CFL Recovery Strategy

Programme Overview

An investigation into the Diversion of Compact Fluorescent Lamps from the general waste stream in the Western Cape. A joint initiative of:

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Description of Content:
The purpose of this document is to provide an overview of activities relating to the development of a CFL recovery solution for the Western Cape, including an overview of key findings, recommendations, additional work required and a proposed way forward.

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Introduction and Background

General Context

During recent years Compact Fluorescent Lamps (CFLs) have played a key role in energy efficient campaigns worldwide. Their energy saving properties present a simple, but effective measure against ever-increasing, global, energy constraints, rising energy costs and concerns for climate change.

However, as the use of CFLs becomes increasingly widespread, the concerns relating to their mercury content and the associated hazards increase. CFLs, commonly referred to amongst consumers as “Energy-saver Lamps” or simply “Energy Savers”, contain an average of 5mg mercury (Hg) per lamp, a bio-accumulative toxicant that is easily absorbed through the skin, respiratory and gastro-intestinal tissues.

While the risk associated with an individual, broken CFL is generally concerned negligible; the cumulative impact of millions of CFLs does however become a more significant issue and could represent a potential risk to the environment. Spent CFLs should therefore be treated as part of the Household Hazardous Waste (HHW) collective.

Disposal of Household Hazardous Waste and e-Waste

The disposal of household hazardous waste is currently not being addressed through policy in South Africa, as quantities have unofficially been considered sufficiently small and innocuous to be treated as part of the general household waste stream.

Lighting waste has internationally been incorporated under e-waste (electronic and electrical waste), which means that an opportunity exists for collaboration with the greater e-waste collective. e-Waste initiatives are however in their infancy in South Africa and present an opportunity for optimizing efforts and collaboration rather than a ready-made solution at this time.

‘Recycling[1]’ Culture in South Africa

With the exception of a few, periodic pilot studies, waste separation and recycling are not generally practiced in South Africa.

Informal sector salvaging, both at the street level and at the landfill, constitutes the bulk of recycling activities in South Africa[2] at present. Recovered quantities and types of material are highly dependent on the market demand, commodity prices and industry organised collection, buy back and redemption systems. Recycling efforts can almost be described as a subculture that most South Africans are either completely unaware of or are aware only of salvagers rummaging through bins on collection days.

Waste separation and formal recycling therefore remains a concept foreign to most South African households.

As a consequence the diversion of CFLs (that have no associated value, for which no organised collection system exist and which constitute a fragile and hazardous waste type) from the general waste stream and recovery for safe disposal, or ideally recycling, requires a unique and specific solution.

[1] Used here as a collective term incorporating the recovery of spent material, the collection thereof, sorting and processing for new use

[2] A few exceptions should be noted, including collection pilots (e.g. yellow/blue bag systems), school/church/community fund raising projects, recycling services offered at a fee in urban centres (e.g. Resolution Recycling, Mama She, Whole Earth, etc) and retailer take-back services (e.g. Makro, Pick ‘n Pay, Woolworths)

Energy-saver Lamps in the Western Cape

Approximately 5 million CFLs were distributed in the Western Cape over a period of 4 months during 2006 as part of a large-scale efficiency drive. These lamps are now nearing the end of their natural life cycle. Whilst normal incandescent lamps (common light bulbs) are relatively easy to dispose of, the disposal of the CFLs (similar to linear fluorescent tubes), poses a challenge because of the small amount of mercury[3] they contain.

CFL Recovery Programme

Given the current limitations of legislation and infrastructure to accommodate CFL recycling and disposal from domestic use, the risk of failed CFLs being sent to general landfill *en masse* has raised concerns.

This prompted a collaborative effort by the City of Cape Town, Provincial Government Department of Environmental Affairs and Development Planning (DEADP) and Eskom to develop a suitable solution for the diversion of spent CFLs from the general waste stream to ensure responsible handling thereof as hazardous waste in the Western Cape.

A comprehensive effort over a two-year period, incorporating input from all identified stakeholders[4], has culminated in several retailer take-back offerings supported by a set of minimum requirements and implementation guidelines to direct the most appropriate practice and compliance with relevant legislative requirements.

Sustainability Concerns

The continued success of these voluntary retailer take-back offerings (or other initiatives of this kind) relies heavily on the urgent formulation of enabling and supporting legislation/regulation that would establish a cost recovery mechanism for the disposal or recycling.

Industry action to date seems to indicate that concerted effort will only be forthcoming if the cradle-to-grave management of CFLs is financially feasible at each management level (e.g transportation, treatment, disposal etc.)

Overview Structure

Subsequent paragraphs provide an overview of the activities and efforts that formed part of this initiative including findings, recommendations and the anticipated and proposed way forward. A summary, as it relates to the following topics, is included here:

- A description of the assessment process followed and the preferred **implementation mechanism** for recovery, diversion and safe disposal of CFLs. **Minimum requirements** and an **implementation guideline** developed as part of the programme outputs and aimed at supporting any party interested in participation, whether as a service provider, a local authority or an environmentally conscious citizen, are also included as appendices to this report.
- Consideration of the **legislative framework** and forum created by the National Energy Response Team (NERT) that will guide the implementation and ownership of a CFL recovery solution. A handy **Legislative Reference Guide** is also included as an Appendix to this report, summarizing all relevant legislation (across different spheres of government and governmental portfolios)
- An indication of **cost** implications and a proposed structure for **fund administration** based on comparative studies amongst other, similar entities and e-waste types.

[3] These lamps initially contain an average of 5mg Mercury (Hg) per lamp that should be regarded as a hazardous substance or waste type. This small quantity of Mercury diminishes further during the lamp's life, reducing the immediate risk of Mercury spillage over time.

[4] A CFL Recovery Workgroup was established based on nominated representation from the lighting industry, civil society, Eskom, City of Cape Town, DEADP, CEF and UCT (EDRC). Six work streams were initiated within this forum to focus on the key aspects identified for solution development. Initial work from the six work streams culminated in a terms of reference used for the appointment of a specialist waste consulting team to develop the detailed solution.

- Suggested **communication and education** efforts essential to solicit participation and to address the severe lack of awareness that exist amongst South Africans regarding waste, recycling and particularly hazardous household waste
- A discussion of possible **recycling** facilities and opportunities anticipated for South Africa in the near future.
- Reflection on the way forward and industry's role in achieving a South African solution.

The overview content is deliberately kept concise, but comprehensive support material is available for further reading. A navigational diagram (see Appendix D) has been compiled detailing all available referencing material and research work included as part of the overall programme. All information listed is available on request.

Implementation Mechanism

The primary focus of the CFL Recovery Programme was to find a practical, viable and effective solution for physically diverting spent CFLs from the general household waste stream to a recycling facility or an appropriately licensed or permitted landfill site.

This necessitated careful consideration and evaluation of all aspects of the product life cycle from manufacture, to distribution, sales and retail to waste management. CFLs as waste products were of particular interest from a waste generation to disposal, land filling or material re-use point of view.

It was recognised that in the South African context, the management of the waste stream from collection to eventual disposal or re-use of material is relatively well understood[5] and hence manageable (even if costly). The focus was therefore primarily on optimisation and refinement into a final solution

The greatest challenge was therefore not the question of what to do with spent CFLs, but rather how to present a sufficiently convincing and convenient solution to homeowners that would realise acceptable levels of CFL recovery while making this affordable for all stakeholders concerned.

Suitable Implementation Mechanism Selection

The development of a potentially suitable collection approach incorporated several selection and screening iterations to identify the best practical solution for South Africa:

- A broad stakeholder workshop attended by representatives from the lighting industry, waste management service providers, academia, Eskom, local, provincial and national government, public and private sector as well as various NGOs and civil society.
- Mapping of waste flows in logic diagrams and due consideration of alternatives according to a ranking system.
- A public consultation process aimed at gaining insight into the suitability of alternative services, the level of support/participation that could be expected from the household concerned, possible motivators and/or required incentives to solicit participation.

Based on the screening of alternatives, suitably demarcated bins placed at central locations were identified as the most suitable and acceptable recovery option for spent CFLs. **CFL points of sale or retailers were identified as the most obvious and practical choice to host collection points or drop-off centres.** This does not preclude other suitable locations, but has focused the efforts for the establishment of 'drop-off' centres and supporting guidelines under this initiative.

