THE SIGMA GUIDELINES- TOOLKIT

SIGMA ENVIRONMENTAL ACCOUNTING GUIDE

The SIGMA Project

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Contents

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Introduction

This guide is aimed at people with responsibility for environmental issues and reporting and will also be of value to finance functions. It is divided into two parts:

- 1: What is environmental accounting? provides a brief introduction to the dynamic subject of organisational environmental accounting. It focuses on helping organisations understand two key areas of environmental accounting:
    - accounting for 'internal' environmental related expenditure (expenditure already incurred and captured within a company's accounting system but perhaps lost in general overheads)
    - 'external cost accounting' (the internalisation of environmental externalities).
- 2: How to estimate an organisation's environmentally sustainable profits provides an external environmental cost accounting tool-kit. This contains a pro-forma set of external environmental cost accounts together with a practical step by step guide, developed by Forum for the Future, to help organisations to begin the task of developing and drawing up their own external environmental cost accounts.

The methodology given in part 2 is one way of generating environmental accounts in the wider field of environmental accounting. This methodology is in use and available in the external reports of several UK companies, such as Wessex Water, Anglian Water, Interface, Bulmers, Carillon and others.

This guide is supplemented by the SIGMA Sustainability Accounting Guide which is aimed at financial professionals and users with good sustainability knowledge and summarises the current state of research and availability of tools and approaches that help organisations account for organisational sustainability performance. Recognising that this is at an embryonic stage, and that there are many inadequacies in current financial accounting, it explores the latest sustainability thinking about resource flows and assets and liabilities in the context of Generally Accepted Accounting Practice (GAAP). Users can understand the drivers for change and benefits of sustainability accounting and see real-life examples of organisations adopting these approaches. It presents different ways of bringing the information together to help organisations understand options for new accounting frameworks. For users that are already implementing changes in their accounting practice, data sources for environmental coefficients and values are provided.

1. What is environmental accounting?

1.1 Why there is a need to produce environmental accounts

Environmental accounting involves the generation, analysis and use of monetarised environmental information in order to improve organisational environmental and economic performance.

A more complete and technical name could be 'Environmental Financial Accounting', indicating that, for this method, an organisation's environmental accountability is seen through the lens of monetised data. Environmental accounting is but one part of sustainability reporting, the growing expectation that organisations will demonstrate their accountability to wider society through reporting and stakeholder engagement.

It is a new area, with no hard and fast rules or standards and only a few leading organisations actively engaged in environmental accounting. Increasingly professional accounting bodies, financial analysts and other stakeholders are demanding the disclosure and reporting of environmentally related financial data to enable them to distinguish between good and bad performers.

Some drivers for these changes include: the Company Law Review; amendment to the 1995 Pensions Act; the Turnbull Report on internal controls; and the Association of British Insurers (ABI) Guidelines on Socially Responsible Investing (SRI). The UK Government is also applying further pressure on organisations to improve and report on their environmental, ethical and social policy through a policy of 'naming and shaming' organisations that are currently not reporting. It is also mandatory to report on environmental information in several European countries.

1.2 Organisational benefits of producing environmental accounts

An organisation seriously committed to the idea of decreasing its environmental footprint needs to consider costs and benefits which are *internal* and *external*,

The *internal* environmental costs and benefits are those that the organisation records in its own accounts. To improve environmental performance, the organisation needs to manage and control costs relating to waste management, energy consumption, and resource use. It also needs to understand the benefits, such as cost savings; environmental grants; taxes avoided or revenues generated.

The *external* environmental costs and benefits are the impacts which the organisation's activity has on wider society and environment, now and in the future. Their activities and operations give rise to external environmental impacts such as the contamination of ground water, traffic congestion, poor urban air quality and so on. The rest of society picks up the costs of these external impacts, prices do not reflect costs and as such organisations (and individuals) do not pay the full costs of their production and consumption decisions. External costs are currently free to the organisation as the rest of society pays for them. This represents 'value extracted' by the organisation.

Instead sub-optimal and inefficient decisions are made as producers and consumers respond to imperfect price signals. Increasingly however, external costs are becoming internalised through regulation and taxes.

Internal and external environmental accounting enables organisations to:

- Inform decision-makers for strategic and tactical planning
- Increase awareness of potential environmental benefits and opportunities
- Reduce the company's exposure to future environmental risks and liabilities.

1.3 The presentation of internal environmental accounts

One way of presenting how environmental investments and initiatives can add value within the organisation is through the preparation and reporting of a company wide Environmental Financial Statement (EFS). The EFS is a financial statement, covering a defined accounting period, that attempts to collate and report total environmental expenditure and any associated financial savings in a single statement. It represents an account of the *internal* environmental costs and benefits for the organisation.

Taking the traditional P&L as its starting point, the EFS restates all environmentally related expenditure, irrespective of which department or cost centre incurred them, and matches those costs with its associated financial benefits or savings.

