The Cost of Recycling

The DTi currently estimates that it would cost between £250 and £300 to dismantle, treat and process one tonne of personal computers to the required standards of the WEEE Directive. This translates to a cost of £5 to £6 for an individual computer and an estimated annual treatment cost of anywhere between £98 million and £207 million a year, not including collection costs. Dismantling and appropriate treatment is necessary as, of the one thousand plus materials of which computer equipment is composed, hundreds including brominated substances, gases, metals, acids and plastics are highly toxic. Table 1 below details some of the materials

Table 1: Materials in IT Equipment by Component

Components	Materials	Potential Effects
Keyboard/mouse	Thermoplastics PVC Aluminium	Contains hormone disrupting dioxins, dioxins that can cause cancer and neurotoxins.
Monitors	Raw glass - 100% recyclable with no ill effects. Leaded glass, metals including barium, strontium zinc, lead, cadmium and phosphor, cathode ray tube.	Contains substances that can cause cancer and may also contain neurotoxins.
Speakers	PVC Steel	Contains substances that can cause cancer and neurotoxins.
Processors/ memory chips	Various metals including, gallium, indium, thallium, silicon, germanium, arsenic, antimony, lead, selenium, tellurium, gold, aluminium.	Substances that can cause cancer, neurotoxins and heavy metals that contribute to liver and kidney disease.
Printed Circuit Boards	Precious metals, PVC coating, glass fibre, thermoset resin, brominated fire retardants, ethylene glycol, dimethylformamide, N-methylpyrrolidinone, aluminium, various solvents.	Cancer causing substances and neurotoxins.
Casing/printer	Plastics - antimony trioxide, thermoplastics (various), polycarbonate, PVC, ABS, HI polystyrene, polyethylene oxide. Metals - steel.	Cancer causing and hormone disrupting substances.
Cooling system	Steel and thermoplastics	Cancer causing and hormone disrupting substances.
Chassis	Steel and aluminium	Neurotoxins.
Storage media	Aluminium alloy and steel.	Neurotoxins.
Batteries	Nickel, cadmium and steel.	Cancer causing and neurotoxins. Also contains materials

		that are toxic to aquatic life.
Power supply/ surge suppressor	Steel, nickel, copper.	Contains materials that are toxic to aquatic life.
Cables/ power cord	Turned copper, PTFE, PE.	Cancer causing and hormone disrupting substances. Also contains materials that are toxic to aquatic life.

Abbreviations:

PVC - poly vinyl chloride
ABS - acrylonitrile butadiene styrene
HI polystyrene - high impact polystyrene
PTFE - polytetrafluroethylene
PE - polyethylene

contained in different computer components and outlines the possible effects of exposure to these substances. Under the WEEE Directive, those substances detailed in Table 1 will have to be treated and disposed of in an environmentally friendly manner, it will no longer be possible for waste disposal agents to stockpile equipment containing these substances in landfill sites. This service will be costly, and manufacturers that have to utilise take back schemes and bear the burden of paying for this disposal will inevitably attempt to pass this cost on to customers, primarily business customers.

Not all components in computer equipment are toxic, some even have some value for recycling purposes and some may even have monetary value. Typically, a personal computer consists of various plastics, metals and glass - Table 2 below shows the typical composition of a personal computer base unit and monitor with respect to these materials. Printed circuit boards (PCBs), for example, contain elements that may be of value to a recycler or reprocessor of electronic equipment. PCBs contain, in very small amounts, precious metals that, if processed in sufficient bulk, can be very valuable to a firm. However, the process of stripping a PCB down to recover materials is very laborious and only worthwhile if it can be done in significant volumes - only one company in Scotland[1] currently processes PCBs to this level. Many recycling firms do operate a policy of refurbishing and reusing working equipment, with the owner's prior consent, and many offer financial incentives to companies to allow them to do so. Some recycling firms will offer a small fee for working monitors, which may be between £5 and £20 dependent on type, size and condition. Also, firms may pay for working base units or PCBs that contain working processors[2]. For most other equipment, including printers, obsolete base units and monitors, hard drives and cables, there will be a charge for recycling or refurbishment dependent on types and volumes. This will vary quite widely between firms and for anyone wishing to dispose of computer equipment it would be wise to obtain quotes from a few recyclers before obtaining their services. Appendix 1 contains details of the quotes obtained from three suppliers for the purposes of this research.

Table 2: Typical Composition of a Personal Computer

Material	**Weight (Kg)**

[1] CCL (North) in Irvine, Contact: Bruce McLean, Managing Director.
[2] Usually Pentium II 250MHz or above.

Steel	8.1
Aluminium	1.1
Copper	1.8
ABS (acrylonitrile butadiene styrene)	3.8
PP (polypropylene)	0.7
Other Plastics	1
Cathode Ray Tube & Other Glass	7.2

It should be noted here that the costs of recycling computer equipment at present do not accurately reflect the true cost of treating and disposing of equipment to WEEE standards. Consequently, as recyclers face tougher restrictions on how they handle and process WEEE, the costs to firms of recycling their redundant equipment may rise, making it even more important that firms put in place a strategy to assist in mitigating what could be rising costs associated with equipment disposal, including a "green procurement" strategy and a policy of upgrade and repair wherever possible.