Environmental Report Card on Computers

2005

Computer Waste in Australia

and

The Case for Producer Responsibility

Environment Victoria

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Recommendation 8	**Governments and the computer industry should work co-operatively together as a matter of urgency to jointly fund and facilitate a material identification scheme which will inform a safe and effective national take-back and recycling scheme in Australia.**
Recommendation 9	**Governments must specify, as a matter of urgency, the parameters of an industry-wide scheme (including take-back targets) and negotiate set up and implementation within a specified time. This would be facilitated by the finalisation of Government assessment of the TV industry's take-back proposals.**
Recommendation 10	**The Victorian State Government should amend the *Environment Protection Act 1970* to clarify the principles of environment protection and give priority to the principle of producer/user pays over the principle of shared responsibility. A definition of producer responsibility is required.**

1: INTRODUCTION

Around the world a new concept is emerging as a way of achieving ecologically sustainable development called Extended Producer Responsibility (EPR). The necessity of a different approach is becoming apparent with the failure of our current systems of production and consumption and product stewardship schemes to conserve resources, reduce the use of toxic chemicals and reduce waste.

As an example of the need for EPR policies in Victoria/Australia, we have highlighted the growing problem of computer waste. While there are a growing number of "social enterprises" which collect and refurbish used computers using subsidised labour and what little revenue they make from sales, the big brandowners are dragging their feet on organising a nationally coordinated take back scheme. Without such a scheme in Australia it is inevitable that a large proportion of used computers and their toxic components will end up in landfill.

Australian Federal and State Governments, in consultation with industry associations and their members, are starting to develop policies to address the current unsatisfactory situation but will they go far enough? Will these policies help to achieve an ecologically sustainable economy? Australia has been slow to adopt the product take-back policies of the European Union and Japan and is behind some of the more progressive States in the US and Canada. We can learn from the experiences of these jurisdictions.

This report has been produced to inform the current debate and to give industry and government the impetus to get over the current hurdles that have left a national computer take-back and recycling scheme balking at the starter's gate.

2: WHY EXTENDED PRODUCER RESPONSIBILITY?

When our forebears set up systems for regular, community-funded collections of domestic waste, they had no way of knowing that this policy would support the development of our modern throwaway society.

As consumer goods became more affordable, the corporate sector went hell-for-leather to create demand for its short-lived products at prices that did not take into account the full life cycle costs of its products. This is because our market accounting systems ignore the input of environmental services despite the fact that they can be easily depleted, downgraded or contaminated in the production process. These types of costs are commonly referred to as *externalities*. The market also externalises the financial costs of waste management – whether for reuse, recycling or disposal – away from the producer and into the tax system via local government rates.

This market structure results in an ever-increasing depletion of our natural capital which is a cost to future generations, and a financial burden on local authorities.

The concept of Extended Producer Responsibility has been developed to remedy this market failing. EPR works to internalise the costs of end-of-life management and pollution reduction associated with a manufacturer's product by providing a financial incentive for producers to design products with the post-consumer stage in mind.

This is the only way that Australian policy makers and consumers, who are technology takers rather than designers, can drive environmental improvements in electronic products.

EPR schemes may take a variety of forms but can generally be categorised into one of four groupings:

- take-back
- specific financial incentives such as Environmental Deposit/Refund schemes
- broader economic instruments such as Advanced Disposal Fees
- performance standards including "recycled content" requirements.

The difference between EPR and Product Stewardship

The NSW Department of Environment and Conservation Priority Statement 2004 defines EPR schemes as those that make producers "physically or financially responsible for the environmental impacts of their products throughout their lifecycle. This includes both the 'upstream' impacts from their choice of materials and the manufacturing processes they use, and the 'downstream' impacts associated with the use and disposal of products. Under NSW legislation, EPR schemes can include product stewardship schemes"

Product stewardship is often referred to as shared responsibility and suggests that all stakeholders have roles and responsibilities in managing waste, from designers and manufacturers through to retailers and consumers. Product stewardship implies that manufacturers/producers can limit their actions to within their sphere of influence (as they define it) and are, therefore, not responsible for the end of life management of their products.

3: THE LIFE CYCLE IMPACTS OF COMPUTERS

The key issues associated with computer waste are as follows:

A. The waste of the copious amount of natural resources that have gone into the production of each piece of equipment multiplied by the enormous numbers being discarded due to the accelerating obsolescence of technology.

B. The toxic materials used in computer manufacturing and the resultant health risks to users generally and, more particularly, to the workers involved production and recycling processes; and

C. The potential environmental hazard posed by the toxic materials when disposed of in municipal landfills or dumped illegally.

A. A waste of natural resources

The production of computers is a highly resource-intensive process that uses significant quantities of energy, water and raw materials. A 2004 study by the United Nations University[1] found that:

- The "materials intensity" of computer manufacturing is 10 times higher than that of automobiles or refrigerators but don't last nearly as long.
- The life cycle energy use of a computer, unlike many home appliances, is dominated by production (80%) as opposed to operation (20%).
- The manufacture of one desktop computer and standard CRT monitor requires at least 240 kilograms of fossil fuels, 22 kilograms of chemicals and 1,500 kilograms of water – equivalent to that of a mid-size car.

[1]Williams E. (2004) "Energy intensity of computer manufacturing" *Environmental Science and Technology* 38 (22) 6166 - 6174 see link at http://www.it-environment.org/publications.html

- Valuable metals contained in computers include copper, aluminium, gold, silver and tin.

The European Union's Waste Electrical and Electronic Equipment (WEEE) Directive Article 1 encourages the reuse of equipment in preference to disassembly and recycling since it reduces the amount of resources consumed and provides potential energy savings of between 5 and 20 times those gained by recycling.

The extent of the waste problem[2]

In 2005	Victoria	Australia	World
Annual sales of personal computers	750,000	3 million	> 1 billion
Number of used computers requiring management	560,000	1.4 million	100 million
Number of computers that will be landfilled	182,875	731,500	75 million
Tonnes of waste sent to landfill	4,938	19,751	> 2 million
Tonnes of hazardous materials recovered from end-of-life computers that will require management[3]	1,861	7,443	>780,000

According to a recent report (Meinhart 2004) the number of computers becoming obsolete annually in Australia will continue to grow every year, to the point where, in ten years, 1.77 million personal computers will require end-of-life management every year.

Recommendation 1

Computers need to be designed for durability, upgradability and repairability with local service infrastructure established in Victoria.

B. Exposure to toxic chemicals in manufacturing and recycling

Workers in the computer assembly industry are exposed to a wide variety of chemicals, many of which are highly toxic by themselves or in combination with other materials. Semiconductors, printed circuit boards, disk drives, and monitors contain particularly hazardous chemicals such as arsenic, benzene, cadmium, PCBs and lead in combinations whose health effects are not fully known.

Computer manufacturers have historically been reluctant to divulge internal data that would allow greater scientific understanding of risks to occupational and community health. There have been a number of well-publicised cases in the US where workers in the semi-conductor industry have brought suits against manufacturers, and more and more evidence is appearing that workers' health is being placed at significant risk through exposure to toxic chemicals.

The Catholic Agency for Overseas Development (CAFOD) produced a report in early 2004 entitled *Clean Up Your Computer: Working Conditions in the Electronics Sector* which detailed labour abuses, inhumane working practices, and unsafe working conditions in computer factories in Mexico and China. The report also examined the performance of the

[2] Figures shown are estimates only based on information taken from various studies and reports

[3] See Table 1: Environmental Impacts of Selected Materials Used in Computer Production

three leading global computer companies: HP, Dell, and IBM, and found them to be deficient when compared with globally accepted labour standards.

Since publication of the report, all three companies have published labour codes of conduct and are taking steps to improve working conditions in their factories.

Although recycling is an environmentally preferred end-of-life option to landfill disposal, it only partially addresses the range of environmental issues involved in the life cycle of computers if hazardous chemicals continue to be used in manufacture. Even in well-managed computer recycling facilities, workers face the potential of being exposed to these hazardous chemicals, both singly and in various combinations.

The export of e-waste from developed to less developed countries for 'recycling', has been internationally condemned due to the often appalling environmental and safety conditions that exist in less regulated economies.

The 1989 Basel Convention on the control of Transboundary Movements of Hazardous Wastes and Their Disposal, an international treaty under the auspices of the United Nations Environment Program was strengthened in 1995 by an amendment known as the Basel Ban. The Ban effectively bans all forms of hazardous waste exports from the 29 wealthiest most industrialized countries of the Organization of Economic Cooperation and Development (OECD) to all non-OECD countries.

Australia ratified the original Basel Convention and passed the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*. While it has not ratified the Basel Ban, it is recognised as a moral force which led to the production of revised *Criteria for the Export and Import of Used Electronic Equipment* in March 2005. The effectiveness of the current regulatory regime with respect to the treatment of hazardous ewaste in Australia is discussed in Section 5

Table 1 lists a number of commonly found materials used in computer manufacture and shows, for each material: their main applications; the percentage by weight found in a typical desktop computer (an average weight of 27 kg per CPU unit is assumed); the known environmental and health effects of each material; the recycling efficiency, defined as the percentage of each material that can normally be recovered using current recycling practices; and the volume of each material requiring management in Australia annually.

