventional incandescent lamps. This also means lower procurement costs, as 1 energy-saving lamp costs less than 10 incandescent lamps.

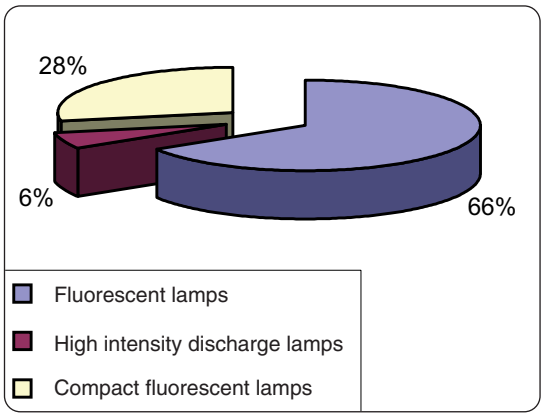
It has never been easier to protect the environment and save money at the same time.

3. Discharge lamps and the environment

Discharge lamps need mercury for highly efficient light production. The amount used in discharge lamps has been systematically reduced in the last few years.

Today the mercury content per lamp is:

Straight standard fluorescent lamps	< 10 mg
Straight three-band fluorescent lamps	< 5 mg
Compact fluorescent lamps	< 5 mg
High intensity discharge lamps, average:	30 mg



Market shares of different discharge lamps

From an ecological viewpoint it is essential to ensure that products containing hazardous substances are disposed of correctly at the end of their life.

To complete the production-recycling-production cycle, all those involved, including the consumer, must play their part.

Despite the legal obligation for consumers to return all such lamps and for there to be a nationwide system of collection, the quantities returned to date have been below manufacturers' expectations.

The highest return rates up to now have been for straight fluorescent lamps. The return rates are much lower for energy-saving and compact fluorescent lamps.

Only by working together will it be possible to increase the return rates for all types of lamp. We – the lamp manufacturers and recyclers in the Lamp Recycling Working Group (AGLV) in the ZVEI – are fully committed to this policy.

4. Legal framework

The European Waste Electrical and Electronic Equipment (WEEE) directive has been in force since 13 August 2005.

In Germany the obligation to take back waste arising from the WEEE directive has been implemented in the Electrical and Electronics Devices Act (ElektroG).

One objective of the ElektroG is to combat the disposal of electrical and electronic product waste – including discharge lamps – in landfills and in incinerators.

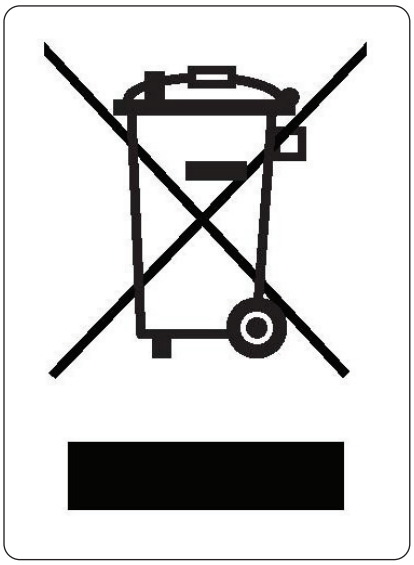
The Act stipulates the collection and recycling of all discharge lamps; exemptions include incandescent lamps, halogen lamps and LED lamps.

All spent lamps from homes can be returned free of charge to the local collection points.

Small quantities of lamps used in commercial properties can also be disposed of there.

Lightcycle is the contact organisation for industrial customers and organisations disposing of larger quantities.

More information on Lightcycle and on its associated disposal systems LARS (Lampen-Recycling und Service GmbH) and OLAV (OSRAM Lampen Verwertung) can be obtained by visiting the relevant websites (see section 8 for details).



The lamps designated in the WEEE directive for recycling are labelled with this symbol.

WEEE labelling

Long-lasting, reliable discharge lamps comply in full with the requirements set out in the ElektroG, i.e. the majority of their components can be reused.