[5] Most of the waste 'supply chain', such as hazardous waste handling, transportation, storage, treatment and disposal, constitutes 'familiar', technical considerations practiced commonly for hazardous and household waste.

The public consultation process confirmed that for most South Africans the points of sale or retailers would constitute a central location. An exception was low income areas where 'central' was found to refer to 'within walking distance'. Even though all forms of separate collection were discarded due to risk and prohibitive costs, sidewalk collection from individual homes would represent the most convenient option and is likely to result in the highest recovery rates (simply because of the convenience factor). In the absence of sidewalk collection, mobile units or mobile drop off facilities (provided as part of a dedicated household hazardous waste collection effort) would present a potentially plausible solution, particularly in the case of lower income areas.

Based on the preliminary assessments, viable implementation of both sidewalk collection and mobile units/drop off events would be dependent on comprehensive service delivery, integrating several waste types and hence collaboration across several industries to overcome the significant implementation effort and operational cost hurdle.

Should cost structures or components therefore change substantially in future (e.g. low cost collection infrastructure and services or greatly reduced fuel costs), or true product custodianship and industrial collaboration can be achieved, these options would have to be reconsidered urgently.

The following graphic depicts the flow of waste from point of origin (typically the household where the lamp is used) to a participating drop off centre, via a possible interim storage or treatment facility until it ends in a suitably permitted landfill site or at a recycling plant (currently none exist in South Africa that can accept fluorescent lamps).

Figure 1: CFL recovery process

Minimum Requirements and Implementation Guideline

The selection process described above, enabled the identification of the most suitable recovery options and served as the basis for the remainder of the project outputs such as the development of the financial cost scenario attached.

The second objective was to facilitate widespread practical implementation by rolling out a simple mechanism that would allow the end user of CFLs (and other hazardous wastes where applicable) to participate regularly and conveniently as well as enable participation for retailers, distributors and all other stakeholders concerned.

As an example, concerns from the project team were echoed in the public consultation process regarding the safety of the bins in public areas. A practical guideline for implementation is therefore that drop-off centres must be properly manned and containers be suitably constructed to prevent any breakage of the CFLs.

This work has culminated in comprehensive Minimum Requirements (refer Appendix A) and an Implementation Guideline (Appendix B) that was developed to support all stakeholders (specifically participants and service providers) by providing suggested best practice and guidance for compliance with current relevant legislative requirements and future policy development.

The objectives of the Minimum Requirements and Implementation Guideline include:

- preventing pollution of soil, surface water, groundwater and air by any part contained in a CFL (with special emphasis on the prevention of uncontrolled mercury release in any form).
- ensuring public acceptance of the widespread introduction and promotion of CFLs as a superior energy saving lamp through an environmentally acceptable, integrated waste management strategy.
- protecting the public's health and safety;
- ensuring a safe environment; and
- complying with legislation.

Implementation in Practice

The project team, particularly representatives from the City of Cape Town and the appointed consultants, extensively engaged various retail chains leading to two retail chains taking the initiative to offer CFL collection points in store. These retail drop-off points offer a take-back service without any incentive to the consumer for participation and are supported by limited communication from the retailer's side.

Eskom's Western Cape Region simultaneously piloted an exchange programme at select Eskom vendors (in most cases spaza shops) located throughout the metro area. This pilot specifically targeted low-income households to gauge their response and participation preferences and offered an incentive in the form of a replacement CFL in exchange for a spent CFL.

With specific consideration of the Western Cape area, CFL recovery in the Eskom low income area pilot were slightly higher than the medium to high income areas targeted by the retail exchange programme. This seems a logical outcome for two reasons:

1.) Low-income households were the primary recipients of the bulk CFL rollout in 2006 i.e. these lamps are expected to approach end of life during 2008/9

2.) An incentive was offered for participation through offering an exchange for a new one.

Taking into account the available information from the retail programme, the following findings seem to indicate some key trends:

1.) The highest participation levels generally corresponded with stores located in high income areas

2.) Participation levels in the Western Cape far exceeded that of the rest of South Africa, with ten (10) of the top twenty (20) stores in the Western Cape having monthly averages roughly twice that of the national average.

3.) Whilst the retail take-back programme showed a slight downward trend in participation over time, the Eskom exchange programme seems to show an upward trend as awareness grew and communication was tailored to suit the specific market needs. Overall the participation in the Western Cape showed improvement as illustrated in the comparison of monthly participation rates below.

	Comparative Monthly CFL recovery rates for the WC
August	18%
September	36%
October	47%
November	Data not yet available

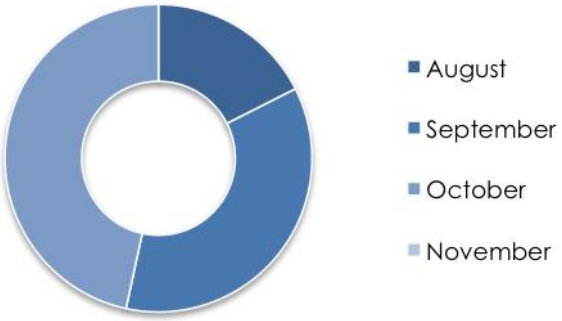

Figure 2: Comparative monthly participation rates (relative to all CFLs collected).

Whilst data is still being collected, initial indications and possible conclusions from the analysis are as follows:

1.) Western Cape participation rates, where mass rolled out CFLs are ending their life expectancy and where awareness levels regarding CFLs are greater, are significantly better than for the remainder of South Africa.

2.) Participation levels were not overwhelmingly positive, but still relatively pleasing, particularly where no incentive for participation was offered and in the absence of a major, supporting communication campaign.

3.) General feedback showed that communication has been insufficient and awareness levels regarding the offered take-back services and exchange points were very low, potentially hampering participation.

4.) Significant education and awareness remains necessary in South Africa regarding all aspects of waste management (but in particular on waste prevention and recycling) to bring about behavioural change leading to less waste generated, mismanaged and landfilled.

Implementation efforts have demonstrated that it is possible to implement a recovery mechanism in South Africa, and also that, similar to international experience, socially responsible retailers will lead the collection initiative in the country. But the responsibility and ownership (which would clearly include the lighting industry's product care and cradle-to-grave custodianship) of the support, infrastructure and communication/education/awareness remains unresolved at this time.

Beyond Collection

As indicated in the introductory paragraphs of this section, the remainder of the waste stream handling activities, including bulk logistics, temporary storage, transportation and treatment facilities, are familiar, but costly components of the waste handling solution. These activities in fact constitute the primary cost component ranging from one third to two thirds of the total expected costs, depending on the collection range and details of the remainder of the waste solution (e.g. whether it is rural or urban collection or whether material is recycled or landfilled).

By the same token, logistics represent significant opportunity for cost sharing and optimisation. Integration of efforts should be a priority to avoid duplication of efforts and costs. Inefficiencies and silo operations are pitfalls that have proven costly for other industries in the past.

Opportunities for synergy should be pursued between manufacturers and brand suppliers, other Mercury-bearing lamps and other hazardous or e-waste types. A comprehensive strategy would have to address bottlenecks, engage stakeholders and role players and give detailed consideration to opportunities for collaboration.

As part of the study, consideration was given to using empty-after-deliver retail distribution vehicles for bulb returns and sharing of transportation amongst different waste types. Preliminary costing and sensitivity analyses have shown that cross-industry collaboration can significantly improve the cost implications of a CFL recovery initiative.

Legislative Framework and NERT

Current Legislative Framework

The South African legislative framework aims to establish an integrated waste management approach with waste prevention, waste reduction and reclamation for re-use and recycling taking precedence before disposal. Under the Constitution (Act 108 of 1996) and the Municipal Systems Act (Act 32 of 2000) the obligation for integrated waste management and specifically the provision of waste services to households reside with local authorities.

The 'duty of care' principle is furthermore contained in the National Environmental Management Act (NEMA) and the Waste Bill makes allowance for and establishes tools for the Extended Producer Responsibility principle (refer to Appendix C: Legislation Reference Guide for clarification of principles).

It is therefore reasonable to expect that over time a solution would be forthcoming from both municipalities and manufacturers.