Table 1: Environmental Impacts of Selected Materials Used in Computer Production

Material	% of Total (by weight)	Main Applications in Computer Production	Environmental/Health Impacts	Recycling Efficiency[a]	Annual Waste Volume (kg.)[b]
Plastics[c] including PVC	23%	Cabling, computer housings	Various cancers; endocrine system disruption PVC emits highly toxic dioxins and furans when manufactured and also if materials containing it are burnt	20%	8,150,000
Lead	6%	Soldering of printed circuit boards and other components; glass panels in CRT monitors	Significant amounts of lead ions are dissolved from broken lead containing glass, such as the cone glass of cathode ray tubes, when mixed with acid waters which commonly occur in landfills. Accumulates in environment and has high acute and toxic effects on plants, animals, and micro-organisms Damage to nervous system, blood system, and kidneys; serious effects on child brain development.	5%	2,126, 000
Barium	0.03%	Vacuum tubes in CRT monitors	Short-term exposure to barium can lead to brain swelling, muscle weakness, damage to the heart, liver and spleen. Long-term effects of chronic exposure not yet known.	0%	10,500
Beryllium	0.02%	Used for thermal conductivity	Recently identified as human carcinogen. Exposure can cause lung cancer and skin diseases.	0%	7,000
Cadmium	0.01%	SMD chip resistors, infrared detectors, semiconductors, older models of CRTs; also used as plastic stabilizer	When plastics containing cadmium are landfilled, can leach into groundwater. Acute and chronic toxic compound which accumulates in human body, esp. in kidneys. Can be absorbed either through respiration or ingested through food.	0%	3,550
Hexavalent Chromium	0.006%	Mostly phased out, but still some limited use as corrosion protector and decorative or hardener for steel housings	Highly toxic material which can pass easily through cell membranes; causes strong allergic reactions (e.g. asthmatic bronchitis) even in small concentrations. May also cause DNA damage. Contaminated wastes can leach from landfills and also fly ash if chromium-containing wastes are incinerated.	0%	2,120
Selenium	0.002%	Used in rectifiers and printed wiring boards	Exposure to high concentrations of selenium compounds cause selenosis, the symptoms of which are hair loss, nail brittleness, and neurological abnormalities.	0%	710

Material	% of Total (by weight)	Main Applications in Computer Production	Environmental/Health Impacts	Recycling Efficiency	Annual Waste Volume (kg.)
Mercury	0.002%	Sensors and switches on printed circuit boards, batteries, switches/housing, printed wiring boards, tubes in flat panel screens	Mercury is released when electronic devices that contain it are destroyed – such as in, or on the way to, landfills. The vaporization of metallic mercury and dimethylene mercury is also a possibility. Both are highly toxic – methylated mercury causes chronic brain damage. Inorganic mercury is transformed into methylated mercury when introduced into natural water systems, where it concentrates in sediment. Easily accumulates in living organisms, especially fish.	0%	710
Arsenic	0.001%	'Doping' agents in transistors and printed wiring boards	Chronic exposure to arsenic can lead to various diseases of the skin and decrease nerve conduction velocity. It can also cause lung cancer and can often be fatal.	0%	350
PCBs (Poly-chlorinated biphenyls)	Only found in older equipment	Used in capacitors and transformers	PCBs affect the immune, hormone, nervous, and enzyme systems of the body and therefore have impacts on almost every organ. PCBs are considered by health agencies as a known carcinogen for animals and a probable carcinogen for humans.	0%	<500
TOTAL	**29-30%**			**<20%**	**~10,300,000**

a) Percentage of the material that can be recovered using current best recycling practices
b) Estimated annual volume of each waste material requiring management, based on an annual average for Australia for 2005-2014 of 1.31 million PCs being available for recycling (Meinhart report), and an assumed average weight per computer of 27kg. Note that these figures do not include CRT monitors or notebook computers.
c) Plastics also contain polybrominated flame retardants and many compounds not listed separately

The following case study outlines the risks associated with one particular class of chemicals known as brominated flame retardants, and highlights the need for addressing these issues at the source, i.e. at the point of manufacture of the constituent materials.

Case Study: Brominated Flame Retardants

Of particular concern to human health is the class of chemicals known as brominated flame retardants, which are commonly used to reduce potential flammability in computer plastics

Instead of staying put, they have been found to migrate into the surrounding air and are soluble in water. Polybrominated Biphenyls (PBBs) have been found to be 200 times more soluble in landfill leachate than in distilled water.[1]

A December 2003 study conducted by the University of Florida[2] into the impact of e-waste on landfills found unexpectedly high levels of organo-bromine compounds in landfill leachate samples, indicating not only the propensity for brominated flame retardants to migrate from landfills through leaching but also their ability to break down into products with higher abilities to bioaccumulate.

These flame retarding chemicals are also fat soluble so accumulate in the body and are increasingly found in breast milk. Research conducted in Sweden over the 25-year period 1972-1997 found levels in human breast milk of one of these substances, Polybrominated Diphenylethers (PBDEs), increasing exponentially – essentially doubling every five years.[3]

Australian levels of PBDEs have been detected at twice those found in the UK and more than five times those found in Germany.[4]

Exposure may cause increased risk of cancer, endocrine disruption and/or neurodevelopmental problems.[5]

High concentrations of PBDEs have been found in the blood of workers in recycling plants. A Swedish study found that when computers are recycled, dust containing flame retardants is spread in the air. Workers at dismantling facilities had 70 times the level of one form of flame retardant in their blood than those found in a control population. Even clerks working full-time at computer screens had slightly elevated PDBE levels in their blood.[6]

A European Union Directive, the Restriction of Hazardous Substances, will ban the sale of electrical and electronic equipment containing polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE) as well as lead, mercury and cadmium and hexavalent chromium after 1 July 2006.

[1] International Program on Chemical Safety – Environmental Health Criteria 152,1994 Polybrominated Biphenyls http://www.intox.org/databank/documents/chemical/pcbpbb/ehc152.htm
[2] Assessment of True Impacts of e-Waste Disposal in Florida Annual Report. State University System of Florida December 2003 http://www.floridacenter.org/publications/Ewaste%20Report.pdf
[3] Meironyté Guvenius et al.: Human Prenatal and Postnatal Exposure to Polybrominated Diphenyl Ethers, Polychlorinated Biphenyls, Polychlorobiphenylols, and Pentachlorophenol. Environmental Health Perspectives, Volume 11, No.9, July 2003 http://www.mindfully.org/Plastic/Flame/PBDEs-Prenatal-PostnatalJul03.htm
[4] 7.30 Report, 12 April 2005 Program transcript http://www.abc.net.au/7.30/content/2005/s1343888.htm
[5] ib id
[6] Sjodin, et al.: Flame Retardants Exposure – Polybrominated Diphenyl Ethers (PBDEs) in Blood from Swedish Workers. Environmental Health Perspectives, Volume 107, No. 8, August 1999

Recommendation 2

To protect human health, urgent action is needed by computer and plastics' manufacturers to develop and use alternatives to brominated flame retardants and other toxic chemicals.

To drive this action, the Australian Government should phase out the importation and sale of electrical and electronic equipment containing those harmful chemicals listed in the EU's Restriction of Hazardous Substances Directive.

C. End-of-life Disposal: Landfilling

Based on an average landfill compaction rate, it is estimated that over 77,000 m^3 of Australian landfill space is taken up by computer waste (2001 estimate). This is estimated to nearly double within 10 years, to approximately 141,000 m^3 per year by 2011[4]. Extrapolating from these figures, it is possible that as much as 100,000 m^3 of landfill space in Australia is taken up by computers (25,000 m^3 in Victoria).

Dumping computers in landfills represents what has been called a 'toxic time bomb'. Even landfills constructed to the highest of standards are not completely impermeable and a certain amount of chemical and metal leaching occurs over time; for older or less well-maintained sites, the potential for leakage is even greater.

Landfills contain large quantities of heavy metals such as lead, cadmium, and mercury, about 70% of which come from e-waste[5]. When these substances are released into the water, they can be ingested by animals and humans and cause serious health problems (see Table 1).

There is also the potential for fires to break out in landfills, and for the materials in them, including waste computers, to release highly toxic gases when combusted.

Illegal dumping or improper disassembly are other ways in which hazardous materials may find their way into the environment. Neither practice is widespread in Australia; however, if landfill bans are implemented, illegal dumping may become a problem.

Recommendation 3

State Governments need to plan for, and encourage, increased industry capacity to recycle end-of-life computers and set standards for the recycling industry.

4: COMPUTER TAKE BACK AND RECYCLING SCHEMES IN OTHER COUNTRIES

About 16 countries now have take-back laws for electronics, each a little different. Within five years, 30 or more countries can be expected to have such laws.

Table 2 summarises and compares e-waste take-back initiatives in the European Union and five other selected jurisdictions (one being a province of Canada). The Netherlands, an EU member, is listed separately as its legislation predates the EU mandate and it provides a good example of producer responsibility schemes which have been operating effectively for a number of years.

Appendix A provides more detail on initiatives in place in the European Union, US, Canada, Japan, and Taiwan. The EU legislation is covered in some detail, as it addresses both end-of-life management and use of hazardous substances in production, and thus embodies the strictest requirements of any jurisdiction worldwide.

