United Kingdom Environmental Technologies Export Market Plan

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Abbreviations and Acronyms

AMP	Asset Management Plan
APC	Air Pollution Control
BAT	best available technology/techniques
BATNEEC	best available techniques not entailing excessive costs
BPEO	best practicable environmental option
BPM	best practicable means
CFC	chlorofluorocarbon
CSR	corporate social responsibility
DEFRA	Department of Environment, Food and Rural Affairs
DTI	Department of Trade and Industry
EA	Environment Agency
EEBPP	Energy Efficiency Best Practice Programme
EHS	Environment and Heritage Service
EIA	environmental impact assessment
ELV	end-of-life vehicle
EMAS	Eco-Management and Audit Scheme
ENDS	Environmental Data Services Ltd.
ETBPP	Environmental Technology Best Practice Programme
EU	European Union
EUETS	EU Emissions Trading Scheme
GDP	gross domestic product
IPC	integrated pollution control
IPPC	integrated pollution prevention and control
NGO	non-governmental organization
Ofwat	Office of Water Services
PCB	polychlorinated biphenyl
PCT	polychlorinated terphenyl
PRN	packaging waste recovery note
SEPA	Scottish Environment Protection Agency
SWAT	Special Waste Tracking System
UKETS	U.K. Emissions Trading Scheme
VOC	volatile organic compound
WEEE	waste electrical and electronic equipment

CHAPTER 1

Executive Summary and Overview

This publication is an overview of the environmental industry and specific environmental sectors in the United Kingdom. It is intended to help U.S. environmental equipment and service companies identify commercial opportunities in the British environmental market.

The report provides

- Information on air pollution, solid and hazardous wastes, and water and wastewater;
- Data on household, industrial, and commercial waste as well as waste management;
- Information on current practices and technologies; and
- Updates on existing and pending environmental legislation.

The U.K. market for environmental technologies had a value of approximately $25 billion in 2002. The sectors included in this figure are, in decreasing size of market share: water and wastewater treatment, waste management, air pollution control, contaminated land remediation, environmental consulting services, renewable energy, environmental monitoring and instrumentation, noise and vibration control, and miscellaneous.

The principles underlying the U.K. approach to pollution control have evolved over many decades, with the concept of "best practicable means" (BPM) providing the fundamental basis for more than 90 years. European Union (EU) directives that aim to harmonize environmental standards of EU members have caused the BPM to be adapted. The "best practicable environmental option" (BPEO) and "best available techniques not entailing excessive costs" (BATNEEC) have become the major themes of industrial pollution control. In addition, there is general acceptance of the "polluter pays" principle and the tenet that environmental legislation should embody the concept of sustainable development. In effect the onus is on the polluter to demonstrate to regulators that its approach to pollution control is the best practicable for the environment as a whole, taking into account the total environmental impact across all media (air, water, and land) and balancing that against economic and commercial considerations. These principles are used to regulate the movement of pollution from one medium to another. For example, an air pollution problem cannot be "solved" by installing a smokestack scrubber that transfers the pollutant to another medium (for instance, water) unless the overall environmental impact is reduced.

Industry sectors—including paper, chemicals, petrochemicals, metal, and steel—that adversely affect the environment are regulated by the Environment Agency (EA) under a regime known as integrated pollution control (IPC). This regime is currently being modified and extended to comply with the EU directive on integrated pollution prevention and control (IPPC), which extends the scope of IPC coverage to contaminated land and environmental noise. The EA in England and Wales, the Environment and Heritage Service (EHS) in Northern Ireland, and the Scottish Environment Protection Agency (SEPA) in Scotland regulate industry sectors affected by IPC and IPPC. A single permit is issued to each polluter's refinery, processing plant, or other facility that covers releases to all environmental media, as opposed to separate permits for water, waste, and air. The EA has published a timetable that indicates the date by which facilities operating in particular industry sectors must obtain an IPPC authorization (or permit) for their operations.

Paper was the first industry sector to be affected by IPPC. In 2002, paper mills were required to obtain an IPPC authorization to operate. As the United Kingdom makes the policy transition to IPPC, opportunities may arise for U.S. companies with expertise in and new technologies for treating effluent discharge, emissions to air, solid wastes, and contaminated land.

Another EU directive requires an environmental impact assessment (EIA) for significant public and private projects. The environmental assessment procedure is required for specific projects listed in the European Regulations Registry and is also part of the planning regime of the United Kingdom.

Many U.K. companies recognize the commercial benefits of an environmentally friendly strategy. ISO 14001 (implemented as EN ISO 14001 in Europe) and

the EU Eco-Management and Audit Scheme (EMAS), have stimulated the market for consultants specializing in environmental management. The EMAS option has been available to companies since 1995, but the voluntary scheme does not have widespread participation in the United Kingdom. Only about 100 U.K. companies are EMAS registered, in comparison with 3,000 EN ISO 14001 certificate holding companies. The primary difference between ISO 14001 and EMAS is that the latter is technically stricter. A good comparison of the two systems and additional differences can be found at *http://europa.eu.int/comm/environment/emas/pdf/factsheet/fs_iso_en.pdf.*

Solid waste is the largest sector of the environmental industry in the United Kingdom, and it generates the second-highest revenues in the industry. The United Kingdom generates 432 million metric tons of solid waste (including sewage and hazardous waste) annually. The waste collection and disposal services provided by private industry are worth more than $7.4 billion, or approximately 0.5 percent of the total U.K. economy. Landfill is the traditional and primary method of disposal of solid waste in the United Kingdom, but the EU landfill directive as well as recent environmental concerns about long-term effects of landfills (toxicity, methane gas, seepage of toxins into water resources, and long-term management of sites) have fostered a new waste strategy from the U.K. government, which defines a hierarchy to encourage re-use, recycling, creation of energy from waste, and composting of solid wastes. So far, the U.K. government's primary disincentives for sending waste to landfills have centered around increasing landfill taxes, treatment of waste prior to landfill, or the banning of landfill disposal altogether (as in the case of tires).

There is a trend away from disposal and toward recycling, as U.K. legislation encourages producers to manage their waste in accordance with the waste hierarchy outlined in the government's *Waste Strategy 2000.*

New EU directives for problematic, so-called waste streams (i.e., wastes that are segregated and collected separately) include waste electrical and electronic equipment (WEEE) and end-of-life vehicles (ELV) directives.