As a "developing country", the current focus in South Africa is on addressing historically distorted patterns of resource distribution and meeting basic needs (i.e. ensuring that all citizens have proper housing, water supply and sanitation, electricity, health care and other services) in order to improve the quality of life of all South Africans. The extension of traditional waste collection services to appropriately incorporate the diversion of household hazardous (and other recyclable) waste therefore represents a significant infrastructure and cost challenge that is not at the top of the immediate priority rankings in most municipal budgets.

Industry therefore seems the more likely and rightful contender for **owning and driving a solution to the CFL waste challenge**. The current legislative framework however governs large-scale users of mercury-containing lamps, but legislation pertaining to industry regarding industry-specific waste is vague and as yet unresolved. This situation will be remedied with the introduction of the new Waste Management Bill under which Extended Producer Responsibility will force industry involvement and collaboration with authorities.

Furthermore, in the absence of relevant bylaws, legal requirements of **residential** consumers relating to hazardous waste is inferred (e.g. the Polluter Pay principle) and a legal "return duty" on the consumer side (and as applicable to e-waste in many other countries such as Switzerland) is practically non-existent.

Pending Legislation: Waste Management Bill

The expectation is that the first quarter of 2009 will see the enactment of the highly anticipated Waste Management Bill.

Following international legal trends, the South African Waste Management Bill seeks to reinforce the **Extended Producer Responsibility principle**, thereby shifting responsibility for waste from government alone to the private industry. In support of this principle, the Bill establishes tools to prompt and facilitate industry involvement, particularly as it pertains to challenging waste types.

The Bill will establish a mechanism for a category of persons or an industry that generates a specific waste that is deemed problematic in any way for the country, to prepare and submit an **Industry Waste Management Plan (Industry WMP)** to the Minister for approval. This plan should outline the industry's approach to solving the waste problem satisfactorily. The Bill also provides two tools for use to enforce or support the development of industry WMPs for selected waste streams.

The first approach **invites/requests** industry participation and allows the impacted industry an opportunity to internally develop a strategy for management of the particular waste stream. Once approved by the Minster/MEC however, the Industry WMP becomes binding to the industry as a whole and contravention or failure to comply is an offence and will invoke penalties.

The second mechanism introduced under the Bill is the declaration of a waste stream as a **priority waste** that allows the Minister to **set waste management measures** to be enforced on priority wastes and generators thereof. Consequences of priority waste status include posing restrictions on import, manufacture, process, sell or export of a priority waste or product that is likely to result in the generation of a priority waste unless it complies with the approved Industry WMP.

National Energy Response Team (NERT)

The first quarter of 2008 was characterised by severe nationwide electricity supply constraints resulting in extensive load-shedding events. A National Electricity Response Team (NERT) was established by the president at the time to coordinate and facilitate all the implementation activities that are taking place as part of the response to the shortage of electricity supply. The primary objective of NERT is to facilitate and coordinate an accelerated programme that would enable South Africa to recover from the electricity emergency quickly with minimal consequences.

NERT is coordinated by an Inter-Ministerial Committee that includes representation from business, labour, civil society as well as all relevant government departments at all three tiers of government.

Large-scale, national rollouts of CFLs, totalling more than 18 million, formed a key part of the 2008 accelerated programme. As a direct result, NERT identified the need for a CFL disposal strategy among its priorities and have requested the DEAT to prioritise the development of an appropriate strategy and to report on progress to the NERT.

As a result the development and implementation of a strategy for safe CFL disposal has escalated in prominence in government. Greater emphasis on spent Mercury-bearing lamps and particularly CFLs is therefore expected and preliminary indications are that a request from the DEAT to the lighting industry for the development of an Industry Waste Management Plan will be forthcoming very soon.

Recommendation

The Waste Management Bill will be introducing a relaxation of storage and handling requirements for hazardous waste in order to facilitate re-use and recycling. Indications from the DEAT is that an allowance expected under the Bill and its related regulations is for temporary storage and recovery activities handling small[6] quantities of hazardous waste to be exempted from the requirements for a license.

Such facilities would still be subject to an environmental impact assessment (EIA). In terms of the National Environmental Management Act (NEMA) and the new Environmental Impact Assessment Regulations (2006), the accumulation and temporary storage of hazardous waste in excess of prescribed quantities and periods necessitate an EIA whilst smaller volumes may only require a basic assessment.

If the reality and hazards of all CFLs disposed at general landfill is recognised, there is a good argument to be made for establishing a countrywide recovery network to facilitate responsible handling. **Particularly in the case of participating collection points such as retailers, an even more simplified EIA mechanism or possibly exemption is strongly recommended, otherwise the initial voluntary retailer involvement may be in jeopardy**.

The US Federal Universal Waste Rule presents an international example in terms of the relaxation of waste management requirements in support of recovery and recycling initiatives.

Federal Universal Waste Regulations were introduced in an effort to facilitate and promote collection opportunities, proper recycling, treatment or disposal of, amongst others, Mercury-bearing lamps. These regulations ease regulatory burdens on businesses, streamline hazardous waste management standards for universal wastes (including lamps) and also ease the regulatory burden on retail stores and others that wish to collect, transport or generate these wastes. In addition, the

[6] 'Small' quantities/volumes remain to be finalised, but are currently indicated as: temporary storage of hazardous waste equal to or less than 3 tons per day, recovery of hazardous waste equal to or less than 100 kg per day

Federal Universal Waste Regulations facilitate programmes aimed at redirecting these wastes from municipal solid waste landfills to appropriate treatment or recycling facilities, pursuant to the full hazardous waste regulatory controls.

Similar regulatory allowances would be essential to prevent excessively onerous regulatory requirements from jeopardising an inherently beneficial and environmentally benign practice.

Costs and Fund Administration

Clarification regarding ownership and funding responsibilities for the management of the specific waste streams is essential before significant progress towards a comprehensive and effective CFL recovery effort will be seen. At present the legislative and regulatory requirements are sufficiently vague to allow inactivity among key stakeholders/role players such as all members of the lighting industry.

Mandatory action through structured and enforced legislation and regulations may be the only effective mechanism to prompt a truly concerted recovery effort.

The following sections provide an indication of what the cost and fund administration responsibilities and requirements, and therefore 'ownership', are likely to entail.

Indicative costing

Comprehensive cost modelling was developed as an indication of the likely cost of operating a National CFL recovery network. Although the model looks comprehensively at all possible cost contributors, cost values have been based on preliminary indications and assumptions such as expected recovery rates for CFLs, assumed exchange rates and travelling distances. Possible incentives to be paid to participating consumers (e.g. through a discount voucher towards a new lamp or a deposit system) were not included in the modelling at this time.

It is very important to note that the existing cost modelling incorporates only direct costs at this point in time and does not take into account any broader economic considerations that would complete a life cycle costing exercise or take the time value of money, or the dynamics of fluctuations in exchange rates or fuel costs into account. A consideration of these would depend on the mechanisms, i.e. whether the waste is simply separated and treated prior to disposal, or if recovery of materials is employed. Some of the indirect costs or savings that should form part of compiling a business case for an overall decision-making process regarding funding include:

- The extended life span of, already precariously full, landfills due to airspace savings,
- The future capital costs saved by delaying the development of landfills (cells that can accept hazardous waste,
- Environmental rehabilitation costs of severe soil and groundwater contamination,
- Healthcare costs arising from treating illnesses due to environmental contamination, which could be chronic considering that mercury is a cumulative non-degradable toxin in small quantities,
- Avoided cost of mineral exploitation, mining and beneficiation that may be further enhanced by the linked savings generated by reusing recovered and processed materials.

Please note that the above is by no means comprehensive, but rather indicative of the complexity of a comprehensive cost benefit analysis.

The expectation is that a recycling **levy on lamps** that is similar to a deposit on a returnable bottle could be instated to fund the recovery of CFLs. However, until the establishment of a levy mechanism, lump sum contributions from stakeholders or a **kick-start fund** will be required.

Tabled below are the modelled costs for various implementation and operation scenarios expressed as a Rand value per lamp sold. These values are indicative of the size of a levy to be collected per CFL sold in South Africa.