For example, Carillion, the construction company, has produced a pilot EFS for one of the company's private finance initiative (PFI) projects - the Dartford and Gravesham hospital in Kent. It is published in its 2000 Environmental and Community Report (pages 26 and 27).

1.4 The presentation of external environmental accounts[1]

It is also necessary to account for the *external* environmental costs and benefits of the organisation. This is done through an organisation's Environmentally Sustainable Profits. This could be defined as:

the profit (or loss) that would be left at the end of an accounting period after provision has been made, or expenditure incurred, to restore or avoid the most significant external environmental impacts made by an organisation during this period.

External impacts are first identified, valued and then internalised within the mainstream financial and management accounting and reporting systems. Forum for the Future has worked with partner such as Interface, Wessex Water, AWG and Bulmers towards establishing what could be considered as the environmentally sustainable profits for each of these organisations.

The key innovation of the EFS is the linking of monetarised organisational environmental data (the estimated environmental sustainability cost) to the company's financial accounts in order to arrive at the estimate of environmentally sustainable profits.

At the level of an individual organisation this means that profits as reported may not be environmentally sustainable. The degree to which the organisation is genuinely 'adding value' through its activities remains uncertain and if the organisation (a company for instance) was to pay a dividend, the payment could end up being made out of natural capital rather than income - a situation which is clearly unsustainable over the long term. The assumption that the organisation is a 'going concern' may also no longer be valid.

For an organisation committed to moving towards environmental sustainability, the challenge is to try to determine what its environmentally sustainable profits are and hence to gauge to what extent it is really adding value (contributing to natural capital) and making the transition to becoming a more environmentally sustainable enterprise. The development of more complete, transparent and integrated accounts and accounting systems, that specifically take into account the most significant external environmental impacts resulting from an

[11] Forum for the Future has developed one type of external cost accounting methodology, as described in this document and are grateful for the funding provided by the Chartered Institute of Management Accountants (CIMA) that contributed to this.

organisation's operations, is a prerequisite of that transition. It provides a powerful indicator of a company's progress towards (or away from) environmental sustainability.

Part 2 provides a guide to help organisations develop their own external cost accounts. An example of the environmental accounting process is presented, based on the process used to generate external cost accounts used by the companies that have trialed this approach. This shows how an organisation can start to develop their own environmental accounts. Appendix A provides detailed pro-forma data sheets or Green Sheets (a term coined by one of the companies engaged in the development of the methodology). They are designed to capture information required to quantify environmental impacts via conversion factors. For example, emissions of carbon dioxide are calculated from gas consumption data. Financial data can also be captured for completeness.

2 How to estimate an organisation's environmentally sustainable profits

The key stages in developing a set of external cost accounts under this methodology are as follows:

1. Identification and confirmation of the organisation's most significant environmental impacts.

2. Estimation of what a sustainable level of impacts may be to determine relevant sustainability targets or the 'sustainability gap'.

3. Valuation of those impacts – on the basis of what it would cost to avoid them in the first place, or if avoidance were not possible, what it would cost to restore any resulting damage (using market-based prices where possible).

4. Development of a set of environmental accounts incorporating these values and subsequent estimation of the organisation's external costs and environmentally sustainable profits.

Although seemingly straightforward, the challenge is in the detail. For example:

- Which impacts do you include, which do you exclude and where do you draw the system boundaries (i.e. to what degree are life-cycle impacts accounted for)?

- Once impacts have been identified, how do you translate them into emissions?

- Do generic conversion factors exist and where can they be found?

- Once the impacts to be included have been found, how do you determine an appropriate valuation to use in the accounts?

- What are the options?

This brief guide cannot provide comprehensive answers to all of these questions. However, by considering each heading of the pro-forma accounts in turn the issues identified above are addressed as much as possible. The information below should enable organisations, with further reference, to draw up draft environmental accounts.

2.1 Impacts to include

Impacts will vary between organisations and hence the headings in the environmental accounts will vary. The list included in the pro-forma accounts is illustrative but by no means comprehensive. Some entries are, however, likely to be common to all organisations - no matter what the precise nature of their activities or scale of their operations. These include:

- emissions associated with the use of energy in offices and buildings - from electricity use and perhaps also gas

- emissions associated with the use of energy in transportation, perhaps from company cars, distribution or simply from employees commuting to and from their regular place of employment.

Other business related travel might also be significant - for example air miles and rail miles. The headings in the example accounts are mainly concerned with emissions to air. The methodology can, and should account for relevant impacts to other media. For example, the impacts associated with abstraction from low flow rivers were found to be material for the two water companies involved in the development and use of this methodology - Wessex Water and Anglian Water.