The U.K. water and wastewater industry—with annual revenues of $9.5 billion—made a transition from a local authority owned and operated system to a fully privatized sector in the late 1980s (although water is still a public utility in Scotland and Northern Ireland). Ten companies were formed to supply water and wastewater services, and 16 to supply water.

Industrial generators of wastewater that discharge into sewers operated by water companies may be interested in technology to treat and manage wastewater. By providing initial collection and filtering processes, such technology could offer a way to minimize water company charges.

The value of the air pollution sector in the United Kingdom is estimated at $2.7 billion. The energy and transportation industries are the primary producers of air pollution in the United Kingdom. Greenhouse gas emissions fell by approximately 13 percent between 1990 and 2000. Rising oil and gas prices, however, have led to the increased use of coal (the largest power plants in the United Kingdom are coal fired), which resulted in carbon dioxide emissions increasing by 2 percent from 2000 to 2002.

Most acidifying air emissions come from large combustion plants (refineries and power stations), but these emissions have been steadily declining. A significant reduction in the release of heavy metals occurred when unleaded gasoline was introduced, while the widespread use of catalytic converters and stringent emissions testing for diesel engines have reduced particulate emissions from road transportation.

CHAPTER 2

Water and Wastewater

Market History and Regulatory Structure

The U.K. water and wastewater market is in a prolonged growth phase due to the pressures of meeting new EU directives, with capital investment in England and Wales running at around $5.6 billion annually. In the 1989–2005 period, more than $80 billion will be invested in improving drinking water quality and raising environmental standards. In Scotland, a single organization for all Scotland's water and wastewater services, Scottish Water, was created in 2002. Investment of $2.9 billion has been earmarked by the organization for improvements, which began with an investment of $560 million in 2002. See *www.scottishwater.co.uk* for further information.

The Office of Water Services (Ofwat) regulates the water industry in England and Wales. It is responsible for making sure that the water industry in England and Wales provides customers with quality service, in an efficient manner and at a fair price.

Ofwat controls the prices that water companies charge to finance their operations and the associated investment programs that are needed to meet EU directives. Ofwat does not, however, regulate the quality of drinking water or associated environmental matters. The Drinking Water Inspectorate (*www.dwi.gov.uk*), whose role it is to test and ensure water quality complies with legal standards, oversees drinking water quality.

EU directives dictate water and wastewater quality standards, and the Environment Agency (EA) regulates and enforces these standards in England and Wales. The functions of the National Rivers Authority, Her Majesty's Inspectorate of Pollution, and the waste regulation responsibilities of local councils were all incorporated into this agency in the early 1990s to protect and improve the quality of rivers, estuaries, and coastal waters. The EA is also responsible for managing water resources and flood protection. The Scottish Environment Protection Agency (SEPA) is the Scottish counterpart. In Northern Ireland, water quality is the responsibility of the Environment and Heritage Service (EHS), which is an agency of the Department of the Environment in Northern Ireland.

Current and Upcoming Regulations and their Effects

Investment in the water and wastewater sector is driven by EU legislation, such as the urban wastewater directive (Statutory Instrument No. 2841) and the bathing water directive (70/160/EEC). The urban wastewater directive has required treatment standards to be improved. Implementing and meeting water and wastewater quality standards has required substantial investment in all stages of purification before water can be discharged into rivers and the sea. Between 1990 and 2001, more than $20 billion was invested in the wastewater treatment sector in England and Wales. The Department of Environment, Food and Rural Affairs (DEFRA) has estimated that, between 2000 and 2005, approximately $8.3 billion will be needed to meet regulatory requirements. A large portion of this investment will be directed to improve treatment standards, storm overflows, and sludge disposal. Overall, this investment will also deliver significant improvements in river and bathing water quality. Over the same period, $4.9 billion is to be spent on maintaining the collection service assets.

U.S. companies that offer technologies to improve treatment standards, storm overflows, and flood prevention as well as sludge disposal should consider opportunities in the United Kingdom with distributors or partners already active in these markets.

Higher standards of wastewater treatment generate more sludge, so the urban wastewater treatment directive resulted in an approximately 12-percent increase in the production of sludge during the first five years of its implementation. It is estimated that 26 million metric tons of raw sludge (de-watered to about 1 million metric tons of dry material) were generated in the United Kingdom in 2002. This trend should continue as the timetables to comply with legislation are being met in more communities. It has been estimated that the volume of raw sludge generated in the United

Table 2.1
Major Water and Wastewater Companies in England and Wales*

Company	Revenue, 2002 (m=million, b=billion)	Owner/Parent Company	Market Share (percent)
Thames Water Utilities	$1.7 b	RWE (German)	15
North West Water	$1.6 b	United Utilities	14
Severn Trent Water	$1.5 b)	Severn Trent Plc	13
Anglian Water Services	$1.2 b	AWG Plc	10
Yorkshire Water Services	$920 m	Kelda Group	8
Welsh Water	$750 m	Glas Cymru (non-profit)	7
Northumbrian Water	$700 m	Northumbrian Water Group	7
Southern Water	$700 m	Royal Bank of Scotland	7
Wessex Water	$430 m	YTL Power International (Malaysia)	4
South East Water	$420 m	Pennon Group	4

* Other U.K. water and wastewater companies include Scottish Water (publicly owned) and Northern Ireland Water Service (publicly owned).

Kingdom will increase by 1.4 million metric tons per year up to 2005.

Historically, about half of the sludge was disposed to agricultural land, while a quarter was either dumped at sea or discharged into surface waters; the remainder was disposed to landfills or incinerated. The dumping of sludge into the sea and surface waters has been banned, and there is now greater reliance on landfill and incineration. The application of sludge to agricultural land has remained at about half of the total disposed, although sludge is applied to less than 1 percent of agricultural land. The use of sludge as a soil conditioner and as a fertilizer on agricultural land remains the United Kingdom's favored sludge disposal method and is subject to the sludge regulations of 1989 (as amended). Due to the pressure of citizens' groups, some supermarket chains do not accept agricultural products that have been fertilized or treated with sludge. This trend has led to a voluntary agreement, known as the Safe Sludge Matrix, developed by the Water Research Centre, which ensures that sludge is only recycled to certain crops and vegetation.