[4] Meinhardt Infrastructure & Environment Group, October 2001: *Computer & Peripherals Material Project, p.27*

[5] Basel Action Network and Silicon Valley Toxics Coalition, February 2002: *Exporting Harm: The High-Tech Trashing of Asia, p.7*

Table 2: Summary and Comparison of Selected E-Waste Initiatives Internationally

	European Union	Netherlands	Norway	Alberta, Canada	Japan	Taiwan
Status & When Enacted	Pending: see below for target dates	Enacted 1999	Enacted 1999	Enacted 2004	Enacted 2001	Enacted 2000
Product Scope	Electrical and electronic products	Electrical and electronic products	Electrical and electronic products	Computer monitors, CPUs, keyboards, cables, laptops, notebooks, printers	Computers, computer accessories, and copy machines	Computers, printers, household appliances including TVs, and air conditioners
What Program Does	WEEE directive: manufacturers must fund collection, treatment, processing. ROHS directive: manufacturers must cease using lead, mercury, cadmium, hexavalent chromium and two types of brominated flame retardants.	National legislation: manufacturers and importers are responsible for take-back and processing. Suppliers must accept used equipment free of charge when selling new equipment.	National program that requires manufacturers and importers to take back and recycle end-of-life electrical and electronic products.	Provides residents with access to collection sites across the province at no charge	National program requiring manufacturers to arrange designated take-back sites, provide transportation of goods from retailers and local governments, and take back their own products free of charge	National legislation establishes that computer manufacturers, importers, and retailers are financially responsible for collection, transportation, and disposal of end-of-life products.
Who Administers	Different for each member state	The Ministry for Housing, Regional Development and Environment oversees collection and recycling.	Norway's Ministry of the Environment	Alberta Recycling Management Authority (ARMA)	Multiple Ministries	Local Government arranges for recycling and collects fee
Manufacturer Responsibilities	Manufacturers must set up treatment centres to recycle computer waste in an environmentally sound way, and collect products from non-household entities. After five years they must finance home collection services.	Local manufacturers and importers created NVMP, an industry association who ensures that computer waste is processed in the most environmentally sound manner.	Retailers and distributors are required to collect any computers from consumers free of charge, regardless of who made them or where they were bought.		In addition to the above, manufacturers must design products for longer life and more rational material usage, and for enhanced recyclability and reusability	As above
Cost/Fee Levels	Equivalent to total cost of collecting and recycling; no costs to the consumer. Cost is currently estimated to be an 1-3% on top of retail prices.	NVMP charges an advanced disposal fee based on market mechanisms of between $US1-7.	Collective financing within sectors: ICT equipment fee is subdivided among manufacturers by product share.	Recycling fee ranging from $5-$45 CAD ($US3.72-$33.44) onto the cost of computers and monitors	Collection and recycling fees for computers range from $25-$37.	Recycling costs vary depending upon type of appliance

	European Union	Netherlands	Norway	Alberta, Canada	Japan	Taiwan
Who Pays Fee	Manufacturers	Consumers pay fixed fee at time of purchase	Consumers pay at point of purchase	Likely to be passed on to consumers	Consumers pay for computers purchased before October 2001 at time of disposal; for items purchased after October 2001, consumers pay on purchase.	Manufacturer pays fee to local governments based upon sales
Collected By	Not yet clear	Manufacturers and retailers	Manufacturers and retailers	ARMA	Retailers, local governments, or designated legal entities (take-back sites)	Local Government
What Fee Covers	Collection, transportation, and recycling	Allocated to fund collection and recycling systems	Collection, transportation, and recycling	Collection, transportation and recycling; education and awareness programs; computer recycling research	Transportation and recycling from designated take-back sites	
Collection Infrastructure	Manufacturers are fully responsible for collecting and recycling their own products.			Residents will have access to collection sites across the province at no charge	Retailers act as collection points for appliances, while post offices collect computers.	Consumers return products to take-back stations or to a recycling company or municipal recycling facility
Dates & Accountability Mechanisms	WEEE directive must be in force in member states by August 2005; manufacturers must be in compliance with ROHS directive by July 2006.	Target goals for 2000 included a 53% recycling rate for small appliances including PCs	Recover 80% of computer waste by July 1, 2004.		For computers, there is a FY 2004 target of a 90% recycling rate	
Labelling for Participating Products	Computer waste must be marked with crossed out wheelie bin.	No	No		Yes	Voluntary sticker system
Success of Program?	N/A	In 2000, 64% of small appliances including PCs were recycled, exceeding national recycling target	Norway has had to take enforcement action against domestic companies that did not join the collection scheme.	Too early to tell	In 2003, there was a recycling rate for data-collection equipment of 87%.	By the end of October 2001, about 1.4 million used computers in Taiwan had been recycled – about 75% of all used computers

5: THE AUSTRALIAN SITUATION

Structure of the Australian Computer Industry

The information and communication technology (ICT) industry is one of the fastest growing industries in the world. Australia is one of the top ten countries per capita using ICT; however, the Australian market accounts for only a small percentage (less than 2%) of total worldwide shipments of computers and peripheral equipment. Computers and peripherals comprise around 7% of Australia's total imports, predominantly coming from Hong Kong, Malaysia, Singapore, and the US.

The Australian computer market is dominated by six manufacturers (Apple, Acer, Dell, Hewlett-Packard, IBM and Toshiba) who account for over 50% of the domestic market, with the remainder consisting of a large number of component and 'white box' manufacturers. These companies are subsidiaries of global companies, mostly of American or Japanese origin. Most companies do not manufacture components in Australia, but undertake assembly of equipment using components produced to the specifications of parent companies.

It is difficult to determine the number of small computer retailers in Australia and Victoria, but it is likely to be in the several hundreds in Victoria alone. The number of wholesale PC suppliers, by contrast, has halved in the past few years, with less than ten wholesalers now sharing the market.

It is conservatively estimated that over 11.4 million computers are in use in Australia.[6]

While there is a lack of definitive data on the geographic distribution of this equipment, various surveys conducted by the Australian Bureau of Statistics (ABS) show that the greatest use is in New South Wales, followed by Victoria, Queensland, Western Australia, South Australia, Australian Capital Territory, Tasmania and Northern Territory.

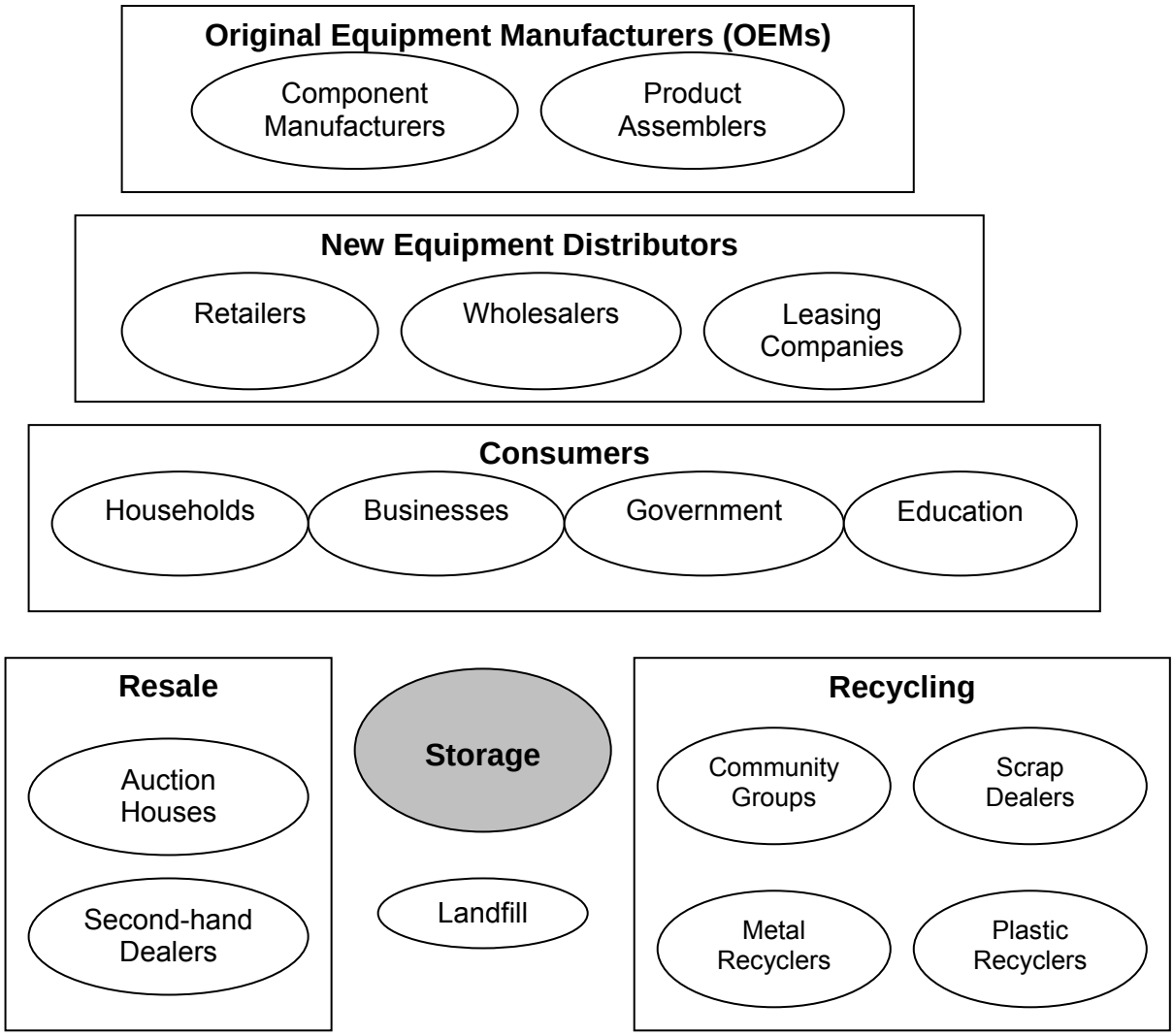
There is also a gap in data on the distribution of equipment across consumer sectors, however, estimates suggest that in decreasing order of significance they are: medium and small businesses; large corporations; Government; households and education. These estimates are based on new equipment sales; when including second-hand machines that are reused, the significance of the educational and household segments increases.