When the organisation operates an environmental management system (EMS), the key aspects register and related documentation should list the relevant impacts to include. Stakeholder engagement, for example, using the SIGMA stakeholder engagement tool or as part of the AA1000 process, may also provide useful information. If an EMS is not in place, discussions with relevant employees, using the SIGMA Sustainability Issues and Explanations Guide and common sense should provide sufficient information to get started. Where relevant and appropriate for the organisation concerned, reference should also be made to the Global Reporting Initiative (GRI) Guidelines to ensure that the environmental account headings are consistent with the relevant GRI indicators used. Precise cost line entries will vary depending upon the nature of the organisation's activities and operations. Broad headings cover impacts to air, land and water.

2.2 Valuation of Environmental Impacts

The environmental impacts disclosed in the accounts should be valued, where possible, on their avoidance or restoration costs. That is, what the organisation would need to spend either to avoid the impacts in the first place or to restore the environmental damage caused by its activities and operations if they are unavoidable. Base costs as far as possible on 'real' or market based prices. The use of avoidance or restoration costs is in line with United Nations

recommendations for environmental adjustments to the national accounts. It is recognised that it may not always be possible to generate relevant avoidance or restoration costs for each impact identified.

The Green Sheets in Appendix A provide further details of potential impact sources for each heading under review.

2.3 Example of the environmental accounting process

Data sources and conversion factors

The conversion factors used (2001 figures) and the data sources suggested (in brackets) are provided as examples.

Please refer to the SIGMA Sustainability Accounting Guide for sources of the latest conversion factors.

Organisations should use the most up to date conversion factors available.

Impacts to Air

Direct Energy Use

- **Electricity Consumption**

Key impacts - associated with emissions of carbon dioxide from the use of fossil fuels consumed in the generation of the electricity, also acidification from emissions of sulphur dioxide and impacts resulting from the formation of photochemical smog from emissions of nitrogen oxides

Data source - utility bills, meter readings

Conversion factors -
CO_2 Department of Transport, Transport and the Regions (DETR) Guidelines for company reporting on green house emissions 0.442 g/kWh
NOx 0.0012g/kWh (UK Digest of energy statistics)
SOx 0.0025g/kWh (UK Digest of energy statistics)

Valuation - Emissions associated with the consumption of grid electricity can largely be avoided by purchasing electricity generated from renewable energy

sources - such as wind power.[2] An illustrative valuation to use would be any premium payable on purchasing 'green electricity'. Some companies - those with relatively low total demand - have achieved the switch at no extra premium. Consequently, to determine a company's relevant avoidance cost for energy related emissions, it is recommended that contact be made with the company's current electricity supplier and one or two of the providers of renewable electricity such as Unit[e] and Ecotricity. Any premiums payable to secure 'green' electricity will in part be determined by the individual company's demand and load profile.

Other valuations could include the costs associated with on-site power generation from renewable energy sources.

Many of the companies using this methodology have used a 'default' avoidance cost of 3p/kWh for valuing their electricity-related emissions (generally applying this premium to the target of their renewable electricity consumption – in these cases 60%). This is based on what the electricity suppliers will have to pay the Government for any shortfall they have in meeting their obligation to ensure that 10% of total electricity supplies are generated from renewable energy sources by 2010 (a UK Government policy target). To ensure this target is met the Renewables Obligation places a statutory obligation on electricity suppliers to hold Renewable Obligation Certificates (ROCs). These represent the appropriate level of purchased renewable energy under the Obligation (building to 10% by 2010). ROCs are already trading for about £30/MW (i.e. 3p/kWh) which suggests this price is a reasonable avoidance cost to use. Use can also be made of the illustrative 'generic' valuations shown below. Organisations should aim to use the most appropriate valuation options available to them.

Carbon dioxide: £5.45/tonne of carbon dioxide restoration cost based on market price charged by Climate Care in the UK. Climate Care invests in renewable energy technologies, energy efficiency and carbon sequestration through the planting of new woodlands.

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[2] Most electricity generated from renewable energy sources results in no net additional carbon loading of the atmosphere. In fact, by displacing supplies generated from fossil fuels, renewable sources actually help to reduce overall carbon emissions. Emissions of SO_2 and NOx from electricity generated from renewable sources will vary depending upon the renewable energy source being used to generate the electricity. If the supply has been generated from wind, hydro or photovoltaics, (i.e. so called 'new renewables') there are no gaseous emissions (ignoring life-cycle impacts). In contrast the combustion of biomass, sewage gas or landfill gas will result in emissions of NOx and some SO_2 (because of impurities in the gas). For simplicity, the figures reflected in the environmental accounts shown in this guide have assumed that conventionally generated supplies have been switched for supplies generated entirely from wind power. Consequently, it has been assumed that all gaseous emissions associated with electricity production have been avoided.

Nitrogen oxides: £14,000/t based on the top end of recent NOx trading prices in the USA and rates used in other similar studies

Sulphur dioxide: £2,400 (based on EU and Scandinavian environmental tax rates)

- **Gas consumption**

Key impacts - associated with emissions of carbon dioxide from gas consumption. Emissions of other gases are unlikely to be significant/material.