Local water and wastewater companies control the industrial discharge of wastewater into sewer systems. An industrial producer of wastewater must enter into a discharge agreement with its local water or wastewater companies. This agreement sets conditions (usually regarding effluent quality and volume) and establishes fees for the effluent to be treated. If these conditions are not met or fees are not paid, the water or wastewater company can make additional charges, suspend the agreement, or agree to modify the agreement and adjust the fees accordingly. If an industrial user causes a water or wastewater company to breech its discharge agreement with the Environment Agency, the company can face prosecution.

Competitive Environment and Market Opportunities

Deregulation and privatization in the early 1990s stimulated the water and wastewater market. Regional companies dominate, although there are numerous smaller water-only companies. Five companies represent almost 60 percent of the market, but because Ofwat strictly regulates the water industry, there is little opportunity for growth. Several water companies have therefore diversified into businesses such as waste management, environmental services, laboratory services, and property management.

Most water companies have expanded into waste management services through direct acquisition or the acquisition of a parent company with waste management interests. Severn Trent owns Severn Trent Water and Biffa Waste Services. Yorkshire Water owns 46 percent of Waste Recycling Group. Several water companies have interests in waste management through their parent companies. These are Northumbrian Water and SITA, owned by Suez Environnement (which also owns Degremont, Nalco, and Entec); South West Water and Viridor Waste, through Pennon Group; Southern Water and Onyx, through Vivendi Environnement; and South East Water and Ecovert, through SAUR Group.

Several U.K. water companies own U.S. water businesses. Thames Water (an RWE Group subsidiary) acquired American Water Works for $7.6 billion in 1999. Yorkshire Water owns Aquarion, the U.S. water-supply

business that serves about 1 million people in the United States. This trend is reversed in the case of Wessex Water. It was owned by Enron, through Azurix, but was sold to YTL, the Malaysian utilities company, after Enron's troubles in 2002.

According to USFilter (a subsidiary of Vivendi International), the U.K. market is mature, but it is accessible with a sound marketing approach. USFilter successfully marketed membrane systems in spite of stiff competition from French and German companies. Until recently, USFilter competed in the domestic market with Kubota, a Japanese-owned manufacturer of filters for industrial engines, owned by Wessex Water. However, a Japanese management buyout team recently acquired Kubota, and it is no longer seen as such a strong competitor.

Technology providers should cultivate relationships with water companies, since their decision cycles are much longer than in most other industries. U.S. companies should research the market thoroughly prior to embarking on any mission to the United Kingdom, as there are some fundamental differences in provision of services. For example, drinking water in the United Kingdom is chlorinated, and then distributed, through a national network of water mains, directly to consumers. Very little water comes from private supplies that would need ultraviolet or other treatments prior to use.

The Environment Agency oversees significant investment in wastewater treatment. The EA's Asset Management Plan 3 (AMP3), covering the 2000–2005 period, indicates that investment of $7.9–9.6 billion will be spent by the water companies on nearly 7,000 projects for sewage works, including on technologies for improving effluent quality through reverse osmosis, and ultraviolet and chemical oxidation. AMP3 is the third investment program run under the National Environment Programme, which plans the deployment of water company resources in upgrading water abstraction, sewage treatment, and sewer networks in the United Kingdom.

Table 2.2
Web Sites of U.K. Water and Wastewater Companies

Company	Web Site
Anglian Water	*www.anglianwater.co.uk*
North West Water	*www.unitedutilities.com*
Northern Ireland Water Service	*www.waterni.gov.uk*
Northumbrian Water:	*www.nwl.co.uk*
Scottish Water	*www.scottishwater.co.uk*
Severn Trent Water	*www.severn-trent.com*
South West Water	*www.southwestwater.co.uk*
Southern Water	*www.southernwater.co.uk*
Thames Water	*www.thames-water.com*
Welsh Water	*www.dwrcymru.com*
Wessex Water	*www.wessexwater.co.uk*
Yorkshire Water	*www.yorkshirewater.co.uk*

CHAPTER 3

Solid Waste

Market History and Regulatory Structure

The United Kingdom produced 432 million metric tons of solid waste in 2002. Mining, quarrying, agriculture, and construction are the biggest producers of waste (totaling 319 million metric tons). Households, industry, and commerce in the United Kingdom produce approximately 113 million metric tons of waste each year, nearly 60 percent of which ends up in landfills. Overall, about 40 percent of industrial and commercial waste is recovered (35 percent being recycled), while the remaining 60 percent is disposed of.

Municipal waste totaled approximately 30 million metric tons in 2001–2002. Approximately 80 percent of municipal waste goes to landfills in the United Kingdom, with roughly 15 percent being recycled. Recycling is most prevalent for separately collected material groups, such as metals and scrap equipment (89 percent), and paper and cardboard (76 percent). Households in the United Kingdom generate approximately 89 percent of municipal waste (about 26 million metric tons in 2001–2002). Municipal waste has been growing at 3 percent annually, faster than GDP, as households consume more goods and dispose of more garbage.

Recycling and composting of waste increased from 7 percent in 1996–1997 to 12 percent in 2001–2002. Approximately 9 percent was incinerated and used to supply energy in the same year. However, the vast majority of household waste, nearly 80 percent, is disposed of in landfills. Paper and cardboard accounted for nearly 40 percent of household waste collected for recycling, while glass and centralized composting each accounted for another 20 percent. Amounts of waste collected for centralized composting have more than doubled in two years, to about 442,000 metric tons in 2000–2001. In addition, local councils' estimates suggest that between 196,000 and 295,000 metric tons of waste are composted at home. There has been a substantial increase in the number of households served by curbside recycling programs, from 17 percent in 1995–1996 to around 58 percent in 2001–2002. Significant efforts are now being made to increase the volumes of waste sent for recycling; local councils have statutory targets to increase recycling and composting of household waste to 17 percent by 2003, 25 percent by 2005, and 33 percent by 2015.

The United Kingdom recycles 90 percent of the 10 million lead car batteries used every year nationwide. Scrap metals are an established market, with 66 percent of lead, 43 percent of aluminum, 38 percent copper, and 39 percent of iron recycled. Nearly half of used oil is recycled, but 45 percent cannot be accounted for. Thirty-eight percent of paper, 22 percent of the 6 billion glass containers used each year, and 7 percent of plastic are also recycled.