Table 1: Cost implications of CFL recovery per lamp sold

Rand/CFL	**Indicative costs without consideration of synergies**	**Indicative costs including consideration of possible synergies**
Scenario 1: Urban collection for processing and **disposal**	R 1.45	R 0.87
Scenario 2: Rural collection for processing and **disposal** (with bakkie)	R 9.96	R 7.79
Scenario 3: Rural collection for processing and **disposal** (mobile units)	R 8.06	R 5.89
Scenario 4: National collection to **recycling plant**	R 3.46	R 3.02

Scenarios and assumptions are defined in subsequent paragraphs. Most important however is the opportunity for significant **cost reduction presented by exploring synergies** with similar operations and other waste types.

The following presents the total cost of operation for each scenario as modelled:

Table 2: Total foreseen cost of operation

Total Rand	**Indicative costs without consideration of synergies**	**Indicative costs including consideration of possible synergies**
Scenario 1: Urban collection for processing and **disposal**	R 1 995 520	R 1 142 305
Scenario 2: Rural collection for processing and **disposal** (with bakkie)	R 1 796 023	R 1 400 460
Scenario 3: Rural collection for processing and **disposal** (mobile units)	R 1 449 799	R 1 054 789
Scenario 4: National collection to **recycling plant**	R 2 419 548	R 1 699 810

The four costing scenarios, as referenced in the tables above, that were investigated for the safe disposal/recycling of spent CFLs, are as follows:.

- Scenario 1: Dedicated CFL collection from retailers in urban areas for processing and disposal

- Scenario 2: CFL collection from rural areas with bakkies for processing and disposal
- Scenario 3: Mobile CFL collection from rural areas for processing and disposal
- Scenario 4: Dedicated CFL collection from retailers in urban and rural areas and transport to a recycling facility (Western Cape collection area to Gauteng-based recycling plant)

The **modelling framework** is based on four primary cost categories i.e. fixed costs, maintenance and running costs (collection logistics), number of participating collection points and number of lamps. Typical cost considerations incorporated under each category include:

Table 3: Cost categories considered in modelling

Cost category	Typical cost components included
Fixed costs	Infrastructure establishment including: ■ Collection vehicles and infrastructure (trucks, bakkies, mobile units, containers, etc as applicable), ■ Fund administration and marketing entity (ideally a Section 21 Company)
Maintenance and operational costs	Includes primarily costs to maintain collection infrastructure considering the cost of vehicle spares, cost of vehicle operation, fuel costs at current value and fleet maintenance. In case of an external service provider it is assumed that these costs would inform the pricing of service delivery, hence the detailed assessment.
Participating collection points	An estimate of the number of participating retailers (all within the Western Cape) coupled with number of collections per day to inform logistics.
CFL Numbers	Modelling of anticipated recovery numbers based on national sales data, a derived sales number for the Western Cape and a range of possible recovery rates based on international experience. These numbers informed frequency of collection, but also the cost of treatment, landfill and recycling.

All costing was done for the Western Cape as the focus of the study. The following key assumptions were used in the modelling:

- A CFL Recovery Rate of 12% (a relatively conservative number based on international experience)
- Exchange rates of R12 to a Euro and R8 to a US Dollar
- Diesel cost at R13,00 per litre (conservatively high)
- Number of CFLs distributed in the Western Cape ranged from 1 million to 2 million per annum
- Average distance travelled from urban centres to landfill: 40 km
- Average distance travelled from rural area to landfill: 240 km
- Recycling facility assumed to be located in Gauteng. Assumed travelling distance: 1 400 km.

The size of the levy for Scenario 4, collection from rural and urban areas for recycling, should be considered in the context of the study parameters and stated assumptions. A Cape Town-Gauteng commute represents the worst-case scenario and therefore the highest transportation cost. The base cost in Gauteng would be much lower with significantly reduced transportation costs, while the transportation cost component for other major centres such as Durban, Port Elizabeth, Bloemfontein and Polokwane would be commensurate with distance. This would ultimately have to be taken into account to determine an average or rather "national" levy.

A logical assumption is however that such a "national" levy would be more favourable than the quoted result for Scenario 4.

Fund Administration Assessment

In order to advise on an appropriate structure for the management of the CFL Recovery fund, a comprehensive assessment was done of similar South African entities that have established or are in the process of establishing recovering and recycling initiatives. Included in the assessment were Collect-a-Can, the paper industry in South Africa (including PRASA, Sappi and Mondi), eWASA, PETCO and the Glass Recycling Company.

In addition, a report from Zero Waste Alliance in Oregon, USA was also incorporated in the consideration of CFL collection options and the accompanied flow of funding.

The assessment was structured in terms of:

- The role, ownership and structure of a management and administration entity;
- Initial start-up funding;
- Continuous fund sourcing and
- Flow (or allocation) of funding.

Findings from this assessment were interrogated and evaluated to determine the optimal solutions for the CFL disposal initiatives. A Section 21 NPO (non-profit organisation) is suggested for the structure of the management and administration entity.

It is furthermore recommended that this entity be registered as a public benefits organisation (PBO) to benefit from available tax allowances.

The optimal solution recommended from the analysis incorporates a management and administration entity that is **directly involved in all aspects of collection, transport, recycling and fund management**. In summary this would entail involvement as follows:

Category of involvement	**Responsibilities**
Basic facilitation and support	■ Provide a platform for the recycling or disposal efforts of CFL manufacturers and importers ■ Awareness, education and communication ■ Facilitation of interaction with government
Funding and flow of funding management	■ Appointment of auditing entity for fund management

Category of involvement	Responsibilities
Collection and delivery of used CFLs	■ Appointment of companies to collect and deliver CFLs.
Recycling/disposal activities	■ Appointment of companies to recycle/dispose of CFLs

Based on the assessment of other industries, it is strongly recommended that participation by industry stakeholders in the management and administration entities should be **voluntary**.

Voluntary funding from industry coupled with seed funding from government will be an optimal solution to expedite the start-up of the initiative.

The recommended sourcing and flow of continuous funding, as depicted below (refer Figure 3) includes: a manufacturer/ importer levy, a refund to the CFL user with a coupon towards a new CFL purchase, contribution towards start-off funding from potential funders and possibly longer term support of the management and administration entity by the same funders, the collective fund/ management and administration entity should make direct payments to the collection entities, transporters and recyclers.

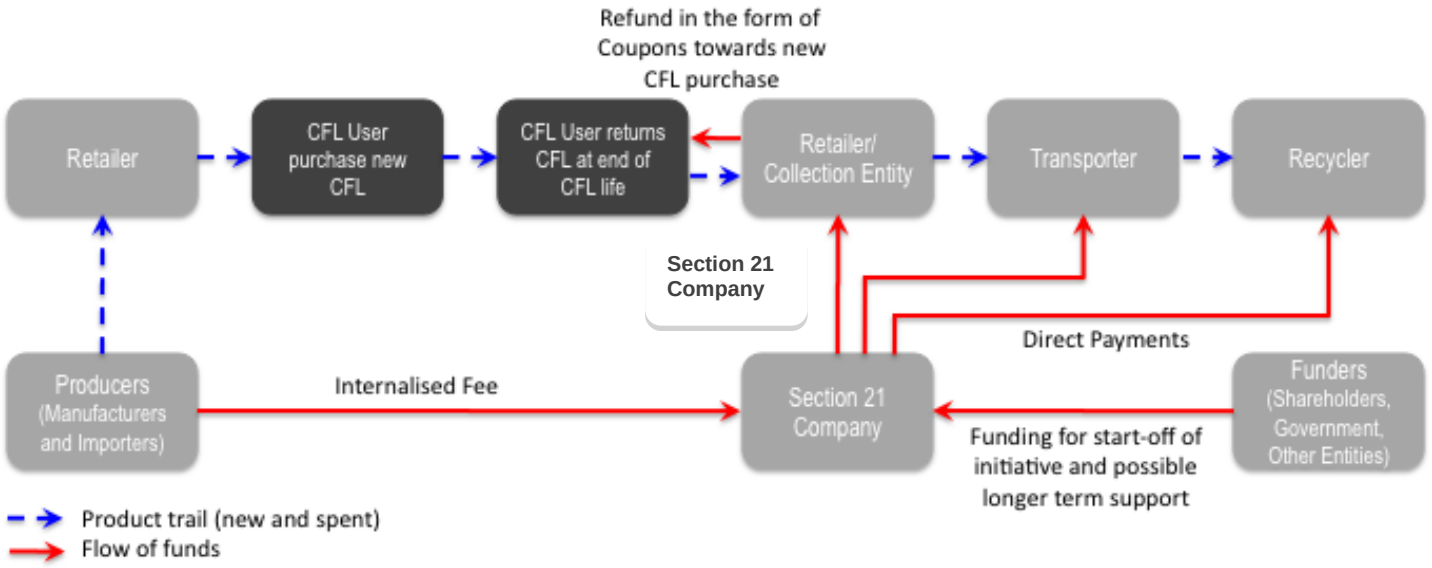

Figure 3: Optimal flow of funding

Of all the entities assessed, it was found that the electronic and electrical Waste Association of South Africa (eWASA) presented the best opportunity in terms of collaboration and synergies of operation. The existing structure and responsibilities of eWASA are closely aligned with the proposed optimal solution, and the association's ambit of interest already incorporates other hazardous and challenging electrical and electronic waste types.