Taking a longer-term view of the product throughout its entire life makes an important contribution to protecting the environment and saving valuable resources. This is due to the reduced energy consumption but also the recycling of the products at the end of their life. Long-life products have other benefits: they don't need to be replaced so often, meaning that savings can be made not only on the procurement costs but also on the replacement costs – benefitting consumers and the environment.

5. Recycling – current situation

With regard to recycling, "attempts should be made to adopt a method of high grade recycling which corresponds to the type and properties of the waste." This is guaranteed by the contract partners of the lamp manufacturers. Businesses are certified or approved as follows:

- Specialist disposal company as defined in the German § 52 KrW/AbfG and the specialist waste disposal regulations (EfbV).
- Certification as a treatment plant in accordance with § 11 (3) ElektroG.
- Approval of the plants in accordance with the German Federal Immissions Protection Act (BImSchG) – Fourth Ordinance on certifiable plants.

The primary objective is the recovery of unmixed materials in order to establish material cycles, i.e. to facilitate primary recycling. Of major significance here is the environment-friendly extraction of pollutants from the materials as a means of protecting the environment. This is effected taking both economic and ecological factors into consideration.

6. Recycling methods

Various methods have become established for the recycling of discharge lamps. These include the shredder method for all types of discharge lamps, including energy-saving lamps, and the product-specific stripping method. These methods can be carried out either in a mobile or fixed system.

With regard to product-specific methods, the widespread "trim + separate" process yields maximum recycling rates for tube-shaped fluorescent lamps. This yields roughly 90% unmixed soda-lime glass, which can be fed directly into the glass melting process, and approximately 5% mixed glass from the lamp stem.

In the case of lamp types with many different forms and relatively low quantities, automatic dismantling systems are generally not economical. The problem here is the variety of materials. For instance, the different types of glass used cannot currently be fed into the glass melting process for primary recycling, meaning that unmixed separation is not viable. In this case, the shredder process, involving the separation of metals and plastics, is not only more economical, there is also no risk to the environment.

To prevent any danger to humans and the environment, all the lamp treatment processes are conducted in vacuum-sealed systems. All the plants have special waste air purification systems.

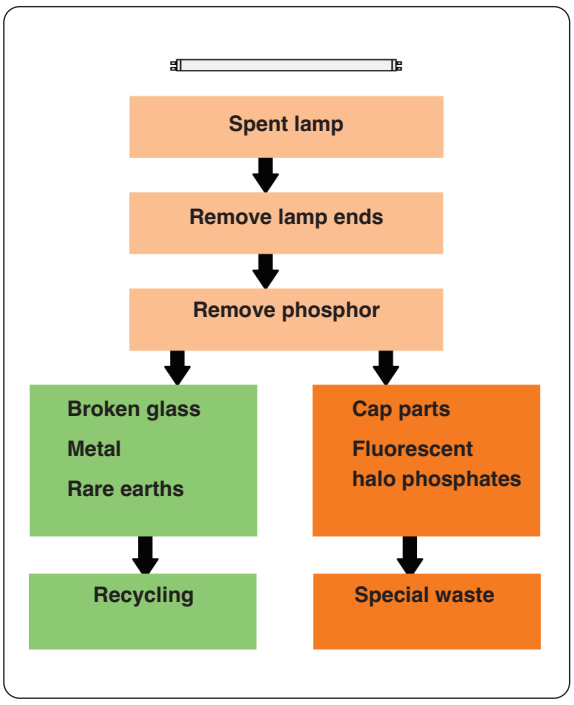
6.1 "End Cut" method

The End Cut process is mainly used for tube-shaped fluorescent lamps. The process is continually being developed, and today there are recycling plants which include phosphor recycling and automatic lamp input.

The main steps in the method are:

a) **Dismantling of fluorescent lamps**

During the stripping process, air is fed into the vacuum-sealed tubes. After this the ends of the lamps (metal/lead glass part) are removed and sent for further processing (separation of metal and lead glass).



"End Cut" method

b) **Removal of phosphor**

The phosphor is blown out of the remaining glass tube, or sucked out if the tube is broken, and separated into dust-tight containers using a dust precipitator.

c) **Glass collection**

The cleaned tube is reduced in a crusher. The broken glass is fed through a metal separator to ensure it contains no more metal. The clean glass can then be used by the lamp industry for the production of new lamps.