For estimating sales and distribution patterns, Victorian consumption is assumed to represent approximately 25% of total Australian sales. Based on this market share, around 600,000 new PCs are sold in Victoria annually. At the same time EcoRecycle Victoria estimates that 500,000 computers become obsolete each year in Victoria.

Table 3 below shows the structure of the Australian computer market, from initial manufacture and assembly through to end-of-life or end-of-use.

[6] Gartner research quoted in The Age *Screen savers* by Nick Galvin 21 May 2005

Table 3: The Australian Computer Market



Sales, Ownership and Usage Patterns

Over 3 million desktop and laptop PCs are sold in Australia each year.[7] Separate monitor sales have generally declined in recent years, along with a notable increase in consumers' uptake of LCD screens over traditional CRT monitors. As the price differential between LCDs and CRTs continues to decrease, and as consumers embrace other benefits of LCD displays (reduced energy use/heat generation, greater portability, compact size, etc.) the LCD market will continue to grow, leading to a temporary increase over the next several years in the number of used CRT screens requiring management.

[7] IDC Australia Press Release, February 16 2005

New computer sales in Australia by market segment are estimated as follows:

Table 4: New Computer Sales in Australia and Victoria

Sector	%	Ann. Sales (Aust.)	Ann. Sales (Vic.)
Education	14	420,000	105,000
Households	17	510,000	127,500
Government	18	540,000	135,000
Large Corporate	23	690,000	177,500
Medium & Small Business	28	840,000	210,000
TOTAL	**100**	**3,000,000**	**750,000**

Industry surveys by IDC Australia indicate that over 30% of Australian small-to-medium enterprises upgrade their PCs every 2 years.[8]

Leasing of equipment is well established in Australia, particularly in the institutional and corporate sectors. Approximately 600,000 computers are currently leased in Australia and around 240,000 computers are disposed of in this sector every year.

Leasing is also likely to become much more prevalent in the future as the life-spans of future generations of computers become shorter and users, especially commercial ones, wish to minimise technology costs. Industry participants suggest that the average lease in the USA runs for approximately 18 months before the machines are scrapped and new ones provided. In Australia, the average lease period is approximately 3 years, although this figure is decreasing.

Recommendation 4

Leasing contracts should guarantee that computers are refurbished or recycled in compliance with federal and state laws and at standards which reflect environmental best practice.

End-of-Life Management

The distinction needs to be drawn between *end-of-use* computers (those in working condition and that could be passed on to another user without being repaired or having their hardware modified) and *end-of-life* computers (i.e. computers that are uneconomical to repair and whose utility lies solely in the value of their components).For the former, there are essentially two possible management options: either refurbishment for reuse or disassembly for recycling. For computers that have reached the end of their useful lives as computers, the only final disposal options are either recycling or landfilling.

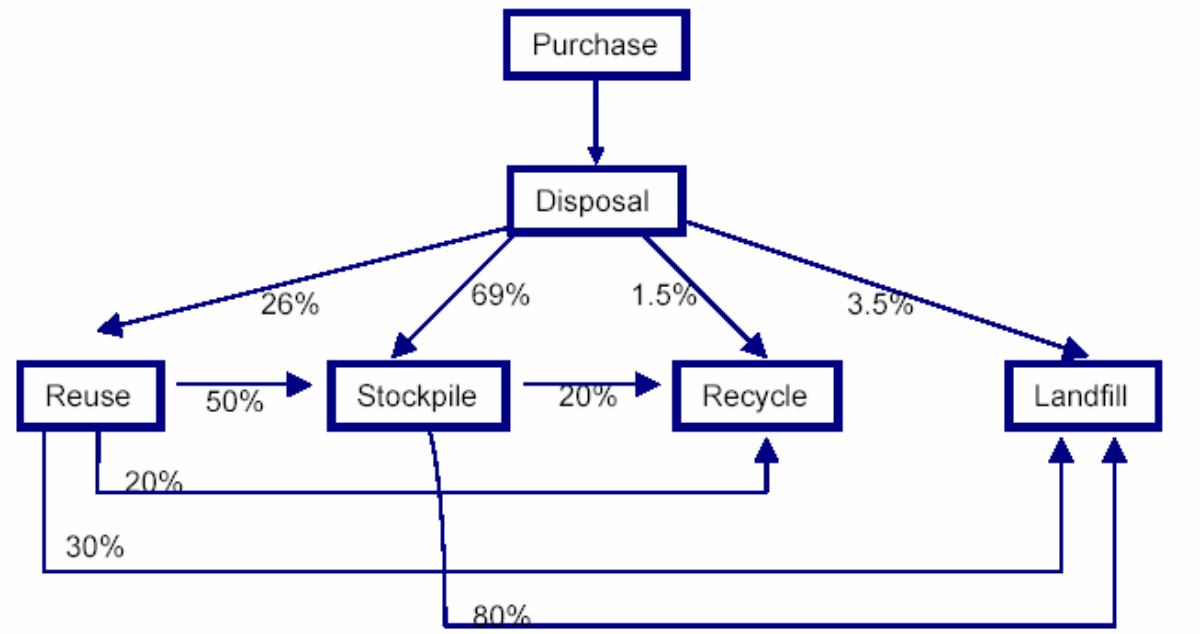
According to Meinhart (2001), the fate of used computers in Australia is as follows: at the end of their first life, 69% of used PCs are stored; 26% are reused; 3.5% are sent to landfill; and only 1.5% are recycled[9].

[8] Meinhart 2001, p.25

[9] Strictly speaking, computer 'recycling' should refer to disassembly and reprocessing of the equipment's constituent materials. Often this term is used by organisations, mostly non-profits, to describe taking computers that are in good working order and modifying them slightly to make them suitable for use again. To avoid confusion, the term 'refurbishment' will be used in the present report to describe this process, while 'recycling' will be used to refer to organised disassembly, reprocessing, and sale of constituent materials.

The eventual fate of used PCs is that 72.5% are stockpiled or sent to landfill and 27.5% are reused or recycled. Therefore, currently three out of every four used computers in Australia are potentially destined for landfill, while only one in four is reused or recycled.

*Table 5: Disposal Pathways for Used Computers within Australia (not showing export of used computers or components) (*Meinhart 2001*)*



At present most of the disassembly and recycling that is occurring in Australia is very piecemeal. Each State or Territory has a slightly different approach to the management and disposal of ewaste.

The ACT is the only jurisdiction that bans computer waste to municipal landfill. In other states, because computer waste is not formally classified as hazardous waste under the relevant state regulations, computer waste from domestic and commercial waste streams is allowed to be sent to municipal dumps.

If computer waste was classified as hazardous waste, its transport would be tracked as required under the National Environment Protection Measure - Movement of Controlled Waste Between States and Territories. The NEPM definition of 'waste' is similar to that contained in the Basel Convention.

In Victoria, certain computer waste could be classified as Prescribed Industrial Waste under the *Environment Protection (Prescribed Waste) Regulations 1998 (*Schedule 1 lists a mixture of the wastes which are contained in computers).

It is reprehensible that Australia is such a backwater when it comes to environmental standards for electronic waste from computers. Companies are taking advantage of this backward situation, failing to set the same standards in Australia as they do overseas. If industry cannot voluntarily be responsible for the whole life of their products, then Government must force them to do so.

Recommendation 5
The Victorian Environment Protection Authority should classify end-of-life computers in Victoria as prescribed industrial waste and ban their disposal to municipal landfill. Computer waste could then be tracked and monitored.

A. Refurbishment/Reuse in Australia

In the absence of any comprehensive policy on the management of end-of-use computers in Australia, (except federal control of certain exports), the main way of diverting computers from landfill is through refurbishment and reuse.

The Commonwealth's Computer Technologies for Schools program coordinates donations of surplus computers and other ICT equipment in each State and Territory. Donations are mainly from Federal and State education agencies, but some are from private donors. To date the program has delivered over 100,000 pieces of ICT equipment.

Used computers from State Government agencies in NSW, SA, and Victoria are diverted to community use through are range of partnership programs.

In Victoria, the Department of Education and Training is involved in a partnership with Green PC to train long-term unemployed people to be recruited and trained as technicians for refurbishment and reassembly of PCs. We also understand the Victorian EPA sends its used computers that are in working condition to Green PC.

Almost all of the organisations that provide computer refurbishment services are not-for-profit organisations assisted by volunteers or employing mildly disabled or long-term unemployed people. Annex B provides a more complete list of Victorian-based organisations providing these services

Most refurbishers have partnership agreements with private corporations, either in the form of in-kind donations or agreements to supply used equipment (e.g. Green PC with Amcor; Work Ventures ConnectIT! with Westpac and the NSW state government)

Microsoft's Approved Refurbisher licensing system allows authorised non-profit groups to install the Windows 98 SE operating system onto refurbished PCs at no charge. There are 12 such licensed organisations across Australia (except NT and Tasmania).

Unfortunately, an ongoing problem for these enterprises is their use as a free waste service by people not wanting to continue hoarding their old computers and not wanting to send them to landfill. Many donated computers are beyond repair and only fit for disassembly or landfilling. Thus the refurbisher is forced to decide between dumping the computer or sending it to a recycler at its own expense.

Recommendation 6

Computer refurbishers should give written guarantees to consumers that used computers will be upgraded for reuse and that any unwanted components will be sent to approved Australian recyclers and not be exported overseas contrary to Australian regulations.

B. Exporting

End-of-use computers can be exported for reuse in less developed countries if the consignment complies with the relevant Federal statutes.

The *Hazardous Waste (Regulation of Exports and Imports) Act 1989* regulates the export and import of hazardous waste within and outside Australia as required under the Basel

Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, to which Australia is a signatory.