Data source - utility bills, meter readings

Conversion factors – UK (DEFRA) guidelines for company reporting on green house emissions gave 0.19kg/CO_2 per kWh

Valuation: Worked example: for an annual consumption of 9 million kWh's, the relevant figure (restoration cost in this case) to include in the accounts would be £9,000 (to the nearest thousand) – i.e. 9 million x 0.19 x £5.45.

Carbon dioxide: £5.45/t (Climate Care avoidance / restoration market price)

Other potential sources of direct energy related emissions could include consumption of propane and fuel oil. This list is by no means exhaustive.

Direct Production Related Emissions

This heading is likely to apply to manufacturing companies. Impacts will obviously vary considerably depending upon the nature of the organisation. For example, Interface Europe, one of the companies using this methodology, have a number of direct gaseous emissions - including emissions of volatile organic compounds (VOCs) and sulphur dioxide (SO_2) - associated with their production processes.

To comply with current legislation, emission levels are periodically measured. Consequently, the company already had quantified emission data. The valuation of these emissions was determined by obtaining quotations from environmental technology companies for the retro-fitting of pollution abatement technology to reduce them by 60% -100%. This capital cost provided a real, market-based price for the avoidance of the majority of the emissions. Depending upon the significance of any capital costs of this nature, it may be necessary to capitalise the investment and to charge depreciation to the external cost accounts according to the organisation's depreciation policy.

Transportation

- **Company Cars**

Key impacts - gaseous emissions including volatile organic compounds (VOCs), hydrocarbons, particular matter and carbon dioxide. Health impacts related to emissions including asthma, respiratory disease, premature deaths and cancer for example. Other impacts include poor urban air quality, congestion and loss of habitat.

Data Source - fleet managers, purchasing, fixed asset registers etc. to get full listing of all vehicles – numbers, make and engine size, fuel type, etc.

Conversion Factors - these can vary enormously depending upon the age, make, fuel type and size of the vehicle. New vehicles have considerably lower emission coefficients. An excellent information source on emissions by make and model is the UK Government's, Vehicle Certification Agency publication, New Car Fuel Consumption and Emission Figures web site: www.vca.gov.uk. Emission data is also available from the EU, OECD, AEA Technology and others.

Emission levels for a new (meeting Euro II) popular company car

Ford Focus 1.6	**g/km**	**Illustrative Valuation**
CO_2	153	£5.45/tonne (Climate Care sequestration (restoration) cost)
HC & NOx	0.097	Avoidance cost - LPG conversion (see below)

It may be easier and more practical to estimate total emissions by class of vehicle – i.e. all petrol vehicles of a certain size range, all diesel vehicles of a certain size etc. If accurate fuel consumption data is available, more accurate estimates for carbon dioxide emissions can be obtained by following the UK DEFRA greenhouse gas reporting guidelines.

An excellent source of information on emissions from mobile and point source is the DEFRA's UK Emission Factors Database web site: www.rsk.co.uk/ukefd/

Valuation
(a) Company Car related emissions

Apart from driving less (e.g. by avoiding unnecessary journeys and making greater use of public transport) and to a limited degree, driving the same distances but at lower speeds, there are not many options to reduce total

emissions of gaseous pollutants from modern (less than 3 years old) petrol or diesel-fuelled vehicles. Emissions from these vehicles have been reduced by an order of magnitude (per vehicle mile) compared to a decade ago.

Ultimately, hydrogen fuel cells, which have the potential to emit only warm water vapour, offer the prospect of significantly reducing harmful vehicle emissions. However, the widespread commercial availability of such vehicles is still some time off, despite the development of a number of prototypes. In the meantime, however, there are a number of 'technical fix' interim or partial solutions that can be used to help to reduce overall transport-related emissions. One involves the use of alternative fuels such as Liquid Petroleum Gas (LPG) and Compressed Natural Gas (CNG). Whilst emissions of carbon dioxide remain similar to those of conventional petrol and diesel vehicles, emissions of PM, VOCs, and NOx are substantially reduced. Compared to petrol engines, for example, oxides of nitrogen are reduced by some 50% and hydrocarbons by between 40-95% with LPG vehicles.

Consequently, a significant proportion of transport related emissions (excluding carbon dioxide) could be avoided by either purchasing or leasing LPG vehicles or perhaps by switching to compressed natural gas. Grants may also be available through the Powershift Programme, administered in the UK by the Energy Savings Trust (EST), to convert existing vehicles to run off LPG or to contribute to the purchase of factory-produced LPG vehicles. Given the difference in fuel costs – in the UK LPG is typically available for as little as 25p/litre for bunker fuel or around 40p/litre at the forecourt compared to 80p/litre for diesel - the business case for making the switch is already very strong, irrespective of any environmental arguments.[3]

A typical conversion cost is £1500 per vehicle - this could be an appropriate valuation to use for petrol vehicles and represents an avoidance cost for the majority of harmful, non carbon dioxide emissions associated with petrol vehicles. The cost should be shown gross of any grants that may be available, although the grants will clearly be an important consideration in the decision making process.