6.2 Shredder method

The shredder method allows all types of lamps to be processed, including broken lamps and production waste.

The lamps are processed in three steps:

a) **Crushing of the lamps**

The spent lamps are first crushed

b) **Fractionation of the mixture**

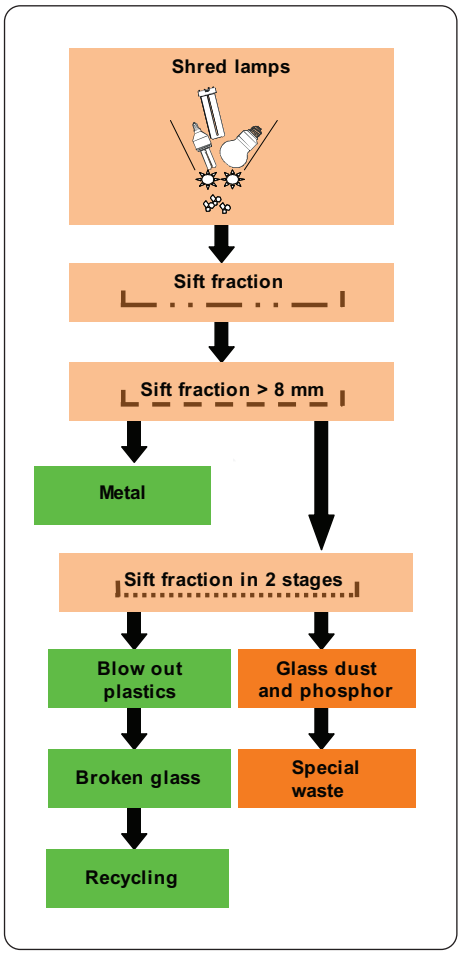
Then, the broken glass is separated into different particle sizes:

- Coarse fraction
- Medium fraction
- Fine fractions

The coarse fraction consists of the lamp caps, which are removed as flat, distorted parts.

The second fraction is the glass/plastics fraction, with a particle size of approx. 5 mm. Phosphor and glass dust is removed from this material. Plastics can be separated from the glass by being blown out.

The third fraction contains sifted phosphor powder and glass dust. This is also collected separately.



Shredder method

c) **Utilisation of recycling**

Metal parts are sent for metal recycling. Mixed glass is used, either directly or after appropriate pre-treatment, for glass products with lower purity requirements, or as an aggregate material for vitrification, foaming etc.

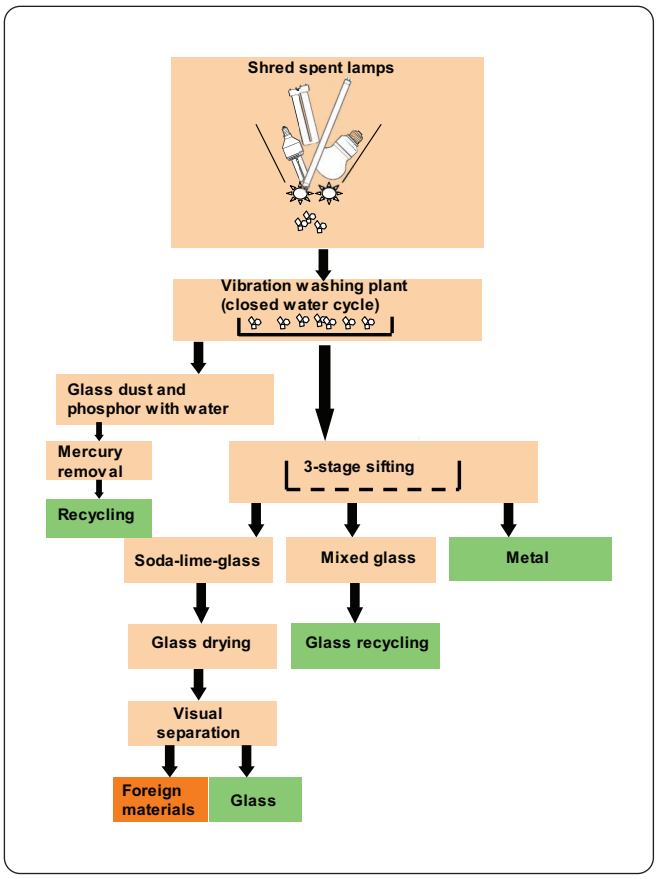
d) **Optional:**

Thermal removal of mercury from phosphor/fine glass by means of distillation.