The number of active landfill sites declined from around 3,400 in 1994 to 2,300 in 2001; there are now approximately 1,500 landfills. However, modern landfills can accommodate significantly more material than traditional landfills. Landfills occupy approximately 69,200 acres (28,000 hectares), or about 0.2 percent of the land area of England and Wales. About two-thirds of waste in landfills is made up of biodegradable organic matter from households, businesses, and industry. The municipal waste that the United Kingdom currently landfills has a higher proportion of biodegradable waste than that of most other European countries. For example, France landfills just 49 percent of its municipal waste, while the Netherlands landfills just 12 percent. Approximately one-third of the landfills taking significant amounts of biodegradable waste in the United Kingdom have gas controls, and more than 75 sites extract gas for energy recovery.

Two rates of landfill tax were introduced in 1996. The tax on inert wastes was introduced at $3.20 per metric ton and will increase to $4.80 per metric ton in 2004. For active waste, the current tax rate is $22.40 per metric ton and will increase to $28.80 per metric ton in 2005. The landfill tax is used to finance environmental projects, such as recycling initiatives and technology evaluations, through a tax credit scheme. As landfill costs increase, opportunities may develop for U.S. com-

panies with waste treatment technologies that reduce reliance on landfills (for example, energy from waste plants).

U.S. environmental companies have vast knowledge of technologies for land remediation, induced by the U.S. Superfund legislation. Those technologies provide excellent market opportunities in the United Kingdom as they comply with the new contaminated land regulations.

Current and Upcoming Regulations and their Effects

An EU landfill directive requires U.K. companies to reduce the biodegradable municipal waste currently sent to landfills by 65 percent by the end of 2005. Local authorities are responsible for managing municipal waste, and they are required to develop strategic plans so that this target will be achieved. Among other things, the directive now bans the practice of co-disposal: hazardous and non-hazardous waste together in landfills. It requires landfills to be classified as inert, non-hazardous, or hazardous. The directive also bans the landfill disposal of whole tires by late 2003 and shredded tires by 2006. Lastly, the directive makes it necessary to treat all remaining toxic and hazardous wastes by separation processes, prior to landfill.

This directive was introduced at a time when the United Kingdom was generating more municipal waste than ever; meeting its requirements represents a significant challenge. Significant investment in alternative disposal routes, such as incineration, is required or recycling rates will need to be increased dramatically—the government's favored option. The current annual capacity for municipal waste incineration is 2.7 million metric tons, which is less than 10 percent of the waste produced. The amount of waste incinerated needs to reach 10 million metric tons by 2010 to meet forecast demands. Of the 7,000 licensed incinerators in the United Kingdom, only 11 burn municipal waste, as the vast majority are small industrial or clinical units. The directive on waste incineration regulates municipal incinerators and other similar large combustion processes. There are, however, major public concerns regarding incineration, and it is unclear if incineration will expand its role in waste disposal.

The waste management industry plays a key role in achieving sustainable waste management and regulatory compliance by providing an infrastructure to handle waste. The facilities it constructs and operates must comply with local plans as well as the waste strategies of relevant planning bodies. Most of these plans have sought to encourage the development of integrated waste management facilities that emphasize recycling. This means that waste management companies must work closely with local councils to identify and develop suitable facilities on appropriate sites.

The Environment Agency regulates the waste management industry according to the Environmental Protection Act of 1990, the Environment Act of 1995, waste management licensing regulations of 1994, and the EU waste framework directive.

EU regulations on ozone-depleting substances, which came into effect on October 1, 2000, require the removal of these substances from refrigeration equipment before such appliances are reprocessed. Significant new recycling capacity emerged in 2002 in response to the legislation. This capacity now affects the reprocessing of about 1 million of the refrigerators that had been stockpiled. The waste industry estimates that 2 million refrigerators will be discarded every year and that additional reprocessing capacity will be needed. This may represent an opportunity for U.S. companies that have suitable technology.

More EU legislation in the pipeline is expected to generate further growth in the waste industry. The most notable is the "producer responsibility" legislation that will require the producers of certain products, which are considered to have significant environmental impact, to be responsible for managing them throughout their life cycles. Recycling targets will be set so that producers will be responsible for collecting their used products and ensuring that some are recycled. A directive on waste electrical and electronic equipment (WEEE) is the first significant piece of legislation in this area. Passed by the European Parliament in February 2003, the directive states that all products that use an electromagnetic current must be recovered from the end user and recycled. This will include the following electrical goods: household appliances, IT and telecommunications equipment, audiovisual equipment, lighting equipment, electrical and electronic tools, toys, leisure and sports equipment, medical devices, and automatic dispensers. The WEEE directive is likely to be implemented in the United Kingdom around August 2005. Recycling targets are set for different product categories, but these are likely to be in excess of 70 percent.

It is unclear at the moment how the WEEE directive will be implemented in the United Kingdom. It is likely, however, that a collective scheme will be introduced, similar to the one that exists for packaging and is used by most British companies. Under this system, producers have the option of collecting and recycling packaging themselves or joining a group scheme for a third party to do this for them. Several schemes exist, but the largest is Valpak. Every year, Valpak members must provide it with information on how much packaging they have generated. Valpak then ensures that certificates,

known as packaging waste recovery notes (PRNs), are obtained from recycling companies to demonstrate that sufficient recycling has taken place. Recycling companies can charge for the PRNs that they issue; Valpak members ultimately bear this cost. The introduction of the WEEE directive may provide an opportunity to U.S. companies with technologies that can be used to recycle electrical and electronic equipment.

New IPPC regulations apply to some operations that are subject to waste management licensing, including

- Disposal and recovery operations with a capacity of more than 9.8 metric tons per day;
- Incinerators of municipal waste with a capacity of more than 2.9 metric tons per hour;
- Treatment of non-hazardous waste with a capacity of more than 49 metric tons a day; and
- Landfills receiving more than 24.6 metric tons a day, with a total capacity of 24,600 metric tons.

Competitive Environment and Market Opportunities

Since waste management companies handle both solid and hazardous waste, this analysis appears in Chapter 4.

CHAPTER 4

Hazardous Waste

Market History and Regulatory Structure

The United Kingdom has a long history of relying on landfill as the ultimate disposal method for hazardous waste, usually via co-disposal with non-hazardous waste. More than 60 percent of the hazardous waste generated is currently disposed to landfills.