An additional benefit to the eWASA model is the self-imposed cap of approximately 4% placed on the administrative and fund management (i.e. the eWASA operational) costs.

Considering the indicative cost analysis and the significant cost savings associated with exploring synergies (refer Table 1and Table 2 above) combined with the time benefit of using an established entity, it is strongly **recommended** that **eWASA** be considered by the lighting industry as a **fund administration entity** for CFLs in South Africa.

Whilst ownership and the onus for compilation as well as legal obligation for the industry waste management plan will remain with the lighting industry, contracting with a functioning and suitable fund and administration entity would alleviate the administrative burden and would avoid an additional operational and planning silo of recovery and collection activity in the country.

Given the specific hazards and complications of CFL waste, the contractual agreement and implementation specifications between the lighting industry and an appointed fund administration entity, in accordance with the above model of operation, would require careful consideration to ensure ongoing compliance with the commitments and requirements of a government-approved industry waste management plan.

Communication and Education

The successful recovery and safe management of CFLs depend largely on participation by the South African public. Research in the Western Cape has however shown that current levels of awareness relating to all waste matters, recycling and particularly household hazardous waste amongst homeowners is very low. This fact, coupled with a slowly emerging, recycling culture, highlights the importance of a comprehensive communication effort.

Effective recovery of CFLs would rely heavily on an appropriate **education and awareness strategy**. Communication and correct messaging to support an initiative of this kind should incorporate a well structured and extensive communication and education campaign to develop an understanding of waste management in general, communicate the importance of waste (and particularly hazardous waste) to the environment and to encourage a culture of recycling.

The research highlighted a number of interesting perceptions and attitudes amongst the general public related to CFLs, but also other hazardous or e-waste waste types, as follows:

1. Significantly, light bulbs (CFLs or otherwise) were not considered hazardous amongst any of the income groups. The greatest danger associated with light bulbs relates to the risk of broken glass. “Hazardous” is also associated with the threat to an individual in a household and not the cumulative threat to the environment. This perceived lack of danger will influence the disposal method and the participation levels in a recovery programme.

2. Hazardous waste products such as poisons, paints and motor oil, were only consciously treated with care where it had to be kept separate from food or out of reach of children. None of the respondents considered separate disposal of these substances necessary. Broad education amongst all residents may be required before any significant numbers of household hazardous wastes may be recovered in South Africa.

3. High income households that clearly tend to be more interested in supporting recycling initiatives are experiencing high levels of frustration with the perceived inconvenience relating to (un)available information, accessibility of recycling sites and services. Most participants in this income group indicated a preference/expectation for a **separate collection service** from their homes.

4. Amongst low income households recycling is associated with individuals who collect recyclable material from bins on waste collection days in order to generate an income and hence carries a **negative stigma**.

Research participants furthermore indicated that a CFL recovery programme should be a collective effort by all stakeholders. and they particularly highlighted the manufacturers, retailers, Eskom and the municipalities as having an obligation to develop a partnered solution. A logical conclusion is therefore that a **partnered approach to communication** would be most effective.

Given the broad scope of education required (general waste/recycling), a national government-supported, private sector partnership seems a necessity.

Communication is a requirement of an Industry Waste Management Plan as stipulated by the pending Waste Management Bill. Industry will therefore be obligated to develop a communication plan in the case of an industry WMP being requested by the Department of Environmental Affairs and Tourism.

It is however recognised that an **education and communication effort directed at the lighting industry** primarily, but also other role players including retailers, would have to precede industry-wide involvement.

Suggestions for communication support for each step of the recovery process are incorporated into the Implementation Guideline.

Recycling

Virtually every component of a Mercury-bearing lamp can be recycled including the metal end caps, lamp glass, and Mercury phosphor powder. Although questionable recycling technologies and practices abound, selected facilities do produce clean, recycled fractions with safe recovery of Mercury for re-use.

Currently, there is no recycling service for Mercury-bearing lamps available in South Africa, but indications are that a technologically advanced recycling plant may become operational in the foreseeable future. This facility will reportedly accept all commercial and industrial lamps, button batteries and Mercury-bearing products for complete recycling.

The establishment of a recycling facility will be subject to the complete legal and regulatory requirements for hazardous waste treatment and handling including an environmental impact assessment (EIA). This means that there may be a lead time before the facility will be formally operational.

In principle, the recycling of CFLs at an appropriately licensed facility is preferential to disposal and best aligned with government objectives of waste minimisation. But, decision-making with regards the establishment of a recycling facility should take into careful consideration both its environmental and economic feasibility.

CFLs are not inherently feasible to recycle. The safe recycling of challenging waste types, such as Mercury-bearing lamps, is expensive and the recycled components do not have a significant market value. Recycling efforts are therefore unlikely to be self-sustainable and would be financially dependent on paid usage of the facility and/or external financial support (refer Costs and Fund Administration section).

In the South African context the number of recycling facilities and the location thereof present both an environmental and economic consideration. Sales volumes and expected recovery rates do not justify more than a single initial facility while the vast geographic spread, and hence transportation needs, complicate the viable positioning options. Long distance transport has both monetary cost and environmental impacts.

It is therefore possible that recycling may only be a suitable option for lamps within a predetermined radius.

Way Forward

It is essential that the momentum created by participating retailer collection services, be maintained if a CFL recovery programme is to become a sustainable and widespread offering in South Africa in the immediate future. Notwithstanding the investigation, research and analysis work completed as part of the initiative described in this document, additional steps and efforts remain outstanding to achieve this.

Most important is the need for an industry waste management plan to be formulated, coupled with a supporting legislative framework and the establishment of a functional and sustainable funding solution.

It is believed that the work that has been completed as part of this study can largely be used towards the establishment of an industry waste management plan.

Additional opportunities for government and international corporates to support the recovery initiative have been identified as follows:

1.) International lighting manufacturers subject to the **Directive on Waste Electrical and Electronic Equipment (WEEE)** are theoretically under obligation to apply the same principles and standards in other countries of operation. Manufacturer take-back of electrical and electronic waste (including lighting waste) is mandatory under the WEEE Directive. It can therefore be concluded that (if the law would be properly enforced) European-based lighting manufacturers active in South Africa would in fact have to provide a similar service.

2.) Government's **economic support** and enablement of the recovery of this waste stream for recycling may include facilitation of an adequate receiving market or take-off agreements, soft loan(s) for the establishment of recycling facilities, supportive policies and an economic environment (utilising economic instruments such as taxes and subsidies) that advance recovery and specifically recycling activities.

3.) Government and businesses with corporate social and sustainability commitments can, as consumers, influence market demand by introducing **green procurement policies** that gives preference to suppliers participating in recovery and recycling initiatives.

This initiative will conclude with a formal handover of all work to the relevant NERT work group and DEAT representative. All material is also available to the lighting industry and other stakeholders for future use.

Acknowledgements

The following individuals and organizations are acknowledged for their invaluable contributions to the CFL Recovery Programme:

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2. Eddie Hanekom from Department of Environmental Affairs and Tourism
3. Eskom as sponsor and specifically Latetia Venter, Lodine Redelinghuys, Iris Cloete and Robert Henderson
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Appendix A: Minimum Requirements

The minimum requirements are structured as principles and objectives that are prescriptive/descriptive of an ideal state of operation.

It is noted that the aim of the CFL recovery programme is to protect the environment and the public from the impacts of poor CFL management practices. Therefore, whilst the minimum requirements describe the ideal operating environment it is recognised that **any** reduction in household hazardous/CFL waste to general landfill is an improvement to the status quo.