Table 7: Materials Regulated by the Hazardous Waste (Regulation of Exports & Imports) Act 1989

Regulated	Not Regulated
Export and import of hazardous wastes, including waste electrical and electronic assemblies or scrap containing components such as accumulators and other batteries, mercury switches, glass from cathode ray tubes and other activated glass and polychlorinated biphenyl capacitors, or contaminated with constituents such as cadmium, mercury, lead, or polychlorinated biphenyl to an extent that they possess any hazardous characteristics.	Export and import of non-hazardous wastes including electronic assemblies consisting only of metals or alloys, or waste electrical and electronic assemblies or scrap NOT containing the components listed at in Column 1. Export and import of materials that do not contain any wastes, including: electrical and electronic assemblies (including printed circuit boards, electronic components and wires) destined for direct re-use, and not for recycling or final disposal (Re-use can include repair, refurbishment or upgrading, but not major reassembly). Electronic scrap (e.g. printed circuit boards, electronic components, wire, etc.) and reclaimed electronic components suitable for base and precious metal recovery when sent from one OECD country to another OECD country for recovery. (Note that the Act normally regulates this waste when it is exported to or imported from a non-OECD country, or sent for final disposal).

In 2004 the criteria for identifying electronic scrap were revised after it became clear that large quantities of used ICT equipment were being exported from Australia for re-use or recycling in developing countries. Under the *Hazardous Waste Act* and the Basel Convention, material that is genuinely going to be re-used for its original purpose is not regulated as a waste. However, old equipment that is exported for disassembly followed by re-use, recycling and recovery of its components, is regulated as waste.

In March 2005 the Department of Environment and Heritage published *Criteria for the Export and Import of Used Electronic Equipment* which is an attempt to simplify the process for determining whether or not a particular waste is hazardous or not. Most computer waste is assumed to contain hazardous components and is therefore assumed to be hazardous unless it can be proved otherwise. The onus of proof rests on exporters (and importers) to verify the status of the waste before its export can be permitted. This is a self assessment process with some auditing. This process would be more rigorous if there was better tracking of waste at the state level.

Recommendation 7

Australian governments needs to treat toxic computer waste consistently across jurisdictions so that it is tracked, monitored and assessed for end-of-life management options and to ensure that end-of-life computer waste is not being exported for recycling in non OECD countries

C. Recycling

To date, Australia has not had much capacity to recycle computers, nor any incentives to invest in reprocessing facilities. To the extent that it is happening, it is being driven by the brandowners that have undertaken their own recycling schemes (see next section).

In order to get good data to inform the development of a national take-back recycling scheme for households, EcoRecycle Victoria is planning a trial take-back program in

Melbourne. This trial will build on the results of the Recycle IT pilot scheme undertaken in NSW carried out in 2002/2003. The Recycle IT trial found that permanent collection sites were well patronised and proved that collection and recycling incur a net cost. For results of the latter scheme see Appendix C.

Another pilot scheme designed to inform the recycling of used computers is international in scope but has an Australian component. The *Promise* initiative aims to research the feasibility of embedding electronic tags with encoded recycling information in consumer electronics.

The project will conduct research on recyclable plastics from TVs, computer monitors, and peripherals, and the results will be included in an international database of best waste management practices for consumer electronic products. Information from the database will then be loaded onto electronic tags indicating date of manufacture, recyclability of components and use of toxic substances.

Recommendation 8

Governments and the computer industry should work co-operatively together as a matter of urgency to fund and facilitate a material identification scheme which will inform a safe and effective national take-back and recycling scheme in Australia.

D. Sector-wide proposals and the "white box" problem

Most of the major computer brands are members of the Australian Information Industry Association (AIIA). However, the large member companies account for only about 40% of the market for desktop and laptop computers leaving a large proportion of other brands and the producers and importers of unbranded ("white box") IT equipment difficult to capture and engage on an industry-wide financed take-back scheme.

The AIIA has set up has set up an Environment Special Interest Group to consider the drafting of a national take-back and recycling scheme for consideration of Australian Environment Ministers later in 2005.

The AIIA's policies on, and degree of commitment to, resolving these issues can be gleaned from its report *Designing for the Environment (*November 2002). This report recognises "the need for a cooperative approach to product stewardship for electrical and electronic products". It does not, however, accept financial responsibility for orphaned or historic white box equipment. To date the Association's position on this does not appear to have changed.

The May 2005 AIIA Newsletter states "Should funding of an ewaste program (whole or in part) become the responsibility of the industry sector, the program set up by industry.....will be primarily designed to be forward-looking to cover all products sold after an agreed date."

Gauging by the recent media coverage[10] of the computer ewaste problem, agreement on who will fund the recovery of non branded equipment has not been resolved, with government refusing to subsidise any scheme.

However, this situation is not as inequitable as it first appears. Information gathered from refurbishers of used equipment indicate that, when it comes to upgrades and repairs, the

[10] Computer recycling articles by Rachel Lebihan in the Financial Review of 18 and 26 April 2005

non-branded products are better designed for disassembly and upgrade because they use standard components and cheaper spare parts.

The Australian computer industry is also concerned to ensure that a 'level playing field' is established through the enacting of 'free rider' legislation to capture entities that could benefit from an industry scheme without bearing the costs of participation.

While governments are attracted to working with industry associations on environmental issues that are common to an industry sector, this approach can be problematic as demonstrated by the mobile phone recycling scheme. The main flaw, is the tendency for member companies to divest their company's responsibility for take-back to their industry association (where take-back is just one of many issues to be dealt with) and assume that it will "do the job". However, a good take back scheme can only happen if member companies are actively engaged and committed to good outcomes.

A better model is the setting up of a Producer Responsibility Organisation which has the sole function of management of end-of-life products. It is encouraging that TV brandowners have set up such an organisation (Product Stewardship Australia) which will raise funds to operate the TV take back scheme.

Recommendation 9

Governments must specify, as a matter of urgency, the parameters of an industry-wide scheme (including take-back targets) and negotiate set up and implementation within a specified time. This would be facilitated by the finalisation of Government assessment of the TV industry's take-back proposals.

If the computer industry continues to fail to overcome the barriers to a national take back scheme then the states should consider taking unilateral action to get computer waste out of landfill.

This action could involve reclassifying computer waste as hazardous waste, thereby instituting a municipal landfill ban. However, such a policy would be only a partial solution. It might reduce toxic leaching from municipal landfills and might even provide a financial incentive for reuse and recycling, (as disposal to prescribed industrial waste site is more expensive than municipal sites) but it would not raise the funds necessary to encourage collection and transport of used computers or the necessary investment in recycling and refurbishing facilities.

The other option would be for state governments to compel computer companies to take-back end of use computers with fees and levies for financing of the scheme either legislated or negotiated with industry

E. Could Victoria mandate a computer take-back scheme?

In both NSW and Victoria, computer waste is high on the priority list of wastes of concern in respective State government-endorsed waste reduction strategies.

NSW is the only Australian state whose environmental protection legislation could mandate extended producer responsibility schemes but only if voluntary industry schemes have been tried and been found wanting. To date NSW has not activated a mandatory EPR scheme and it is unlikely in the case of computers while no voluntary industry-wide scheme exists to evaluate.

Under the Sustainability Covenant section (49) of the Victorian *Environment Protection Act 1970* the state government has the power to call in an industry sector and require preparation of an environmental impact statement. However, Sustainability Covenants are meant to reflect and protect best practice and given the EPA's preference for improving industries' environmental performance through voluntary, co-operative, incremental, and reputational mechanisms, such action is unlikely.

In addition State governments are wary of possible legal impediments to going it alone on extended producer responsibility schemes which involve products that are traded nationally and move between states. Section 92 of the Australian Constitution prohibits any restriction on interstate trade and commerce and the Federal Mutual Recognition Act 1992 (mirrored in state legislation) guarantees the ability to sell goods produced in one state in another state without the need to comply with recipient state regulations.

The only relevant test of these impediments relates to challenges to the South Australian Beverage Container Act. With respect to Section 92, the High Court found that refundable deposits on drink containers in SA did not discriminate against interstate trade. In the case of the Mutual Recognition Act, the SA bottle deposit scheme has been exempted from its provisions on historical and public benefit grounds.

Therefore, on the basis of these tests, it would seem that a state wanting to mandate a take back and recycling scheme could do so and not be in breach of constitutional or legal requirements, particularly as such a scheme could focus on end-of-life and not point-of-sale.

Recommendation 10

The Victorian State Government should amend the Environment Protection Act1970 to clarify the principles of environment protection and give priority to the principle of producer/user pays over the principle of shared responsibility. A definition of producer responsibility is required.

6: COMPUTER COMPANIES' ENVIRONMENTAL PERFORMANCE

This section reviews the environmental practices of the major computer brandowners, both internationally and within Australia.

Methodology

The top six computer companies; Hewlett-Packard Australia, Dell Australia and New Zealand, Acer Computer Australia, IBM Australia/NZ, Apple and Toshiba were chosen for evaluation. Together they represent about 58% of the market for desktop and laptop computers in Australia. The rest of the market is occupied by numerous other non proprietary computer hardware suppliers. While none of the major producers has a dominant place in this market structure, we considered that as the top six are large global companies they should be showing leadership on the environmental issues facing the industry.

While IBM has sold its PC division to Lenovo it has been evaluated against other PC companies because there is still many IBM computers in the market to be recovered and Lenovo-manufactured computers will be made to IBM specifications.