There are two merchant incinerators in the United Kingdom: Shanks at Fawley (Hampshire) and Cleanaway at Ellesmere Port (Merseyside). They operate at high temperatures and specialize in the disposal of hazardous wastes from various industrial and medical sources. These merchant incinerators have a total annual capacity of 50–60,000 metric tons. It is estimated that there are approximately 60 in-house incinerators in the United Kingdom, but these are usually small, dedicated units treating hazardous waste from various industries: chemical, medical, pharmaceutical, oil, food processing, and paint. There are also four drum reconditioning facilities, located in Aldershot, Avonmouth, Deeside, and Barking, which include incineration as part of their operations. These facilities use thermal treatment to remove and treat hazardous materials from drums prior to reshaping, repainting, and refinishing the drums for sale. However, the market for these drums is limited, because the treatment process ensures that the drums no longer comply with U.N. transportation standards.

Waste solvents are used as alternative fuels in kilns for cement and lime. There are currently nine such kilns authorized to either burn or run trials with waste-derived fuels. These kilns are supplied by a number of "fuel" blending facilities operated by companies such as SafetyKleen. The demand for their services is expected to increase as a result of the introduction of the EU landfill directive.

Current and Upcoming Regulations and their Effects

An EU hazardous waste directive provides the framework for the control of hazardous (or special) waste, and the annexes to the directive describe the categories or generic types of hazardous waste. These substances are hazardous by the nature of the activity from which they were generated, as well as by their properties. Further, a European Commission decision established the Hazardous Waste List, which includes wastes that display one or more hazardous characteristic or property, such as explosive, highly flammable, toxic, or carcinogenic. Since the beginning of 2003, all hazardous wastes in the United Kingdom have had to be categorized in accordance with this list.

The Environment Agency enforces regulations covering hazardous waste management. Anyone who handles such waste is subject to duty-of-care regulations. Facilities that receive waste are regulated under the waste management licensing system. Further legislative and technical requirements for the management of hazardous waste include the

- Special waste regulations (amended) of 1997;
- Waste management licensing regulations (amended) of 1994;
- Directive on the disposal of waste oil;
- Directive on the disposal of polychlorinated biphenyls (PCBs) and polychlorinated terphenyls (PCTs);
- Directive on the incineration of hazardous waste;
- Directive on the landfill of waste;
- Regulation on shipments of waste; and
- Directive on pollution prevention and control.

The waste industry faces significant challenges, and waste producers must ultimately bear the costs of the investment needed to address these challenges. However, the rising costs of hazardous waste treatment and disposal have made waste producers far more aware of the financial as well as the environmental benefits of reducing both the volume and hazardous nature of waste, and there is now a significant focus on waste elimination and recycling. The government's Environmental Technology Best Practice Programme (ETBPP) plays an important role in promoting cleaner technologies to reduce hazardous waste generation. However, many haz-

Table 4.1
Major U.K. Waste Management Companies*

Company	Revenue (m=million, b=billion)	Owner/Parent Company	Market Share (percent)
Cleanaway Limited	$1.1 b (2002)	Brambles Group (Australian)	16
SITA	$950 m (2001)	Suez Environnement (French)	13
Shanks	$850 m (2002)	Shanks Group	12
Biffa Waste Services Ltd.	$820 m (2003)	Severn Trent Plc	12
Onyx	$590 m (2001)	Veoila Environnement (French)	8
Waste Recycling Group	$480 m (2002)	Terra Finance Capital Partners	7
Viridor Waste Limited	$240 m (2003)	Pennon Group Plc	3
Cory Environmental	$90 m (2003)	Exel	1

* Cleansing Service Group is a major player, but revenue figures from this privately owned company.

ardous wastes, including certain chemicals, pesticides, PCBs, and chlorofluorocarbons (CFCs), cannot be re-used but must be destroyed or treated to remove their hazardous properties.

Some of the positive examples of the ETBPP are

- Organic solvent recovery for use as fuel;
- Organic solvent recovery by re-distillation (halogenated solvents, phenols);
- Regeneration of fine chemicals (spent catalysts);
- Refining of waste oils and using as engine oils; and
- Recovery of metals from batteries.

High temperature incineration is considered to represent the best practicable environmental option for the disposal of hazardous organic wastes. Incineration facilities are subject to high levels of air pollution control to protect human health and are required to be fitted with energy recovery systems, where practicable.

The hazardous waste incineration directive sets out stringent environmental performance standards for hazardous waste incinerators. The directive applies to all incinerators burning waste on the EU Hazardous Waste List, and the Environment Agency is in charge of the licensing program (IPPC). The government is studying whether current high-temperature incineration capacity is sufficient to deal with the additional hazardous waste expected as a result of the landfill directive. One of the existing incinerators, operated by Shanks, has already installed a fluidized bed incinerator, but it is unlikely to be enough to process the increasing waste volume.

The new landfill directive will significantly affect the disposal of hazardous waste as it introduces more stringent controls to protect human health and the environment. In 2001, 45 percent of hazardous wastes were disposed of in landfills, a statistic that shows a decreasing trend from 1999, when 53 percent of hazardous wastes were disposed of in this way. The directive bans the co-disposal of hazardous wastes with other waste and prohibits some waste streams, including whole tires, from being sent to landfills. Another important aspect of the regulation is the requirement to provide aftercare for a minimum of 30 years after hazardous wastes have ceased to be deposited. This will require significant financial provisions and will drive smaller landfill operations out of business.

Pre-treatment can reduce the hazards associated with a waste, or, in some cases, can render it non-hazardous. Under the landfill directive, pre-treatment will be required for all hazardous wastes that are to be sent to landfills. A wide variety of pre-treatment technologies are available, albeit not generally used in the United Kingdom, with biological or thermal treatment most suitable for organic wastes and physical/chemical treatment most suitable for inorganic wastes. U.S. companies with such technologies should find good opportunities with hazardous-waste treatment facilities in the United Kingdom.

Newly emerging energy recovery technologies can be expected to become increasingly prominent, encouraged by the need to divert wastes away from landfills. A notable waste that will now require pre-treatment will be medical waste, of which the United Kingdom generates about 350,000 metric tons annually.

Another emerging issue is contaminated soil. About 525,000 metric tons were generated in 2001, or about 20 percent of all special wastes. Under the new contaminated land regulations (Part IIA of the Environmental Protection Act) and with the introduction of fiscal measures to increase the development of more brownfield sites, the quantity of contaminated soil is expected to rise significantly after 2003. The majority

of contaminated soil is currently put in landfills. The landfill directive will, however, require contaminated soils to be pre-treated. At the moment, the best practicable environmental option (BPEO) and best available techniques not entailing excessive costs (BATNEEC) for treatment still need to be defined. Any U.S. company with suitable technology should seek to influence the decision-making process.