Other technological options may be available to reduce emissions and the costs of these would be an appropriate valuation to use in the accounts. For example, oxidation catalysts can be retro-fitted to older and larger diesel vehicles. Alternatively, the cost of trading in existing vehicles and purchasing new hybrid vehicles such as the Toyota Prius could be used as the basis of valuation. Consideration could also be given to the accelerated depreciation and write off of older vehicles and their replacement with more fuel efficient and cleaner vehicles.

[3] Based on summer 2002 fuel prices

Any premiums payable on the early termination of current leases or additional costs associated with the earlier purchase of new vehicles would then provide an appropriate valuation/cost to include in the accounts for the emissions avoided by adopting such a policy. If alternative fuel/dual fuel vehicles are purchased, there may actually be a net saving from such a policy.

(b) Haulage/Distribution

Similarly, significant emission reductions of hydrocarbons and particulate matter from large diesel vehicles can be achieved through the retrofitting of existing vehicles with Continuously Regenerating Traps (CRTs). These catalysts, produced by Johnson Matthey in the UK, are capable of reducing emissions of hydrocarbons and particulate matter from exhaust fumes by 90%[4]. Retrofits cost in the region of about £3,000 per vehicle.

Other options could include the premium to purchase new, more fuel-efficient and lower impact vehicles over any trade-in value resulting from the accelerated depreciation of existing vehicles.

If avoidance options are not available or appropriate, carbon dioxide emissions should be valued on the basis of their restoration costs - as noted, the illustrative figure of £5.45/t given by Climate Care can be used. Nitrogen oxides emissions (often reported/aggregated with hydrocarbon emissions) can be valued at the illustrative £14,000/t. This figure is very high and where gaseous emissions are aggregated, is likely to overstate the sustainability cost, hence, wherever possible, appropriate avoidance or restoration costs should be used.

(c) Third-Party Carriers

Given that many organisations contract their deliveries and freight movements to third-party carriers it is important to ensure that accurate estimates of contractor mileage, fuel consumption and vehicle type and vehicle numbers are obtained to ensure that the impacts associated with this activity are captured in the accounts. For many of the companies engaged in external cost accounting this source of transport related emissions have accounted for 50% or more of gaseous emissions to air. Obtaining detailed information on third party carriers/contractor mileage can also provide a useful starting point for supply chain management - setting targets to reduce contractor mileage and impacts and developing new ways to share the benefits down the supply chain of any cost savings achieved.

[4] NOx emissions are only reduced by a maximum of 12%. The CRT is primarily designed to remove soot and at this time, there are no readily available technical fixes that can be retrofitted to reduce these NOx emissions.

Aviation
Aviation is responsible for a myriad of external environmental impacts including significant (and increasing) emissions of gaseous pollutants (from aircraft and ground operations), congestion, loss of biodiversity through the building of airport infrastructure, contamination of land and ground water and so on. To date, the companies using this methodology, have only accounted for the emissions of carbon dioxide and nitrogen oxides associated with aircraft fuel burn – i.e. the direct, marginal environmental costs/impacts resulting from their employees use of air travel. This clearly understates the true or full external costs associated with air travel and it is hoped that further development and refinement of the methodology will enable some of these wider impacts, where appropriate (depending upon the choice of system boundaries adopted), to be included.

Total emissions of these gases can be determined from total air miles by applying the following conversion factors:

LTO emissions (landing and take off)
Carbon dioxide 35,000 g/passenger

Cruising emissions
Carbon dioxide 184 g/passenger km
Nitrogen oxides 0.432 g/passenger km

Air mile data should be available from the organisation's travel agent. All organisations involved in the development of this methodology have required, or are in the process of requiring, their travel agents to provide this information. Alternatively, with a schedule of points of departure and arrival and number of flights flown on that route, an approximation of total air miles can be found via various internet sites.

Impacts to Land
Contaminated Land

The presence of contaminated land is likely to be an issue for many organisations, especially where industrial activity has taken place on the site over several decades. Site investigations should be able to provide a suitable valuation for inclusion in the accounts – i.e. in effect, a restoration cost for the environmental damage caused. Whilst it may seem unfair to provide for the full costs of restoration in one year, since any damage that may have occurred could have taken place over several decades it is probably prudent to do so.

Disposal of Waste to Landfill

Waste is a major sustainability challenge. It is estimated that the UK generates between 170 million and 210 million tonnes of waste each year. Nearly 60% of this waste is disposed of to a diminishing number of UK landfill sites. By sector, around 55% of commercial and industrial waste and 82% of municipal waste is landfilled. The linear nature of our production and consumption systems, creating products that quickly end up as waste, is clearly unsustainable.