6.3 Broken glass washing method

The broken glass washing method can be used to recycle large volumes of collected fluorescent lamps. Regardless of their length and diameter (no sorting), the material from fluorescent lamps, broken lamps and production rejects can all be reused.

The main steps in the method are:



Broken glass washing method

a) **Crushing of fluorescent lamps**

The fluorescent lamps are fed directly from the containers into the plant and crushed. Big-bags containing broken lamps can be input directly into the conveyer unit and emptied.

b) **Removal of the phosphor**

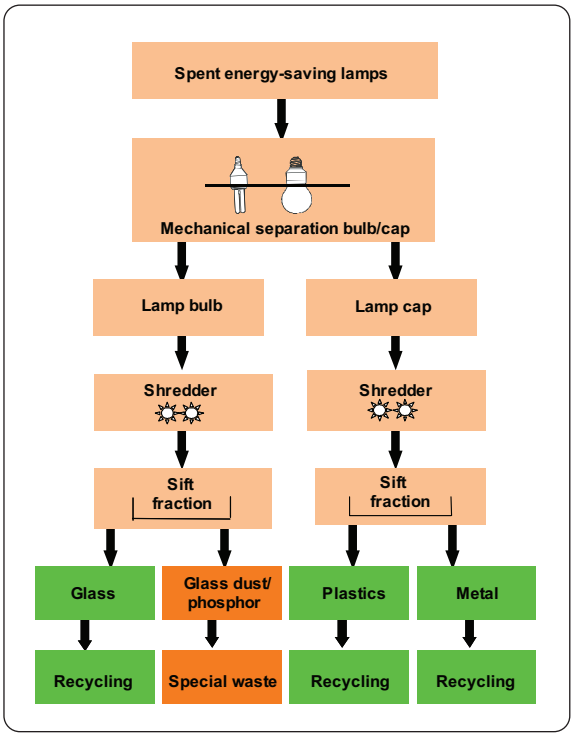
The broken lamps are cleaned of all phosphor with water in a vibration tank. The rinsing water is pumped out through an inclined filter in which the phosphor powder sludge is sedimented and the water subsequently reused. Mercury is removed from the phosphor powder by means of rotary distillation.

c) **Material separation**

The individual material fractions are rinsed and separated by means of sifting. The soda-lime glass separated in this way is dried and sent for quality control via a metal separation unit and an automatic detection system. There the lead glass is separated. The cleaned soda-lime glass is then put into big-bags and delivered to the lamp industry as a secondary material for the production of new lamps.

6.4 Other product-specific stripping methods

Only lamps of a similar kind can be processed using product-specific stripping methods. The advantage of this method is that the lamp bulb containing the hazardous material is separated from the cap, and mercury is separated from all the other lamp components in the first processing stage. Higher yields of recycling glass can also be obtained. The disadvantage is that the spent lamps first have to be manually separated.