The EA and DEFRA are developing guidelines on how to proceed with the formal assessment of the BPEO for key hazardous wastes streams. The development of the BPEO will consider a number of issues, mostly regarding the waste hierarchy:

- Reuse or recycling of waste streams, on-site or elsewhere;
- Reclamation of energy from waste;
- Incineration without energy recovery (this may be the only appropriate option for PCBs and CFCs);
- Constraints on landfill (this may remain as the only appropriate solution for asbestos);
- Special treatment to reduce hazardous properties, even if it increases the quantity of waste; and
- Existing and alternative management practices.

Competitive Environment and Market Opportunities

The forthcoming implementation of the landfill directive prompted a great deal of activity in the waste industry. After a couple of years of instability, 2002 saw significant consolidation in the industry (both in the solid and hazardous waste area). As a result, there are 11 national companies left, three of which (Onyx, SITA, and Ecovert) are French owned. The value of the waste industry is about $7.4 billion. The top five companies represent 45 percent of the market, followed by nine companies with a combined 15-percent market share. Small regional companies have the remaining 40 percent.

The three market leaders are SITA, Biffa, and Onyx, and they belong to utility groups. Shanks and Cleanaway are the leaders in the management of special waste. They operate treatment plants, landfills, and incinerators.

The waste industry is a high single-digit growth area with significant potential. A mix of economic factors, contracts from local councils, and additional standards ensuing from legislation and regulation will all drive growth. Waste volumes have generally grown slightly ahead of GDP, because of demographic changes and rising living standards. However, in the long run, growth in waste streams may taper off as the government seeks to de-couple economic growth from waste generation. Overall value growth in the medium term is expected to be 5 to 10 percent annually, supplemented by the increasingly complex nature of the industry as it becomes more highly regulated and more dependent on higher-value waste management technologies. The U.K. waste management market, which has traditionally lagged behind continental Europe in implementing waste management strategies, is expected to be the one of the highest-growth markets in Europe over the next five to 10 years.

Table 4.2
Web Sites of Major U.K. Waste Management Companies

Company	Web Site
Biffa Waste Services	*www.biffa.co.uk*
Cleanaway	*www.cleanaway.co.uk*
Cleansing Service Group Ltd.	*www.csgwasteman.co.uk*
Cory Environmental	*www.coryenvironmental.co.uk*
Onyx	*www.onyx-environnement.com*
Shanks	*www.shanks co.uk*
SITA	*www.sita.co.uk*
Viridor Waste Limited	*www.viridor.co.uk*
Waste Recycling Group	*www.wrg.co.uk*

The few U.S. companies that entered the waste management industry in the United Kingdom have disengaged from the market. A common reason given for U.S. reluctance to enter the U.K. waste management market has been the reliance on landfills and the need to acquire and manage landfill sites, rather than segregate and recycle waste. The last U.S. waste management company, Waste Management International, pulled out of the United Kingdom in 2000.

Since the United Kingdom has the lowest municipal recycling rate (12 percent) in Western Europe, with many local authorities showing no signs of improvement, the Environment Agency recently called for the landfill tax to be doubled in the hopes of stimulating innovation in the waste management industry and helping the United Kingdom meet the EU recycling rate target of 25 percent by 2006. U.S. companies that offer solutions to help meet this target may have opportunities by partnering existing waste management companies with proven recycling technologies from the United States. Of particular interest is the requirement to treat biodegradable waste prior to landfill.

CHAPTER 5

Air Pollution

Market History and Regulatory Structure

Air pollution has been highlighted as an issue in the United Kingdom since the major smog problems of the 1950s, which were caused by a combination of household coal fires, gas and diesel automotive engines, and coal-fired power generation in and around London. The Clean Air Act of 1956 signified the beginning of legislation to control emissions to air. Since then, a number of changes have led to considerable improvements in air quality, including the widespread replacement of coal by natural gas and electricity for domestic heating, tighter regulation and structural changes in industry, and the introduction of progressively more stringent standards for vehicle exhaust emissions. For example, in 1970, 8.9 million metric tons of carbon monoxide and 6.5 million metric tons of sulphur dioxide were emitted into the air in the United Kingdom. By 2002, these emissions had fallen to 4.2 million and 1.2 million, respectively.

Industrial processes with the potential for producing pollutants are subject to IPC and IPPC regulation. Processes with a significant but lesser potential for air pollution require approval—in England and Wales from local authorities, in Scotland from SEPA, and in Northern Ireland from the chief pollution inspector or relevant district council, depending on the process. Local authorities also control emissions of dark smoke from commercial and industrial premises, and implement smoke control areas to deal with emissions from domestic properties, mainly to control emissions from coal fires used for domestic heating.

Under the provisions of the Environment Act of 1995, the government is required to publish an air quality strategy. The most recent such report dated 2000, which is entitled simply *Air Quality Strategy*, sets out the policies for managing ambient air quality in the United Kingdom, particularly in relation to reducing air pollution and any remaining risks to human health and the environment. The current strategy contains air quality standards and objectives for eight pollutants in particular: nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone, lead, benzene, particulate matter (PM_{10}—less than 10 microns in diameter) and 1,3-butadiene.

Emissions of volatile organic compounds (VOCs) increased until the late 1980s, but now are decreasing due to stringent regulations. VOCs and nitrogen oxides react in sunlight to form ground-level ozone. This ground-level ozone is the main cause of air pollution in rural areas; it is detrimental to human health and can damage crops and building materials.

Since low lead gasoline was introduced in 1985, followed by unleaded gasoline in 1986, emissions related to vehicle exhaust have decreased significantly and are expected to decrease further as a result of the ban on leaded fuel in 2000. PM_{10} emissions have decreased steadily since the mid-1980s due to the widespread use of catalytic converters and more stringent emissions standards for diesel engines.

The average number of days when air pollution has exceeded national standards has decreased over the last decade. In urban areas, the number of high-pollution days has steadily fallen, whereas rural areas have seen no change. The main cause of air pollution in urban areas is particulates, whereas in rural areas it is ground-level ozone.