The main environmental impacts attributable to waste disposal to landfill are as follows:

- Emissions of greenhouse gases (methane and carbon dioxide from the landfill sites themselves)
- Leaching of contaminated and in some instances toxic chemicals into water bodies (with associated impacts on the chemical and biological oxygen demand for the receiving watercourses)
- Contamination of the landfill site itself
- Impacts on habitat and biodiversity from the construction and operation of landfill sites
- Congestion and emissions of air pollutants from the transportation of waste

EU waste legislation, for example the Waste Framework Directive and the Landfill Directive in particular - require Member States to manage waste better based on the waste hierarchy. This means decreasing the volumes of waste disposed of to landfill and incineration, which are at the bottom of the hierarchy, and increasing the volume of materials reused and recovered. Applying this logic, UK organisations have to reconsider the way they manage their waste, how much they pay for its disposal and the availability of alternative disposal (and avoidance) routes open to them.[5] Ideally, waste generation should be avoided in the first place - through good design of new products and processes and from careful materials selection.

UK organisations are already paying for some of the external costs of waste disposal through the Landfill tax - either directly or indirectly via the charges they pay to their waste disposal contractors. The tax rates are based on estimations of

[5] As noted in the DEFRA Environmental Reporting *Guidelines for Company Reporting on Waste,* most companies should already be aware of the wastes they produce and where they go. The Environment Protection Act 1990 places a *Duty of Care* on anyone who produces commercial or industrial waste. This means that all companies must secure their waste and can only transfer it to an authorised person with a transfer note. This implies waste records and recording should be good, or of a standard, even if this data is not being publicly reported. With the Packaging Regulations, Landfill Directive and likelihood of further legislation around the areas of Producer Responsibility and Integrated Product Policy companies are going to have to develop comprehensive strategies and policies for managing and reducing all of their waste flows. They will have no choice, and the DEFRA Guidelines have been produced to help them achieve this.

the external costs of waste disposal commissioned by the then Department of the Environment (DoE) (CSERGE *et al* 1993). The initial rates payable when the tax was introduced were £10 per tonne for active waste and £2 per tonne for inert waste. It could therefore be argued, that waste disposal to landfill should be excluded from the external cost accounts as organisations have already internalised these costs. However, the tax does not currently capture all of the external costs attributable to waste disposal.

Consequently, organisations should provide an additional amount per tonne of waste disposed of to landfill to cover these additional and 'unaccounted for' external costs. Whilst there is uncertainty over what the true or full external costs of waste disposal are, an £18 per tonne premium is being used by several companies engaged in the use of this methodology. This premium is based on the differential between the current UK tax rates and the most progressive landfill tax rate in continental Europe - the Austrian landfill. The Austrian tax, currently charged at approximately £28/tonne, is designed to offer incentives to reduce the level of waste disposed of in landfills *and* to generate additional revenues to support the cleaning up of contaminated sites as well as encouraging the transition towards sites with 'state of the art' technology. This is a more realistic restoration cost for waste disposal at this time.

Impacts to Water
Other Impacts

Sheets on water and waste water use have been included in Appendix A because it is the quantification and subsequent analysis of the actual costs incurred by organisations in these areas that can lead to profitable opportunities to reduce impacts and enhance profits. This data can actually be surprisingly difficult to obtain. Waste costs and other environmentally related expenditure cost items are often lost in general overheads leading to sub-optimal pricing decisions in the organisation as managers respond to imperfect information. Environmental accounting that focuses on what is actually going on inside an organisation is very much concerned with breaking out these costs and allocating them to the cost centres/activities that give rise to the costs in the first place.

Pro-forma Consolidated Environmental Accounts for A Company PLC
for the period to 30 April 2003

			UK Pounds £'000S	
			to deliver the relevant sustainability targets	
Emissions/Impacts *(selected account headings)*	Emissions (Tonnes)	Reduction Target (tonnes) Sustainability Gap	Unit Avoidance or Restoration Cost	Total Avoidance or Restoration Cost
		= A	= B	C = A x B
IMPACTS TO AIR				
Direct Energy				
Natural Gas Consumption kWhs				
CO_2	X	A	B	
NOx, SO_2	X	A	B	
Total				C
Electricity Consumption kWh				
CO_2	X	A	B	
NOx, SO_2	X	A	B	
Total (avoidance)				C
Production Related Emissions	X	A	B	
	X	A	B	C
Transport				
Company Cars kms				
CO_2	X	A	B	
NOx, HCs & Particulates	X	A	B	
Total Company Cars				C
Freight/Distribution & Contractors kms				
CO_2	X	A	B	
NOx, HCs & Particulates	X	A	B	
Total Distribution				C
Air Miles/Aviation				
CO_2	X	A	B	
NOx	X	A	B	
IMPACTS TO LAND				
Contaminated Land (restoration)		X		X
IMPACTS TO WATER				
Abstraction at vulnerable sites		X		**X**
Total Sustainability Cost				**X**
Profit after Tax per the Financial Accounts				**X**
Environmentally Sustainable/Adjusted Profit				**X**

2.4 Environmental sustainability cost estimate

The sustainability cost estimate for an organisation's activities, as shown in the pro-forma accounts, is simply the summation of all of the various quantified and valued environmental impacts. It represents the calculated cost, at market prices, to the organisation to reduce their environmental impacts to a socially acceptable and sustainable level[6].