The minimum requirements should therefore be read in conjunction with the implementation guidelines that provide convenient and practical practices and solutions for the recovery of CFLs. The minimum requirements are also intended to guide the development of additional or new services.

It is anticipated that full compliance with the minimum requirements is likely to be through a process of continuous improvement only.

This appendix explains the necessity of establishing a minimum requirements framework. It discusses the approach taken and the principles and regulatory framework applied that informed the development of the minimum requirements defining the management of spent CFLs from generation to their ultimate destiny.

Objectives

The objective of the minimum requirements is to establish a framework that can assist with:

- protecting and promoting public health and safety;
- protecting the environment;
- legislative compliance;
- promoting sustainable practice; and
- safe management of spent CFLs.

Approach for development of these minimum requirements

The approach of the minimum requirements and implementation guidelines is based on the Integrated Environmental Management (IEM) planning principles. These principles promote the proactive control of pollution, by integrating environmental aspects into the planning of developments. This approach has also been aligned with the Environmental Impact Regulations in terms of the National Environmental Management Act, 1998 and the Minimum Requirements Waste Management Series of the Department of Water Affairs and Forestry (DWAF).

The required processes and activities must meet the “Best Practicable Environmental Option” (BPEO). This is the option that provides the most benefit and least damage to the environment as a whole, in both the long and short term. It is derived through due consideration of all alternatives and related costs.

The methods and practices used to implement the above processes and activities must be the “Best Available Technology Not Entailing Excessive Cost” where excessive cost is determined by a cost benefit analysis (refer Costs and Fund Administration section).

The Minimum Requirements and Implementation Guidelines for the Safe Management of Spent CFLs are based on the Minimum Requirements Waste Management Series and as such those requirements and guidelines are based on similar principles. For ease of reading, the characteristics of the minimum requirements are repeated below.

Definitions of a minimum requirement

- A. The rule rather than the exception decides a minimum requirement

  This is fundamental to the approach used in the formulation of this document and must be born in mind when applying it. The principles involved in the minimum requirements cannot address every situation but should be relevant to the most common scenarios.

- B. Minimum requirements tend to concentrate on objectives and principles towards a desired outcome rather than on detail on how to achieve the envisaged “results”

  This means that, although explanatory detail is sometimes provided, minimum requirements generally specify the expected standard rather than the method of how to achieve it

  Numerical requirements have been used with discretion and the reason for this is that each situation must be considered on its merits. The inclusion of too many numerical requirements would transform the document into a prescriptive handbook.

- C. The degree to which a minimum requirement is applicable is not specified

  The degree to which a minimum requirement must be executed in order for the end result to be acceptable is not specified. This must be determined by the specific circumstances and in some instances on a case-by-case basis. An independent auditing and verification process should possibly be applied to ensure an acceptable performance quality from all CFL waste management parties and for their activities concerned with those minimum requirements.

- D. Practicality often dictates substantially less than the ideal, so that minimum requirements may sometimes fall short of the ideal

  The minimum requirements are frequently less stringent than standards applied in developed countries. This is to ensure practicability and sustainability under local conditions and across a wide socio-economic and demographic spectrum that is typical for South Africa. At no time, however, will the protection of the environment be compromised.

- E. The minimum requirements address basic administration procedures

  An example of a minimum requirement addressing the basic administrative procedure is the minimum requiremen that a Section 21 company must be established to manage all monies for spent CFL management costs that are recovered through an advanced recycling fee (ARF).

Principles integral to the minimum requirements

Several principles were identified as critical to the provision of CFL management services. These principles have been incorporated into the minimum requirements and are highlighted in subsequent paragraphs.

Health, environment and quality of life

Quality of life is enshrined as a core value of the Constitution of South Africa. Within the Bill of Rights in the Constitution, the rights may be viewed as having direct or indirect relevance to the environment. The environmental right can be divided into two components i.e. the right to an environment that is not harmful to human health or well-being and a positive obligation on the state to pass legislation to give effect to that right.

Within the Bill of Rights it becomes clear that:

- All organs of state are bound by the right and must give effect to it;
- In giving effect to the right, the state must establish an effective regulatory framework; and

- That since poor waste management practices can result in pollution, ecological degradation and negative health effects, an effective waste management system will fall within the ambit of the right.

In addition to the Constitution, the issue of adequate and effective waste management has always been directly linked to the issue of human health and the consequential effects of poor waste management on human health.

The National Environmental Management Act (NEMA), Act 107 of 1998, contains a set of principles that govern environmental management and against which all environmental management plans and actions are measured. Sustainable development requires the consideration of all relevant factors including the following:

- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably;
- The pollution and degradation of the environment must be avoided, or, where they cannot altogether be avoided must be minimised and remedied;
- Waste must be avoided, or where it cannot be altogether avoided, minimised and reused or recycle where possible and otherwise disposed of in a responsible manner;
- That a risk averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions;
- Responsibility for the environmental health and safety consequences of a policy programme, project, product, process, service or activity exists throughout its life cycle;
- The participation of interested and affected parties (I&APs) in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation by vulnerable and disadvantaged persons must be ensured;
- Decision makers must take into account the interests, needs and values of all interested and affected parties and this includes recognising all forms of knowledge, including traditional and ordinary knowledge;
- Community well-being and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means;
- The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected;
- Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law; and
- The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted.

Integrated waste management approach

The future National Waste Management Bill as well as the National Environmental Management Act prescribe the integrated waste management hierarchy (IWMH) as a waste management approach, which is internationally accepted and underpins integrated waste management. This waste hierarchy outlines waste management options, in descending order of priority with the overall objective of promoting and encouraging waste reduction:

- Firstly by avoiding/preventing the generation of waste;
- Secondly introducing waste minimisation (where both the quantity and toxicity of waste is reduced at source and during manufacturing which is often related to the introduction of cleaner production technologies);
- Thirdly, as far as possible, establishing recovery for reuse and/or recycling opportunities for waste (the latter includes natural recycling activities such as composting and vermiculture);

- Fourthly considering treatment to reduce the harmful effects of waste (physical, thermal and chemical destruction); and
- Finally implementing the practice of safe waste disposal.

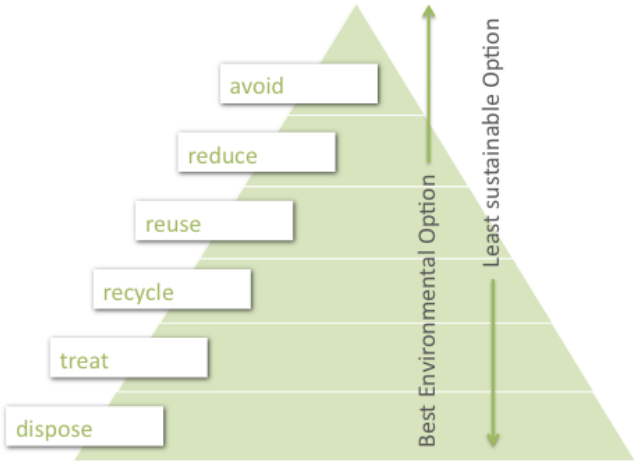

Figure 4: Waste Minimisation Hierarchy

The South African government has adopted the IWMH approach to reduce waste generation and disposal as well as to pursue the targets stated in the Polokwane Declaration 2001.

Within the context of the Minimum Requirements and Implementation Guidelines for the Management of Spent CFLs, the IWMH relates to waste treatment and recycling of post consumer waste. This is achieved through the requirements necessary for separation at source, collection, transport, storage and treatment and recycling. Separation of CFLs at source must be implemented to:

- assist the service provider in the collection of recyclables, thereby preventing double handling of all domestic waste at a secondary point, which could have associated health and safety issues, as well as increased costs;
- create a waste awareness by the original generator of the waste (typically the manufacturer but further downstream also the distributor and finally householder) which will further enhance the avoidance or minimisation of waste generated;
- aid in diverting waste away from landfills and reducing the unnecessary consumption of valuable airspace.

It must be noted however, that additional mechanisms and facilities will be required to handle, treat and process the CFLs collected at source. Ensuring sustainability and financial viability within all aspects of the recycling cycle is critical.