Current and Upcoming Regulations and their Effects

In 1982, the U.K. government set up the U.K. Smoke and Sulphur Dioxide Monitoring Network, comprised of 200 urban and rural sites to measure pollution levels. This was in response to the combination of national and international legislation that addressed air quality. The aforementioned *Air Quality Strategy* provides a framework for air quality control, with standards and objectives for certain pollutants, and a timetable for their achievement. DEFRA is due to issue a technical guidance report on air quality in late 2003.

At the 1997 Kyoto summit on climate change, the European Union pledged to reduce greenhouse gas emissions by 8 percent by 2010 (based on 1990 levels).

The United Kingdom committed to reduce emissions by 12.5 percent initially, and the U.K. government recently decided to create an economic instrument to promote this reduction. In 1999, it introduced a climate change levy, which became effective April 2001. All non-domestic consumers of energy pay the levy on their emissions. An alternative scheme was also made available to polluters, the U.K. Emissions Trading Scheme (UKETS).

This is the first economy-wide scheme in the world and will be followed in the next few years by the EU Emissions Trading Scheme (EUETS), which is due to commence in 2005, and potentially by a worldwide scheme in the future.

UKETS is designed to reduce the emissions of six "greenhouse" gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. Of these, carbon dioxide accounts for over 80 percent of emissions and is potentially the easiest to control through reduced energy use. The general principle is the creation of a market that allows companies that reduce emissions to benefit financially by selling their "credits," while companies that have failed to reduce emissions will be financially penalized by having to buy "credits" to make up their shortfalls. The buying and selling prices will be set by market traders, just like any other commodity, and will be driven by supply and demand.

The uncertainty surrounding the implementation of the EUETS, and the desire by industry to achieve the highest possible emissions allowances prior to the scheme starting, through the National Allocation Plan, which sets a base level and further targets for reductions in emissions, has led to a reluctance to invest in new technologies at this time.

Competitive Environment and Market Opportunities

The U.K. air pollution control (APC) market is worth more than $1.8 billion and has been relatively flat in the last five years. Parts of the market appear to be reaching maturity, which is reflected in low or flat rates of annual growth. Low rates of recent growth suggest that much of the abatement equipment required by larger-spending U.K. industries is already in place; implementation of some regulations, such as regulations covering abatement of VOCs, has been delayed; and U.K. manufacturing industries have declined. The low growth rates also reflect the uncertainty surrounding the EUETS scheme, due to start in 2005.

Potential factors influencing future growth in the U.K. APC market include

- A U.K. air quality strategy that, among other things, requires local authorities to review local air quality;
- The possibility of stronger future enforcement of local authority pollution control regulations;
- IPPC regulations, which now cover a wider range of sectors;
- A possible increase in the number of waste incinerators in the United Kingdom;
- The EU air quality directive;
- The EU solvents directive;
- Increased emphasis by the Environment Agency on requiring industrial emission monitoring and reporting; and
- The status of the EUETS program and the reduction of greenhouse gas emissions, increasing concerns about the health effects of air pollutants such as fine particulates and dioxins, and the impact of transportation on air quality.

The U.K. APC sector includes APC technology suppliers and related services such as design, process advice, installation, commissioning, monitoring, and maintenance. Leading companies include Torit DCE, Colt International, Carter Environmental, AB Dust Control, and Haden Drysys Environmental. These firms supply technologies and full turnkey services, including process design, process optimization, engineering and commissioning, maintenance, and monitoring.

Foreign APC technology suppliers have recently been active in acquiring U.K. APC suppliers in order to establish a presence in the U.K. or European markets, and to add to their portfolios of technologies and services that they supply to international markets. Examples of U.S. companies in this field include American Air Filter International, Catalytic Combustion Corporation, and Engelhard Corporation.

CHAPTER 6

Environmental Services

Market History and Regulatory Structure

The U.K. environmental consulting market has seen significant growth in the last five years, growing at approximately 10 percent annually, according to Environmental Data Services Ltd. (ENDS), an environmental market research company. The market is growing fastest in areas such as contaminated land services, water pollution and resources, waste management and minimization, environmental auditing, risk assessment, environmental management systems, and environmental impact assessment. EU and U.K. regulations, private sector merger and acquisition activities, economic development, increasing awareness of environmental issues in industry, and increasing costs associated with poor environmental performance have spurred activity.

ENDS lists more than 700 consultants in its directory of U.K. environmental consulting sector, which is indicative of the diverse nature of environmental consulting in the country. No single consulting firm can claim more than a 6-percent share of the U.K. market. Currently, 13 companies earn revenues in excess of $16 million; the total market is estimated to be worth nearly $1.5 billion.

The sectors producing the largest revenues are

- Contaminated land—14 percent or $200 million;
- Environmental impact assessment—12 percent or $170 million;
- Water quality and resources—11 percent or $160 million;
- Waste management—9 percent or $130 million;
- Government and NGO policy—9 percent or $130 million;
- Environmental auditing—7 percent or $100 million;
- Hazard/risk assessment—7 percent or $100 million; and
- Air quality—6 percent or $90 million.

Current and Upcoming Regulations and their Effects

Due to the fact that environmental consulting spans and to some extent depends on other environment industry subsectors, future prospects for the U.K. market depend on the same factors—for example implementation of the U.K. waste management strategy and higher future levels of investment and activities in the U.K. water industry. Increasing consumer and other stakeholder expectations for corporate environmental responsibility are also creating opportunities in the U.K. environmental consulting market, as companies seek to establish environmentally friendly reputations.

The new contaminated land regime is known as "Part IIA," meaning Part IIA of the Environmental Protection Act of 1990, which was amended in England in 2000, and in Wales in 2001. The regime provides, for the first time in the country, an explicit statutory definition of contaminated land, focusing on risks arising in the context of the current use and circumstances of land. It places specific duties on local authorities to inspect their areas to identify land falling within this definition and, where they do, to require its remediation in line with the "suitable for use" approach. The regime also provides detailed rules for assigning liabilities for contaminated land, based on the "polluter pays" principle.

The Environment Agency is responsible for compiling reports and statistics on contaminated land identified by the Part IIA regime. By March 2002, the report had identified 33 sites determined to be contaminated land, of which 11 were further classified as special sites. Special sites were designated because controlled waters are being, or are likely to be, polluted.

The recent extension of environmental impact assessment (EIA) regulations in the United Kingdom in 2002, along with the increase in new transportation infrastructure, new freeways, town bypasses, road widening, and rail improvements, have increased the number of opportunities for consultants to provide EIA reports prior to work commencing. These regulations also apply to the agricultural community, because an EIA must be carried out before a landowner undertakes

any improvements in drainage, land clearance, or other activity likely to have an impact on the environment.