To facilitate the ability to compare sustainability cost estimations (and or environmentally sustainable profit figures) between years and between different companies, institutional incentives (in the form of grants and rebates) together with potential savings available if avoidance options are adopted, should be excluded from the accounts. Although of immense importance in terms of decision-making, such incentives may change overnight and hence comparative figures from previous years could become meaningless in later periods.

Consequently, the estimation simply represents the cost of achieving a given improvement in environmental quality based on current (and available) technology. In this form, the environmental sustainability cost estimate (to achieve consistent standards or improvements in environmental quality) will only change for two reasons: changes in absolute emissions/impacts (which will hopefully be decreasing) or from changes in abatement technology (and the price of that technology).

2.5 Environmentally sustainable profit

When deducted from the organisation's financial profits, as reported in the main annual report and accounts, an estimate of what could be considered as the

[6]In determining what level of impacts could be considered as 'socially acceptable' and 'sustainable,' the studies undertaken to date have made reference to current health based guidelines and standards for the various pollutants covered in their own accounts. To meet World Health Organisation (WHO) air quality standards, for example, road transport emissions of NOx need to be reduced by about 55%. In the case of greenhouse gas emissions a sustainability standard of zero has been adopted. Whilst the Intergovernmental Panel on Climate Change (IPCC) suggest that anthropogenic emissions of greenhouse gases need to be reduced by about 60% (compared to their 1990 levels) industrial countries will have to reduce their emissions by a considerably higher percentage. This will be necessary in order to allow developing nations to increase their own emissions in their quest for development. Consequently, in the interests of equity, a sustainability standard of zero for greenhouse gas emissions has been adopted by all of the company's involved in the development of this methodology. In reality, the level of emissions that is sustainable is not known, hence a pragmatic approach is required based on current knowledge and understanding.

organisation's environmentally sustainable profits is obtained. It is this linking of the monetarised environmental performance data to the mainstream financial accounting (and or management accounting) system that is the key innovation in the methodology. Senior managers and directors are familiar with traditional accounting and reporting systems and by integrating monetarised impact data in this way, the methodology provides easily understood information on the external costs and negative impacts of the organisation's operations. More importantly, it provides an indication of what it would cost the organisation to get its operations onto a more sustainable trajectory and a base line upon which to measure progress year on year.

Appendix A – Pro-forma 'Green Sheets'

GREEN SHEETS

Environmentally related data required to produce corporate environmental external cost accounts

Please note these sheets also capture environmentally related financial data that may already be captured (but perhaps lost) within the company's financial accounting system/the nominal ledger.

Table 1: Direct Energy Use

Type of Energy	KWh *Or other units please specify*	Total Financial Cost	General Ledger Account Number	Cost per Kwh/Litre etc
Gas/Natural Gas				
Electricity: *From Renewable Sources (please specify type)** *Non Renewable/Fossil Fuel Sources* *CHP – please provide details*				
Fuel Oil/Gas Oil/Diesel				
Propane				
Other (please specify)				

Notes:

- Please specify data sources and also details of any assumptions made or estimated figures disclosed
- Total financial cost should be the total energy/utility bill – i.e. including all standing charges & rentals
- Electricity obtained under a green tariff/guaranteed renewable source should be disclosed separately in the above table, if known, please detail source of renewable energy, e.g. wind, landfill gas, biomass, etc.

Potential Sources of Information:

- utility bills, supplier bills, etc.

TRANSPORTATION

Table 2: Company Cars

Fuel Type	No. of Vehicles	Total Kms	Total Fuel Consumption (litres)	Total Fuel Cost (*please specify currency*)	General Ledger Account Number	Average Fuel Efficiency (Kms/litres)
Petrol						
Diesel						
Low Sulphur/City Diesel						
Other (please specify)						
Totals						

NOTES:

- Please specify data sources and also details of any assumptions made or estimated figures disclosed in the above table
- Please provide as much details as possible – ideally a listing of all cars detailing the registration, vehicle type, driver (not necessary), kms, fuel used and total fuel cost
- Other fuel types could include electric vehicles (EVs) or liquid petroleum gas (LPG) or compressed natural gas (CNG)

POTENTIAL SOURCES OF INFORMATION:

- Fuel cards, leasing company records, etc.

Table 2a: Distribution Fleet

Fuel Type	No. of Vehicles	Total Kms	Total Fuel Consumption (litres)	Total Fuel Cost (*please specify currency*)	General Ledger Account Number	Average Fuel Efficiency (Kms/litres)
Petrol						
Diesel						
Low Sulphur/City Diesel						
Other (please specify)						
Totals						

Note:

- Please state number of vehicles by class of vehicle by type – i.e. articulated truck, rigid truck, panel van and so on. Please also state mileage per year per vehicle and what EU class it is - Euro I, Euro II, Euro III.