Information on the companies was sourced using publicly available information on each company website, written and oral responses to our inquiries and independent

assessments from other sources such as the Silicon Valley Toxic Coalition's (SVTC) *Clean Computer Report Card*, the Australian Conservation Foundation's *Corp Rate* and the Australian National Reputex Index.

The following criteria were used to evaluate the performance of these companies:

- Existence of local product take-back schemes which are user friendly
- Participation in, and commitment to, industry-wide take-back scheme.
- Ease of access to information relevant to Australia on company website
- Commitments to worker health and safety, reduction of toxics in manufacturing, design for disassembly/remanufacturing. Documentation of commitments with specific, measurable, and timed targets for achieving objectives.

A ranking of the companies was attempted using 26 criteria with total marks for all criteria adding to 100. Each criterion was marked against current best practice rather than an ideal "closed cycle" production process**.**[11]

The combined criteria assessing local take-back aspects of producer responsibility was allocated a higher percentage of the marks, reflecting, not so much the most effective ways of reducing the environmental impact of electronic goods, but rather the degree of control that can be exerted by local subsidiaries of global companies in Australia. However, the assessment did not include a detailed investigation of what happens to computers that are taken back.

Due to the difficulty of assessing the technical specifications of different computer products and other information gaps caused by the inability of some companies to respond to our inquiries within the time period allocated, we were unable to rank the companies' environmental performance with a sufficient degree of accuracy.

However, some general comments follow on a range of factors pertaining to the environmental impacts of computer use in Australia

Internationally, environmental improvements in product design and end-of-life management of computers are being driven by Japanese manufacturers and regulation in the larger markets, particularly Europe. While these regulations are setting benchmarks for the industry, they are not yet the ideal of a "closed cycle" manufacturing and distribution process.

Company take-back programs

Dell, offers to take back all products from all sectors and provides a dedicated contact number for the service. There is a cost for the service depending on the state and age of the equipment. Dell is the only company offering a service to the household and small business sector which accounts for about 45% of all computers sold. Hewlett Packard provides a similar service covering all products but this applies mainly to the corporate sector. As far as we know, the other companies' recovery programs are limited to recovery of their own brand from corporate customers.

[11] This would only occur where the manufacturer provides a computing service and takes complete responsibility for the lifecycle of the product (reusing all components without waste). Hazardous components would be designed out of the product and easy upgrades would delay the need to completely recover all components for reuse or recycling.

Participation in industry association co-ordinated take-back proposal
Dell, Hewlett-Packard, IBM and Apple are members of the Australian Information Industry Association and its Environment Special Interest Group that is developing a co-ordinated take-back proposal for approval by governments. Acer and Toshiba are not AIIA members.

Environmental Management Systems
All of the companies had ISO 14001 certification although the extent to which this covered different aspects of their business seemed to vary. All had their manufacturing plants certified and, from what we were able to gather, most had suppliers that were either ISO certified or in the process of being certified.

Acer's website states that the scope of its EMS "extends to the entire life cycle of IT products, from design, manufacturing and supply management, sales and marketing, to after-sales services". Currently, 99% of its suppliers have acquired the ISO 14001 certification.

According to Dell's website, the company plans to include additional operations in its EMS such as product design, services, procurement and logistics. At Dell, measurable targets are set, measured and reported on. The same is true for HP, whose Global business is ISO certified and progress in reaching targets is publicly reported.

IBM is the only company that has an audited Environment and Well-Being Progress Report covering its Australian and New Zealand operations which is available on its website. It is to be commended for this initiative.

Progress towards the Removal of Hazardous Substances
The European Union Restriction of Hazardous Substances (RoHS) Directive, which applies to all electrical and electronic products and their component parts, offered for sale into the European Union after 1st July 2006, restricts the presence of the six substances: lead (Pb), cadmium (Cd), mercury (Hg), hexavalent chromium (Cr^{6+}), polybrominated biphenyl ethers (PBB), and polybrominated diphenylethers (PBDE).

All companies seemed to be aware of the need to be RoHS compliant by 1 July 2006. Apple stated that it was on track to reach this deadline. Acer and Dell stated they were ahead of schedule.

In addition, Acer stated that it aims to sell lead-free products from January 2006 and that it was also banning or phasing out polychlorinated biphenyls (PCB), polychlorinated naphthalenes (PCN), chlorinated paraffin (CP) (C10~C13), chlorofluorocarbons/hydrogenated chlorofluorocarbons (CFC/HCFC), azo compounds, organic tin compounds, formaldehyde, asbestos, and polyvinyl chloride (PVC).

HP has a stated goal of applying the RoHS directive to goods sold in any market. The company first started shipping RoHS-compliant components in 2004 and has a transition plan in place for its entire product range.

IBM provides detailed website information on its approach to designing out hazardous chemicals, however we couldn't find any target dates.

Clarity of Consumer Information
In this era of Corporate Social Responsibility and Triple Bottom Line reporting, it was disappointing that so much of the research for this report was hampered by websites that were difficult to navigate and text that lacked clarity of expression. To some extent, this is a factor of Australia being a small "branch office" for these global companies. As a result,

the Australian websites of these companies, with a few exceptions, presented like a sales catalogue and searches for company information ended up in the maze of the country-of-origin website.

The companies with dedicated environmental managers in Australia, HP and IBM, were better able to furnish us with environmental information relevant to Australia. However, the communications managers from Acer and Dell also responded in detail to our inquiries.

Overall, it is disappointing that, despite being involved in co-ordinated take-back and recycling schemes in other countries (where such arrangements are compulsory), these companies and their industry association have not been able (to date) to devise a co-ordinated land-fill avoidance scheme in Australia.

All of these companies are large multinational companies with a relatively large proportion of the Australian market and should have the capacity to do better.

7: Conclusion

It is clear that Australia's serious and growing e-waste problem is largely attributable to the patchy environmental performance of computer manufacturers worldwide and the lack of a co-operative industry take-back scheme in Australia. This is the result of a lassai faire attitude of government which ignores its own regulations with respect to hazardous waste and the principles enshrined in its environment protection legislation. Australia's federalist system of government and the fragmented nature of the computer industry have been used as excuses to procrastinate on reaching agreement on a national take-back and recycling scheme.

While recognising that recycling is not the total solution to the ewaste problem, mandating producer responsibility for end-of-use and end-of-life computers is the only way that Australia, as a technology taker, can drive better equipment design and cleaner, safer production techniques.

8: Recommendations for Action

Governments must be clear about the practical implications of their responsibility to protect the environment from the actual and potential threat of hazardous electronic waste. They must set objectives and timelines for resource recovery, reuse and recycling of computer waste.

We consider that governments' duty to the public goes well beyond ensuring a level playing field for industry: Governments should be:

- setting measurable, staged targets for recovery of used or end of life computers.
- mandating or negotiating the most effective take back scheme at least cost. This may include market based incentives such as advanced disposal fees at point of entry or point of sale.
- if market-based instruments, which have automatic sector wide coverage are not introduced, then sufficient enforcement resources must be provided to ensure that non participating companies are identified and made to contribute to a sector wide scheme
- incorporating into legislation the European Union's Restriction of Hazardous Substances Directive with a timeline for the phase out and non acceptance for sale in Australia of equipment containing heavy metals, chromium and brominated flame retardants.

- as an interim measure, supporting and facilitating the development of toxic material and component identification systems to assist safe refurbishment and recycling.
- supporting and facilitating the development of best practice recycling infrastructure and processing in Australia.
- instituting a landfill ban for toxic ewaste
- supporting and facilitating consumer awareness and education.
- ensuring government tenders for purchase or lease of office computers includes end of use take-back and refurbishment or recycling

The Computer Industry must accept logistical and financial responsibility for the costs of a post-consumer-friendly collection system and reuse/recycling operations. It should also accept that:

- It is funded from levies or deposits on importers/wholesalers on receipt, or consumers at point of sale, and not at point of disposal.
- It is responsible for orphaned products
- Any voluntary scheme to which government is a party, should be considered public policy and subject to independent, periodic evaluation.
- It is responsible for ensuring that any of its used products which are exported are in working order and not destined for recycling ie not in breach of Basel Conventions
- It brings pressure to bear on headquarters to improve the design features of the product to eliminate toxic components, build in longevity, repairability and recyclability.
- Labelling and advertising of environmental features must be honest and verifiable
- Computer retailers and installers offer a take back service or take back advice to customers

The Computer Industry must respond appropriately to the environmental and ethical concerns of the community. It must assume high levels of producer responsibility to solve the ewaste problem it has created and profited from.

The Computer Industry must not

- continue to let its products contaminate landfill
- continue to let social enterprises and charities bear the burden of diverting used computers away from landfill.

What the consumer can do

- Make use of purchasing power. Buy or lease a new computer only if needed and choose the most environmentally sound option – for example, look for labels indicating the machine is energy-efficient.
- Buy computers that can be easily upgraded to avoid having to purchase entire new systems as technologies advance.
- Don't throw away old electronics. Some manufacturers take back old computers – such as Dell – Ring them for a quote on pick up. Urge manufacturers to dispose products responsibly.
- Donate old computers to organisations that can refurbish or reuse the parts (ask for a written guarantee of safe disposal).
- Write to your Federal or State Environment Minister or local member urging them to take action to bring Australia into line with European standards of producer responsibility

It’s time the Australian IT Industry accepted its responsibility to

Take IT Back

APPENDIX A

COMPUTER TAKE BACK AND RECYCLING SCHEMES IN OTHER COUNTRIES

European Union

The EU produces over 6 million tonnes of WEEE a year, over 90% of which is either landfilled, posing risks to water supplies through leaching, or incinerated, which can result in the formation of highly toxic atmospheric pollutants if hazardous materials are not removed beforehand. WEEE is also the fastest growing element in the waste stream, increasing at 12% per annum.