Worker health and safety

As CFL collection, transport, treatment and recycling is labour intensive, there are a number of critical health and safety issues which have to be taken account of in the Minimum Requirements and Implementation Guidelines, as follows:

- That waste in itself can be unhealthy and hazardous;
- Equipment and vehicles used by workers can be complex and highly mechanised;
- Work is often undertaken in difficult and relatively unsafe environments; and

- Service delivery and productivity are directly linked to ensuring the health and safety of the workers.

Minimum requirements

These minimum requirements are aimed at achieving the environmental, social and legal objectives as described in preceding paragraphs. As stated previously, it is structured as principles and objectives that are supplemented by implementation guidelines (refer Appendix B to this overview) with practical implementation solutions towards satisfying the minimum requirements.

The following therefore constitute the ideal end state of CFL recovery activities across the value chain.

	**Separation at source**
Definition	The term “separation at source” refers to the householder or consumer as a waste generator in the waste management system.
Objectives	Separation at source is aimed at preventing spent CFLs from entering the general waste stream and subsequently being disposed of at general landfill sites. As such the objectives are to: ■ ensure that CFLs are diverted from the general waste stream; ■ ensure that CFLs are separated in a manner that is not harmful to any potential waste handler (being both the householder and further downstream the waste removal service provider) or the environment; and ■ ensure that CFLs are removed from the general waste stream in such a way that the CFL is unbroken and in a physical condition that can be safely treated and landfilled.
Minimum requirement(s)	■ No CFLs to go to a general landfill i.e. all CFLs to be separated from the normal household waste stream. ■ CFLs to ideally remain intact.

	**Transportation (private)**
Definition	Transportation refers to the collection and transport of spent CFLs to a storage and treatment facility and thereafter to a permitted hazardous landfill site or alternatively to a recycling facility in a way that ensures safe containment of the mercury.
Objectives	The objectives of collection and transportation minimum requirements are as follows: ■ To ensure that CFLs are collected and transported in a manner that is not harmful to the waste handler or the environment; and ■ To ensure that CFLs are handled in compliance with all applicable current legislative

	requirements and these minimum requirements.
Minimum requirement(s)	■ Vehicles must be roadworthy and appropriate and in accordance with the National Traffic Act (GNR. 225) requirements. ■ The applicable TREM decals must be displayed on the vehicles and provide correct details. ■ The driver(s) of the vehicle(s) must be qualified, trained and certified to transport hazardous goods. ■ Spent CFLs must be transported in such a manner that the breakage of CFLs is prevented and that in the case of breakage no mercury leakage emanates from the transportation containment.

	**Drop-off centres/facilities**
Definition	Drop-off centres/facilities are conveniently located collection points for spent CFLs. Drop-off facilities can be hosted by, amongst others, retailers, 24-hour convenience stores (e.g. garages), Eskom centres, municipal centres and mobile collection units (a mobile service by specialised vehicle/container that serve communities without access to permanent drop-off facilities at routine intervals) on condition that they comply with the minimum requirements /implementation guidelines.
Objectives	The objectives of drop-off centres are as follows: ■ To provide a convenient point for the consumer / generator to return their spent CFLs; ■ To ensure that CFLs are temporarily stored in a manner that is not harmful to the individual householder, the public or the environment; ■ To provide a permanent or temporary point for waste transporters to collect spent CFLs *en masse* (as part of a permanently growing CFL collection infrastructure).
Minimum requirement(s)	■ No breakage in the drop off or temporary storage process. ■ Ideally CFLs should be brought to a collection facility unbroken. ■ Designated areas must be supervised by an appropriately qualified responsible person present during hours of operation i.e. drop-off centres cannot be hosted at unmanned premises. ■ Adequate container labelling identifying contents as hazardous, describing the type of waste accepted and correct disposal procedures. ■ Designated areas must be child proof, safe and easily accessible ■ Personnel to be suitably trained and enabled (in the possession of a clean-up kit) in the event of CFL breakage. ■ Collection and replacement frequency of containers commensurate with volumes of lamps

	**Drop-off centres/facilities**
	received and within legal specifications. ■ The correct permit/license or exemption from such a license must be obtained - where the maximum weight of waste collected does not exceed the permissible concentrations (anticipated regulation allowances associated with the pending Waste Management Act), so that the retailer is legally permitted to act as a temporary waste storage facility.

	**Transportation (Bulk)**
Definition	Transportation refers to the collection and transport of spent CFLs to a storage and treatment facility and thereafter to a permitted hazardous landfill site or alternatively to a recycling facility in a way that ensures safe containment of the mercury. It should be noted that after-treatment and storage transportation requirements may include **crushed and possibly chemically treated** CFLs for final disposal at a permitted hazardous landfill site or **uncrushed CFLs** to be sent to a recycling facility for further processing.
Objectives	The objectives of collection and transportation minimum requirements are as follows: ■ To ensure that CFLs are collected and transported in a manner that is not harmful to the waste handler or the environment; and ■ To ensure that CFLs are handled in compliance with all applicable current legislative requirements and these minimum requirements.
Minimum requirement(s)	■ Vehicles must be roadworthy and appropriate and in accordance with the National Traffic Act (GNR. 225) requirements. ■ The applicable TREM decals must be displayed on the vehicles and provide correct details. ■ The driver(s) of the vehicle(s) must be qualified, trained and certified to transport hazardous goods. ■ Spent CFLs must be transported in such a manner that the breakage of CFLs is prevented and that in the case of breakage no mercury leakage emanates from the transportation containment. ■ Transportation of crushed and/or treated CFLs requires suitably containment to prevent any mercury leakage.

	**Storage and treatment**
Definition	Storage and treatment refers to the temporary storage and accumulation of sufficient CFL volumes and/or crushing and treatment into an inert and sealed format for economically feasible transportation and recycling or disposal, as applicable.
Objectives	The objectives of storage and treatment minimum requirements are as follows: ■ To ensure that CFLs are stored and treated in a manner that is not harmful to the waste handler or the environment; and ■ To ensure that CFLs are stored and treated in such a way that the CFL is in a form that can be disposed of in an environmentally acceptable manner (short term) or recycled (long term).
Minimum requirement(s)	Storage (with the intent to prevent breakage) ■ Storage areas for spent CFLs must be permitted and legally compliant with all relevant acts and legislation. ■ Storage containers must be appropriate to prevent breakage. ■ Mercury emissions must be contained in the case of accidental breakage. Treatment (breakage integral to treatment process) ■ All CFLs that will be disposed of at landfills must be pre-treated under controlled conditions that meet the legislative requirements and comply with these minimum requirements. ■ Mercury vapour must be contained and immobilised at any crushing operation. ■ Maximum allowable levels of mercury vapour emitted from any treatment process must comply with the Occupational Health and Safety Act's (OHSA) minimum standards. ■ All waste and recovered material must be contained and stabilised. ■ Personnel to be suitably trained and equipped to handle CFL waste and deal with emergency situations. ■ Proof that CFL waste is treated in accordance to the DWAF minimum requirements for hazardous waste must be generated and provided to the receiving facility (landfill).

	**Landfill disposal**
Definition	Landfill disposal refers to the appropriate disposal of the CFL waste at a designated and appropriately permitted hazardous landfill site. It is reiterated that the re-opening or downstream chemical treatment of CFL waste with mercury immobilising chemicals is strictly prohibited. All treatment must be completed **PRIOR** to arrival at

	**Landfill disposal**
	the landfill site.
Objectives	The objectives of landfill disposal minimum requirements are as follows: ■ To ensure that CFLs are disposed of in a manner that is not harmful to environment; and ■ To ensure that CFLs are disposed of in compliance with all applicable current legislative requirements and these minimum requirements.
Minimum requirement(s)	■ Spent/failed CFLs must be disposed of at an authorised (licensed / permitted) hazardous landfill site ■ All containers received must be clearly labelled according to their contents ■ Containers must not be opened as part of the disposal process i.e. **NO** opening of drums and/or treatment of CFLs may take place at the landfill site.