Table 3: Air Travel (Summary Table)

Total Kms flown	Total Cost of Air Travel	General Ledger Account Number
Totals		

Total company air miles need to be determined for the year/accounting period under review. This data should be available directly from your travel agent/s. Ideal they should be able to provide a detailed list of destinations flown to, number of times that destination was flown to and the total mileage flown – ie destinations times number of occasions that route was flown. This data will be needed every year so ideally you should ask your travel agent to begin to collate it routinely. If this is not possible this year please provide what you can – e.g. number of short haul and number of long haul flights, total cost of air travel, etc.

Sources of data:

- Travel agents records
- Travel agents invoices

Note: If you have/can get hold of the detail, please complete, in addition to the above table, the table below – you'll need to complete most of this to fill in Table 3.

Table 4: Air Travel (Detail)

Destination – Departure and Arrival Points	Flight Cost (total per journey)	Total Mileage/KMs (please specify miles/kms)	General Ledger Account Number
E.g. London Heathrow to Brussels, Cape Town or wherever			
Totals (where applicable)			

OTHER TRANSPORT RELATED INFORMATION NEEDS

THIRD PARTY DISTRIBUTIONS

For completeness and to get a 'true and fair' view of a company's total transport related impact it is necessary to estimate total road miles incurred by third party carriers. One possible way of doing this would be to go back to the relevant carriers and see if they can provide the total mileage covered by their fleet over the relevant period and an approximation for the proportion of that mileage attributable to your company.

It will also be necessary to find out the fuel type, make and model and age of a typical third party vehicle or types of vehicles. Emissions can then be estimated on the basis of standard emission coefficients for each class. For example, Euro I panel derived van, Euro II artics and so on.

Table 5: Personnel Commuting Travel

Mode of Transport	Number of People	Average Return Journey/Daily Commute kms	Average Return Journey Travel Time (hours)	Average Weekly Distance (kms)	Average Annual Distance (kms) (47/48? week year)
Car					
Motor Bike					
Bus					
Bicycle					
Walk					
Other					
Totals					

This data needs to be collected to get a more accurate and complete estimate of a company's environmental/ecological footprint. Given the fact that a full survey may not be feasible/practical, data may have to be estimated based on an appropriate and representative sample.

Notes:

- Account needs to be made of people car sharing – ie to avoid double counting
- Provision also needs to be made for people who travel to work by more than one mode of transport, e.g. drive to local station and then walk/get a bus for the final stage of their journey
- Account also needs to be taken for part-time workers

Table 6: Waste & Waste Management

Type of Waste	Quantity Generated per year (tonnes)	Quantity Recycled per year (tonnes)	Sales Revenue Generated	General Ledger Account Number	Estimated Costs of Disposal	General Ledger Account Number
Paper						
Cardboard						
Plastic						
Aluminium						
Other materials –please specify						
Totals (where applicable)						

Note: Please quantify/estimate the total quantities of waste being generated annually and provide a rough estimate of the breakdown of this waste – paper/card/plastic/aluminium etc. Please also note any sales of waste for recycling or quantities of waste by category collected/given away for recycling.

WATER USE AND WASTE TO WATER

Table 7: Drinking/Process Water

Source of Water	Quantity of Water Used (Cubic Metres)	Cost per Cubic Metre	General Ledger Account Number
Mains Supply			
Bore hole			
Other			
Totals			

Table 8: Waste Water

Quantity of Waste Water Discharged to Sewer/Water Course	Cost per Cubic Metre of Waste Water	Total Disposal Costs	General Ledger Account Number
Totals			

About the SIGMA Project

The SIGMA Project - ***S**ustainability **I**ntegrated **G**uidelines for **M**anagement* was launched in 1999 with the support of the UK Department of Trade and Industry (DTI) and is led by:

- British Standards Institution - the leading standards organisation
- Forum for the Future - a leading sustainability charity and think-tank
- AccountAbility - the international professional body for accountability.

The SIGMA project has developed the SIGMA Guidelines and a series of tools to provide clear, practical advice to organisations to enable them to make a meaningful contribution to sustainable development.

The SIGMA Guidelines consist of:

- a set of **Guiding Principles** that help organisations to understand sustainability and their contribution to it.
- a **Management Framework** that integrates sustainability issues into core processes and mainstream decision-making. It is structured into phases and sub-phases.

The SIGMA **Toolkit,** consists of targeted tools and approaches to help with specific management challenges, and case studies explaining how organisations have used the SIGMA Guidelines and Toolkit to tackle real issues.

More information including the full SIGMA Guidelines and the accompanying SIGMA Toolkit are available at: www.projectsigma.com.