The EU's Waste Electrical and Electronic Equipment (WEEE) Directive, aims to reduce the waste arising from electrical and electronic equipment and improve the environmental performance of all those involved in the life cycle of electrical and electronic equipment, was adopted by the European Union on 13 February 2003. It is binding on all 25 member states and must be adopted into their national laws by August 2005[12].

WEEE includes all components that form part of a product at the time it is discarded as waste. An item is regarded as waste when it is discarded and falls out of the normal commercial chain, even if it has a positive value (e.g. computer motherboards).

A related EU directive, the Restriction of Hazardous Substances Directive (RoHS), aims to remove hazardous materials from EEE. After July 1 2006, no new equipment sold may contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). Non-complying products will be banned from sale in the EU.

The WEEE Directive aims to minimise the environmental impact of all waste electronic equipment through the following measures:

- Encouraging the reuse of used equipment and components
- Separate collection of WEEE from other waste streams
- Retailers to offer free take back of like for like products
- Only approved recyclers to be used to treat WEEE using best available techniques
- Pre-treatment of cathode ray tubes, batteries, toner cartridges, and flame retardant plastics prior to disposal.
- Recycling 65% and recovering 75% by weight of IT products discarded as waste (to "recover" means to recycle materials or treat by waste-to-energy incineration)
- Producers to pay for recovery and recycling of WEEE from private households
- Users other than private households (e.g. businesses and public organisations) can conclude an agreement whereby users or another party take on liability for WEEE recovery and recycling costs, encouraging reuse sales.

<u>Producer Responsibility</u>

This is a key theme of the WEEE Directive, based upon the principle that producers select the materials and components used, and so should bear the financial consequences of these decisions. Traditionally, taxpayers have picked up such costs without being able to influence the design and selection of materials in the products they purchase.

[12] (It is now likely that this deadline will be extended, since Greece is the only member state so far that has written language clarifying equipment manufacturers' responsibilities into law. Germany formalised the directive but said it would not meet the August 13 deadline, with producer-funded take-back and treatment now expected to begin there on March 1, 2006. And the UK government has decided to delay implementation until January 2006 to give stakeholders time to agree on how to implement the directive effectively).

Since early 2005, all producers have been required to register their company and supply data on the amount of equipment placed on the market in 2004. From August 2005, producers will have to fund collection, treatment and processing of WEEE and show that they have met recycling and recovery targets. They will also have to demonstrate that financial provision has been made for the collection, treatment and processing of post August-2005 products, unless the company has registered with a compliance scheme.

For equipment supplied to businesses after August 2005, producers will finance collection, treatment and recycling or disposal, unless alternative arrangements have been made with the user. This latter arrangement is designed to encourage businesses to reuse equipment by reselling it. For equipment supplied before then, producers are only responsible for financing the removal of equipment on a like for like basis.

Producers must provide information on components that can be reused or recycled, keep records on the mass of components and materials that enter and leave the treatment facility, and ensure that products are labelled or marked with WEEE symbols.

Users

Business users must separate WEEE from other waste and ensure it is passed for treatment to an approved treatment facility.

Up to August 2005, 'Historic WEEE' (items placed on the market before this date) can be collected freely by distributors on a one-for-one, like-for-like basis. This means that anyone buying, say 50 computers, can expect the distributor to collect up to 60 PCs or any other computer items, free of charge. If the user does not have to, or wish to, dispose of their used computers at this time, they will be responsible for its disposal when they do decide to discard the items. Waste treatment, and reporting on recycling and compliance, will follow the same requirements as for producers.

Distributors/Retailers

Distributors and retailers will have to offer like-for-like in-store take-back from 13th August 2005 or register and contribute to a central fund or registered compliance scheme to manage their WEEE obligations. They can pass items collected under take-back schemes to producers free of charge for recycling and disposal.

Transfer of Obligations

Users and producers can conclude an agreement whereby users or another party take on liability for WEEE recovery and recycling costs, encouraging reuse sales.

Japan

The *Law for the Promotion of Utilisation of Recycled Resources* was enacted in 1991 to set standards for the use of recycled materials by domestic manufacturers and facilitate ease of recycling in product design. A *Basic Law for Establishing a Recycling-based Society* was approved by Cabinet in June 2000 as an overarching framework for more specific laws related to recycling and EPR.

Japanese businesses have been required to recycle PCs since 2001, and since October 2003, the law has required manufacturers to collect and recycle used computers, with home consumers required to pay a fee of 3,000-4,000 yen ($AUS 33-44) per unit, included in the cost of purchase.

Under the Japan Electronics and Information Technology Industries Association (JEITA), Japan's 36 largest PC manufacturers, who cover 98% of domestic production, have set up a collection system using Japan's network of around 20,000 post offices. Consumers can

either drop off used equipment at a post office or arrange for home collection. PCs made by the companies participating in the JEITA program carry a recycling logo to show that the recycling fee has been paid on purchase; for orphaned or white box PCs, users must ask municipalities to collect them if the manufacturer does not have an office in Japan.

The Japan Environment Association (JEA) administers the *Eco-Mark* labelling program under the authority of the Environment Agency. Certification criteria for computers were released in 2000 and include design for recycling, take-back and recycling provision, elimination of hazardous substances, and energy conservation.

Taiwan

In July 1998, Taiwan became the first country to mandate recycling of used computers through national legislation.

Taiwan is the world's third largest producer of computer equipment and its compulsory scheme makes manufacturers, importers, and retailers financially responsible for the collection, transportation, and disposal of end-of-life computer products.

The scheme is administered through the government-created *Environmental Protection Administration Recycling Management Fund,* and has resulted in an extremely high rate of 75% for recovery and recycling of used computers. The fund, which also covers printers, household appliances, TVs, and air conditioners, is drawn from recycling fees paid by computer manufacturers.

United States of America

In the US, electronics makers and legislators are currently trying to craft a national take-back plan which would include federal legislation if passed. If not, there will inevitably be continued, and inconsistent, e-waste initiatives in individual states: in 2004, there were about 36 bills awaiting ratification in 22 states, and 65 mercury-related restriction bills, 10 of which affect consumer electronics.

The Environmental Protection Agency (USEPA) administers several programs aimed at minimising the environmental risks arising from both manufacture and disposal of ICT equipment, through the *Common Sense Initiative, Design for Environment (DfE)* and *Waste Wise* programs. Computer-related projects include the following:

- *The DfE Computer Display Project*, which is a partnership with members of the display industry (e.g. Apple, Sharp, Sony and the Electronics Industry Association) and the community sector to evaluate the life cycle environmental impacts of CRT and LCD displays.
- The *DfE Printed Wiring Board Project,* which involves 10 representatives from community, Government, industry and research sectors to examine alternative technologies to reduce the volume of hazardous waste from printed circuit boards.
- The *Waste Wise* program, a voluntary scheme to encourage pollution prevention and recycling, which includes 32 partners from the computer industry sector.
- The Computer & Electronics Sector Subcommittee of the *Common Sense Initiative*, which has 25 members representing government, industry, and health and community organisations. The subcommittee has initiated pilot residential recycling projects for electronic products, investigated regulatory barriers to CRT recycling, and hosted a conference on electronic product recovery and recycling.
- The *Electronics Recycling Initiative* run jointly by the National Recycling Coalition and US Postal Service to promote recovery and reuse of electronic equipment and encourage environmentally responsible design, manufacture and purchase.

Disposal of some computer materials (e.g. Ni-Cd batteries) is regulated under the *Universal Waste Rule* issued by USEPA in 1995, which is designed to reduce the amount of hazardous waste items in municipal solid waste, encourage recycling and proper disposal, and reduce the regulatory burden on businesses that generate these wastes.

Individual states have adopted their own, often conflicting, directions on the management of waste computers and peripheral material – the following are some examples showing the need for unified national legislation in the US:

- Massachusetts declared by State rule that unbroken CRTs are not hazardous waste, however the US EPA disagree with this interpretation for being less stringent than federal legislation requirements.
- In Florida, CRTs are considered hazardous wastes when deposited to landfill or combusted in waste incinerators; they are not hazardous wastes when reused as a substitute for commercial products (e.g. glass for new CRTs or as a fluxing agent in secondary lead smelters).
- California has determined that only hazardous waste facilities should legally accept CRTs, and that disposal by existing collection and recycling facilities is illegal; it has therefore introduced emergency regulations to address CRT disposal.

Canada

Since waste issues in Canada are handled at the provincial and municipal levels, there are presently no national regulations dealing with e-waste.

In December 2002, Electronics Product Stewardship Canada (EPS Canada), representing the country's major ICT companies and the consumer electronic sectors, was formed. EPS Canada works with provincial governments across the country to develop programs for the collection and recycling of computers and other e-waste products. In June 2004, the Canadian Council of Ministers of the Environment (CCME) endorsed 12 national principles for the management of e-waste, specifying that financial responsibility for managing e-waste is to be primarily borne by producers and not by taxpayers.

The province of Alberta was the first to enact computer recycling legislation: from February 2005, a $30 recycling levy is now charged on every new desktop computer sold. Ontario has passed the *Waste Diversion Act* which requires manufacturers and sellers to reduce waste from packaged products and a range of electronic items including computers.

Most other Canadian provinces also have the authority to require take-back of e-waste. Industry has agreed on a visible fee concept, and is negotiating with some provinces on whether they will require take-back of more than computers, peripherals, and TVs, the items discussed by industry.