	**Recycling**
Definition	The closed loop recycling of CFLs wherever financially viable and logistically do-able should be given preference to safe disposal. The establishment of a recycling facility for CFLs and other mercury-bearing wastes may become a reality in the course of the next few years and as such provides the outlook for a medium to long-term solution. This section briefly outlines the minimum requirements for spent CFLs in order to render them recyclable and stipulates some basic technical requirements for the recycling facility.
Objectives	The objectives of recycling minimum requirements are as follows: ■ To ensure that CFLs are recycled of in a manner that is not harmful to environment; ■ To ensure that CFL recycling is a environmentally and financially viable option; ■ To ensure that CFL recycling is done in compliance with all applicable current legislative requirements and these minimum requirements.
Minimum requirement(s)	■ Spent/failed CFLs should ideally arrive at the recycling facility intact, i.e. not broken; ■ Any mercury residue resulting from the crushing of CFLs under a negative pressure must be immobilised and appropriately packaged; ■ Recycling technology applied must be proven to be environmentally safe and financially viable; ■ No mercury vapour may escape during the recycling of spent CFLs; and ■ All mercury must be removed from the recycled material.

Appendix B: Best Practices/Implementation Guideline

Refer to separate A5 Booklet.

Appendix C: Legislation Reference Guide

Legislation has been key in driving the development and successful implementation of the Minimum Requirements and Implementation Guidelines for the Management of Spent CFLs.

Numerous laws and documents relating to waste management, service provision and related issues such as transport and other environmental, health and safety related aspects have been promulgated and published (see below). Not only does legislation prescribe what is required from all levels of government, civil society and industry, but, it is often explicit in the roles and responsibilities of government.

For the purposes of this document, both current and pending legislation are important for a number of reasons, namely:

- It establishes the current parameters and/or requirements which must be taken into account in the development and implementation of the Minimum Requirements and Implementation Guidelines for the Management of Spent CFLs; and
- It determines the institutional powers, functions and responsibilities of the different spheres of government (including local government).

Regulatory principles of relevance

A few principles of interest to the handling of CFLs that are entrenched in the South African legislative and regulatory framework are listed below. These principles should guide decision-making and interpretation of legal requirements and are therefore noteworthy[i].

- The South African legislative framework already in place and under development aims to establish an **integrated waste management** approach with waste minimisation and reclamation for re-use taking precedence prior to disposal. However, mechanisms for handling general recyclable materials and hazardous household waste according to this hierarchy have not yet been established (National Environmental Management Act (108 of 1998));
- The **polluter pays principle** that requires an organisation causing the pollution to pay the costs incurred;
- Similarly the **extended producer responsibility principle** imposes accountability over the entire life cycle of products and packaging introduced on the market. This means that firms, which manufacture, import and/or sell products and packaging, are required to be financially or physically responsible for such products after their useful life.
- The principle of **green procurement to** first avoid and accumulation of hazardous waste and second to reduce the production of the quantities of waste;
- The **duty of care** that places the onus on any organisation that generates waste to dispose of the waste safely;
- **Waste avoidance** in the first instance, **waste minimisation**, waste **re-use** (on-site first), waste **recycling**, environmentally friendly waste **treatment** and safe and environmentally friendly **waste disposal**;
- The **precautionary principle** that assumes that waste is hazardous until shown that it is safe;
- The principle of **segregation at source** of hazardous waste to ensure that all hazardous waste is treated in accordance with the risk that it poses

Legislative framework

Details of relevant key legislation related to the management of spent/failed CFLs are captured in a subsequent table (refer Table 4), but a list of relevant legislation is given below:

- The Constitution of the Republic of South Africa (Act no. 108) of 1996;
- The Municipal Systems Act no. 32 of 2000 and Amendment Act (Act no. 44) of 2003;
- The Environmental Conservation Act (Act no. 73) of 1989;
- National Environmental Management Act (Act no. 107) of 1998;
- The National Health Act (Act no. 61) of 2003;
- Municipal Finance Management Act (Act no. 56) of 2004;
- National Road Traffic Act (Act no. 93) of 1996;
- Occupational Health and Safety Act (Act no 85) of 1993;
- National Building Regulations and Building Standards Act (Act no 103) of 1977 (Reg. No: R 432, 8 March 1991);
- Waste Management Bill to be promulgated as the National Environmental Management: Waste Management Act;
- Waste Management By-laws; and

Standards, guidelines and policies:

- The Integrated Pollution and Waste Management Policy and the National Waste Management Strategy;
- The Western Cape Provincial Integrated Waste Management Policy;
- Minimum Waste Recycling Standards for South Africa; and
- Draft National Waste Collection Standard Guidelines.

Evident from this list should be the fact that relevant legislation and regulations are extensive and involve several spheres of government and authorities.

Table 4 below summarises a list of the most pertinent laws pertaining to the general management of Mercury-containing waste. Incorporated into this summary are the established and anticipated parameters and/or requirements and the institutional powers, functions and responsibilities of the different spheres of government (including local government).

Table 4: Legal responsibility pertaining to the different activities of Mercury-containing waste management

Responsible Entity	CFL Activity	Relevant Legislation	Matter of Relevance	Standards/Guidelines	Lead Authority
Manufacturer/ Generator of waste (excepting Mines)	Generation	Waste Bill (B39-2007), Sections 28 to 34	Prepare, submit and implement Industry Waste Management Plan	MR DOC 1 and Section 30 of B39-2007	DEAT
	Separation/treatment/ processing at source	Waste Bill (B39-2007, Sections 19, 20,21, 43 to 57 and Schedule 1 or prior to its promulgation Section 20(1) of ECA	Application for license; general requirements for storage of waste and list of activities in respect of which a waste management license is required.	MR DOC 1and 2 as well as Section 21 of B39-2007	DEAT/provincial environmental department
	Decommissioning of facilities	GNR 386 and 387 of GG No 28753 of 21 April 2006.	Application for basic assessment or full EIA environmental authorisation	EIA guidelines	DEAT/provincial environmental department
	Storage of hazardous waste (HW)	GNR 386 and 387 of GG No 28753 of 21 April 2006.	Application for basic assessment or full EIA	EIA guidelines	DEAT/provincial environmental department
	Extended producer responsibility	Waste Bill (B39-2007), Section 18	Requirements pertaining to waste minimisation, financial arrangements packaging subject to consultation with industry and ultimate notice in Government Gazette	Still to be provided by DEAT	DEAT

Holder of waste - mines	Stores, accumulates, transports processes, treats disposes of HW, process HW waste	Section 21(g) NWA excepting transportation in which case National Road Traffic Act no. 93 of 1996 applies	Requirements for licensing of storage, treatment, processing of CFL waste facilities SABS standards for transportation relating to vehicles, records and drivers.	MR DOC 1, 2 and 3 SANS 11518 SANS 10230 SANS 10231 SANS 10265 SANS 10368	DME Department t of Transport (DT)
	Decommissioning of HW treatment/processing facilities	GNR No. 7949, Vol.466 of 23 April 2004 in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002)	EMP amendment	Draft template for EIA as prepared by DME	DME
Holder of waste – industry	Stores, accumulates, transports processes, treats disposes of HW waste, process HW waste	Section 20(1) ECA (to be superseded by NEM: Waste Management Act once promulgated), excepting transportation in which case National Road Traffic Act no. 93 of 1996 applies	Requirements for permitting of storage, treatment, processing of CFL waste facilities SABS standards for transportation relating to vehicles, records and drivers.	MR DOC 1, 2 and 3 SANS 11518 SANS 10230 SANS 10231 SANS 10265 SANS 10368	DEAT DT

	Decommissioning of HW treatment/processing facilities	GNR 386 of GG No 28753 of 21 April 2006.	Application for basic assessment or full EIA environmental authorisation	EIA guidelines	DEAT/provincial environmental department
Transporter	Collection of HW	Relevant by-laws of LA and s.23 and 24 of Waste Bill (B39-2007	Requirements of by-laws and authority to collect waste	None	DEAT
	Transportation of HW	Relevant by-laws of LA	Requirements for registration and disposal at authorised facilities only	None	DEAT
Public	Indiscriminate dumping (littering)	Section 19 of ECA	Prohibition of littering	None	Local authorities (LAs)

Appendix D: Navigation Diagram

Extensive research, analysis and modelling have culminated in this programme overview, conclusions, recommendations, minimum requirements and implementation guidelines as presented in this documentation.

All this information is not reproduced, but is available on request or from the relevant website (XXXX). For ease of reference and to facilitate requests for information, the navigational diagram below is provided. Supplementary documentation are categorised as either supporting documentation, i.e. reports and analyses generated as a result of project efforts or alternatively as reference documentation, i.e. summarised research that formed part of the initial desktop study or was compiled by the steering committee work groups.