Product-specific stripping

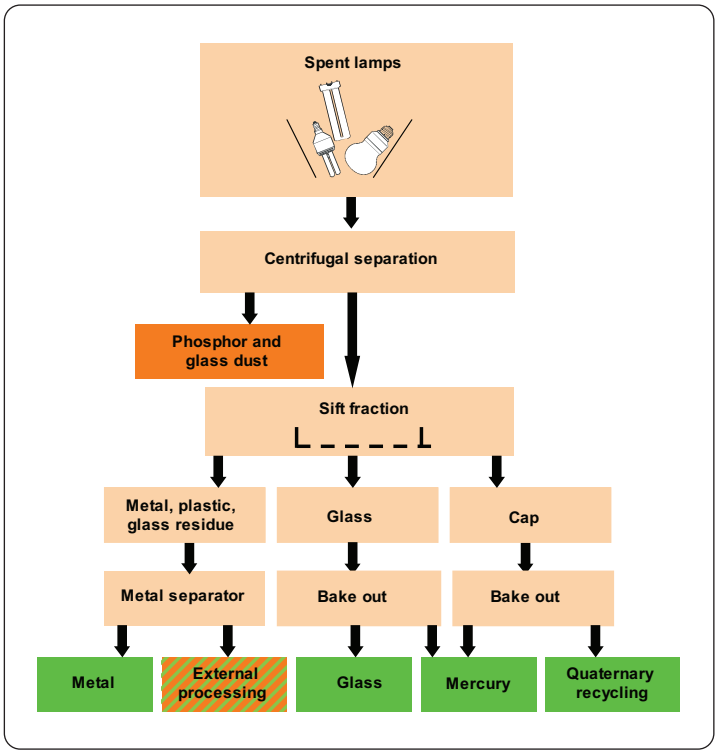
6.5 Centrifugal separation method

The centrifugal separation method allows compact fluorescent lamps, energy-saving lamps and other non-tubular discharge lamps to be processed.

a) Stripping and separation of the fractions

In a centrifugal separation system the discharge lamps are separated into the fractions of glass components and metal/plastic components of the lamp caps, without the lamp caps and electronics components being destroyed

The phosphor is extracted and filtered out in filter plants.



Centrifugal separation method

b) Thermal treatment stage

The glass of the discharge vessels is then subjected to thermal treatment in heating chambers.

c) Magnetic treatment stage

The lamp caps, plastic and electronic parts separated in the centrifuge are then fed into a shredder. The shredded material is then passed beneath a separator magnet. This extracts all metal parts

d) Utilisation of recycling

Metal parts are sent for metal recycling. The glass is fed directly into the processing system for glass products.

Plastics are energetically recovered. The phosphor/fine glass is disposed of in an underground landfill.

7. Reuse of materials

The unmixed extraction of the metal and glass lamp components permits high quality reuse with a significant level of material utilisation. Fluorescent lamp glass, for example, is used as a raw material for the manufacture of new lamps.

Plastics from the processing of compact and energy-saving lamps are mostly used to generate energy.

The aim is to continually improve the procedures through the further development of the technologies, to complete material cycles and to keep the proportion of residual waste as low as possible.

8. Contact addresses

Lightcycle has been founded by the lamp manufacturers to ensure environment-friendly collection and recycling of discharge lamps. Within Germany, Lightcycle organises the collection and transportation of spent lamps for the system partners Lampen-Recycling und Service GmbH (LARS) and OSRAM Lampen Verwertung (OLAV) in accordance with the German Electrical and Electronics Equipment Act (ElektroG).

If you regularly have more than 3 cubic metres of used lamps to dispose of each quarter, Lightcycle can arrange a special collection point for your company.

LIGHTCYCLE Retourlogistik und Service GmbH

Landsbergerstraße 155
Haus 2, 3. Stock
80687 München

See the website for the latest information and contact partners.

eMail: info@lightcycle.de
www.lightcycle.de

Lampen-Recycling und Service GmbH (LARS)

The latest information, names of contact persons and email addresses can be found on the website:

www.lampenrecycling-service-gmbh.de

OLAV

The latest information, names of contact persons and email addresses can be found on the website:

www.olav.ccr.de

Enquiries concerning the technical environmental aspects of lamps can be sent to "Fachverband Elektrische Lampen im ZVEI" at the following address:

ZVEI – Zentralverband der Elektrotechnik- und Elektronikindustrie e. V. Fachverband Elektrische Lampen

Lyoner Str. 9
60528 Frankfurt am Main
Phone: +49.69.6302293
Fax: +49.69.6302400

eMail: licht@zvei.org
www.zvei.org/lampen

Additional information on "light and lighting" can be obtained from licht.de (formerly Fördergemeinschaft Gutes Licht – FGL):

licht.de

Lyoner Str. 9
60528 Frankfurt am Main
Phone: +49.69.6302353
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eMail: licht.de@zvei.org
www.licht.de

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