Competitive Environment and Market Opportunities

The U.K. environmental consulting sector includes large, multi-disciplinary consulting firms, such as AEA Technology Environment, Entec, Enviros, and Environmental Resource Management, as well as engineering firms with significant environmental practices, such as Babtie Group, Montgomery Watson, and Halcrow Group. There are also large U.S. consulting companies established in the United Kingdom that are competing and winning contracts in a variety of sectors, including NERA Economic Consulting, URS Corporation, and ENSR International.

NERA has been successful in bidding for contracts with the U.K. government and the European Union. NERA is a Marsh & McLennan company, and has European offices in London, Brussels, Madrid, and Rome. In the United Kingdom, NERA works on a variety of environmental projects for both the private and public sector. NERA is an appointed consultant to DEFRA, on the UKETS integration into the EUETS, working with industry stakeholders, NGOs, and government departments to establish a new U.K. National Allocation Plan, prior to the EUETS commencing in 2005.

Client satisfaction with environmental consultants' work is extremely good, reflected in a high rate of repeat business secured by consulting firms. There are new accreditation schemes such as the EIA Practitioner Register, Specialists in Land Condition Register, and the Environmental Auditor Register, all of which are run by the Institute of Environmental Management and Assessment. The high level of repeat business would suggest that breaking into the consulting sector could be a difficult task for environmental companies entering the U.K. market, and would require a long-term strategy to understand U.K. and EU legislation, build relationships with potential customers, and explore strategic alliances with other consultants.

The current growth sectors (contaminated land, EIA, water resources, and waste management) are under the influence of various underlying factors, but a prominent factor is corporate social responsibility (CSR). Following some recent high-profile corporate governance scandals, such as Enron and WorldCom, companies are now much more diligent regarding all aspects of CSR and the environmental impact of their operations worldwide. Large companies in particular are outsourcing their special environmental requirements to consulting firms, due to the downsizing of in-house environmental teams. This again creates demand for environmental consultants to complement their in-house teams in specialist or high-growth sectors.

Opportunities in the water industry are very cyclical, due to the sector's five-year investment plans, or Asset Management Plans (AMPs), of which the next five-year period starts in 2005. Therefore, revenues are down in water quality and resources consulting, but are expected to rise again immediately prior to, and during 2005, when the Environment Agency commences planning for capital expenditure on water and wastewater treatment schemes. Indeed, the water industry is already discussing price rises to fund the large amount of investment that is envisaged. Such a program of investment will help to generate consulting work.

APPENDIX A

Support for Environmental Companies

The U.S. Department of Commerce has numerous programs that help American companies do business abroad. The International Trade Administration promotes U.S. trade through several units, including Trade Development and the U.S. Commercial Service.

The Office of Environmental Technologies Industries (ETI) serves as the main point of contact at the Department of Commerce for U.S. environmental technologies and services firms. This office is charged with increasing the international competitiveness of the U.S. environmental technology industry. ETI trade specialists and representatives of the U.S. Commercial Service provide information, counseling, trade promotion, and advocacy services to help U.S. companies that specialize in pollution control, prevention, monitoring, and remediation to enter and compete in the rapidly expanding international environmental market. ETI services include

- The ETI Web site, *www.environment.ita.doc.gov*, which provides the latest news, country environmental market plans, research reports, a trade events calendar, and links to environmental resources.
- *Environmental Export News*, the ETI quarterly e-mail newsletter, which informs U.S. companies about developments in international markets and programs that help exporters.
- Regional and industry-specific market research reports, which feature detailed analyses of key countries, regions, and industry subsectors.

U.S. Government in the United Kingdom

U.S. Commercial Service
Embassy of the United States of America
24 Grosvenor Square
London W1A 1AE
United Kingdom
Tel: +44-20-7408-8019
Fax: +44-20-7408-8020
Web site: *www.usexports.co.uk*

APPENDIX B

Environmental Web Sites

Government

Department of the Environment (Northern Ireland): *www.doeni.gov.uk*
Department for Environment, Food and Rural Affairs: *www.defra.gov.uk*
Department of Trade and Industry: *www.dti.gov.uk*
National Assembly for Wales: *www.wales.gov.uk*
Scottish Executive: *www.scotland.gov.uk*

Regulators

Environment Agency (England and Wales): *www.environment-agency.gov.uk*
Environment and Heritage Service (Northern Ireland): *www.ehsni.gov.uk*
Office of Water Services (England and Wales): *www.ofwat.gov.uk*
Scottish Environment Protection Agency: *www.sepa.org.uk*

Trade Associations

Environmental Industries Commission: *www.eic-uk.co.uk*
Environmental Services Association: *www.esauk.org*
Institute of Environmental Management and Assessment: *www.iema.net*
Water U.K.: *www.water.org.uk*

Regulations

Legislation of the European Union: *www.europa.eu.int/eur-lex/en/index.html*
Legislation of the United Kingdom: *www.hmso.gov.uk*

Information

Digest of Environmental Statistics: *www.defra.gov.uk/environment/statistics/des/index.htm*
Environmental Facts and Figures: *www.environment-agency.gov.uk/yourenv/eff*
Ofwat Facts and Figures and FAQs: *www.oftwat.gov.uk*
State of the Environment Reports: *www.sepa.org.uk/publications/stateoftheenvironment/index.htm*
The ENDS Report: *www.ends.co.uk*
Waste Management: *www.letsrecycle.com*
Waste Management Survey: *www.defra.gov.uk/environment/statistics/wastats/index.htm*
Waste Strategy 2000 for England and Wales: *www.defra.gov.uk/environment/waste/strategy*

Grants, Funds, and Other Programs

Environmental Grants: *www.crystalfaraday.com*
Envirowise: *www.defra.gov.uk/environment/business/envirowise/index.htm*
Export-Import Bank of the United States: *www.exim.gov*
Faraday Partnership: *www.mini-waste.com*
Foresight: *www.foresight.gov.uk*

TradePort: *www.tradeport.org*
Trade Partners U.K.: *www.tradepartners.gov.uk*
Waste Minimisation and Recycling Fund: *www.defra.gov.uk/environment/waste/localauth/wastefund*
Waste and Resources Action Programme: *www.wrap.org.uk*