APPENDIX B

Computer Refurbishers and Recyclers in Victoria

Name	Address	Phone	e-mail	Website
Business to Community (B2C) Recyclers	114-116 Campbell Street Collingwood 3066	9416 2604	darren@com-it.net.au	www.b2crecyclers.com.au
Computerbank Victoria	483 Victoria Street West Melbourne 3003	9600 9161	mailkylie@optushome.com.au	http://vic.computerbank.org.au
Green PC/Infoxchange	375-377 Johnston Street Abbotsford 3067	9418 7400	vic@greenpc.com.au	www.greenpc.com.au
PC Recycling	87 Swan Street Richmond 3121	9421 2736	info@pcrecycling.org.au	www.pcrecycling.org.au
Equipment Recycling Network Inc.	17 Greenwood Avenue Ringwood 3134	9879 5211	erni@erni.asn.au	www.erni.asn.au
PC Graveyard	84-86 Station Street Norlane 3214	5275 8835	recycle@pcgraveyard.com.au	www.pcgraveyard.com.au
Enhance IT	12 Hall Street Eaglehawk 3556	5446 3477	enhanceIT@bigpond.com	http://www.enhanceit.org.au/contact.html
Drive In Salvage Centre	Shanley Street Wangaratta 3676	5721 6661	blooby@bigpond.net.au	www.driveinsalvage.com.au
Sims E-Recycling (formerly Global Remarketing)	275-281 Boundary Road Braeside 3195	8586 7777	rick.wakelin@globalremarketing.com.au	www.globalremarketing.com.au
MRI Australia	20-24 Dennis Street Campbellfield 3061	1300 858 550	mri@mri.com.au	www.mri.com.au
Outlook Environmental (formerly Minibah Recycling)	29 Racecourse Road Mornington 3931	8790 1764	enquiries@outlookenviro.org.au	www.outlookenviro.org.au

APPENDIX C

Recycle IT!

The *Recycle IT!* computer collection pilot program was conducted in western Sydney between November 2002 and April 2003 by the Australian Information Industry Association (AIIA) and the Sustainability Programs Division of the NSW Department of Environment and Conservation, with the following objectives:

- Testing the effectiveness of promotion and collection methods for unwanted computers and peripherals from households and small businesses;
- Establishing benchmarks for existing infrastructure, the types and ages of unwanted equipment, and current computer reuse/recycling rates;
- Understanding costs of collection, transportation, recycling and reuse; and;
- Informing the development of voluntary collection and recycling schemes by industry for computers and peripherals based on a product stewardship approach.

All brands of computer equipment were accepted through three types of collection methods: permanent sites (waste management centres and retail outlets); one-day events; and special events with limited access (at schools and corporate facilities).

A total of 6,383 pieces of equipment, including non-computer-related products (<5% by weight) were collected, with a total weight of almost 57,000 kg. On average, 80% of equipment was last used in households, 18% in small businesses, and 2% in schools.

Overall participation at permanent sites indicated good levels of support for a permanent public drop-off scheme. This collection method was also the most cost-effective based on the amount of equipment collected. Neither the one-day nor the special events produced substantial results in terms of the level of participation or quantity of equipment collected.

Most of the items collected were monitors (2,195), followed by CPUs (1,627). By weight, these two types of equipment together made up almost 75% of the equipment collected. Branded items comprised 71% of the number of items collected, representing 677 different brands. 28% of all equipment was made up of branded equipment from companies that no longer trade in Australia (orphaned products).

45% of all collected equipment by weight was either unbranded (17%) or orphaned (28%). About 44% of equipment by weight was sent for resale (reuse), the majority to HMR Australia's repair facility in the Philippines, where minor repairs were made to the equipment before its resale into the local market. Only 1% of collected equipment was suitable for sale directly back into the Australian market.

The remaining 2,735 items of equipment (56% of all equipment collected) were sent to HMR's Central Processing Facility) in Melbourne for disassembly and materials recovery. A total of 22,892 kg (or 86% by weight) of components and materials were recovered.

Material recovery rates were 77% for monitors, 89% for CPUs, and 88% for other equipment types combined. The remaining materials (3,800 kg) were landfilled: the majority of these were plastics contaminated with brominated flame retardants.

The cost of processing was minor in comparison with the cost of promotion and collection. Analysis also indicated that permanent site collection was the most cost effective method.

Analysis of Findings

Perhaps the most interesting finding of the report is the large number of different brands collected. This is a point often mentioned by the AIIA when discussing take-back schemes and the need to develop a strategy for dealing with 'white box' products.

The report also has some value in providing a 'snapshot' of community usage and disposal patterns. Other than this, its findings – that permanent collection sites are the most effective method; that collection and reuse/recovery is a cost, not a revenue generator; and that external funding is required to cover shortfalls – are hardly surprising.

Concentrating as it does on end-of-life management, the report does not address product life cycle issues, vital in any discussion of EPR schemes. It is difficult to see how the information presented in the report could be useful in developing collection and recycling infrastructure (it is noteworthy that the report specifically refers to voluntary schemes and product stewardship, not EPR).

Appendix D

DESIGN FOR THE ENVIRONMENT

Eco-Innovation and Sustainability

A 2004 report entitled *Digital Eco-Sense: Sustainability and ICT*[13] notes an emerging paradigm for sustainable development called 'eco-innovation' which is based on an increasing awareness of the potential for technology to shape development in a way that benefits business, the environment, and society. The key principles of eco-innovation are:

- Valuing prevention
- Preserving and restoring 'natural capital'
- Life cycle thinking
- Increasing 'eco-efficiency' by 'factor x'
- Decarbonising and dematerialising the economy
- Focusing on design of products and product-services

Some academics and business leaders believe that ICT has great potential for delivering these benefits – however such optimism needs to be tempered with the realisation that the ICT revolution has not automatically led to a reduced demand for natural resources. The potential is there for ICT to achieve sustainability outcomes.

The following examples are ways in which the ICT industry can redesign computer products, and the structure of the industry itself, to reduce its environmental impacts:

- Reducing the overall number of parts and materials used
- Labelling materials, or coding them using electronic tags, to facilitate recycling and provide information on toxicity
- Use of metals in preference to plastics, as they are easier to recycle
- Standardisation of components to make disassembly easier
- Avoiding glues that contaminate the recycled materials, making sorting difficult
- Reducing the number of screws and using parts that snap together (and if screws are used, using the same type of screws, all oriented in the same direction, so they can be removed in rapid succession, using one tool)
- Eliminating paint and dyes that contaminate and weaken plastics when recycled

[13] lab.3000 supported by EcoRecycle Victoria

- Switching to water-based paints which can be easily dissolved
- Creating computer components and peripherals of biodegradable materials
- Re-evaluate use of 'cheap' products which downgrade the product cycle and reduce the viability of disassembly and recycling
- Technology and knowledge sharing between manufacturers and demanufacturers
- Encouragement and promotion of green procurement for corporate buyers;
- Transform current sales model of providing 'products' to one of providing 'services'

APPENDIX E

OECD Requirements

The OECD has issued guidelines entitled *Environmentally Sound Management of Used and Scrap Personal Computers (PCs)* for use by its member countries, which includes Australia. The guidelines cover end-of-life management of PCs and their constituent materials, but not product design, materials selection, or energy efficiency.

The movement of materials found in computers and peripheral equipment between OECD countries is controlled by Decision of the Council concerning the Control of Transfrontier Movements of Wastes Destined for Recovery Operations. Electronic scrap and solid plastic wastes are classified as "Green" tier items, and their movement is not subject to additional OECD controls above those normally applied in commercial transactions. Glass from CRTs and used batteries is classified as "Amber" tier materials, and requires that written consent be provided by responsible authorities before shipping occurs.

Standards

The physical characteristics of computer equipment are influenced by a variety of design standards produced by a number of organisations, including Standards Australia, the International Standards Organisation, the International Electrotechnical Commission, and the Institute for Electrical and Electronic Engineering. Standards of particular relevance to the ICT industry relate primarily to PCBs, including the following Australian Standards:

- AS1795 *Sheets and Boards for Electrical Purposes*
- AS2546 *Printed Boards*
- AS3508 *Printed Board Assemblies*

Whilst the majority of standards refer to the minimum acceptable performance of a particular component rather than specifying the materials used in their construction, some standards provide an opportunity to improve the choice of materials. For example, ISO11469 *Standardised Material Marking System* provides a framework for identifying plastics used in the construction of a product and is used by several major computer companies to facilitate identification of parts for recovery.

Some standards mention environmental considerations within design (e.g. Standards Australia HB98 - 1997 *Guidance on Environmental Aspects in Specifications and Design Briefs for Electrotechnical Products*, or IEC60249 *Base Materials for Printed Circuits,* which instructs designers of PCBs to consider the risk of emission of hazardous substances arising from combustion or incineration).

Annex A
Glossary of Acronyms

AEEMA	Australian Electrical and Electronic Manufacturers Association
AELA	Australian Environmental Labelling Association
AIIA	Australian Information Industry Association
BAN	Basel Action Network
CESA	Consumer Electronics Sales Organisation
CPU	Central Processing Unit
CRT	Cathode Ray Tube
DEH	Department of Environment and Heritage
DfE	Design for Environment
EPAV	Environment Protection Authority of Victoria
EPHC	Environment Protection and Heritage Council
EPR	Extended Producer Responsibility
ERV	EcoRecycle Victoria
EU	European Union
ICT	Information and Communications Technology
IT	Information Technology
LCD	Liquid Crystal Display
NEPM	National Environmental Protection Measure
NSWDEC	New South Wales Department of Environmental Conservation
OECD	Organisation for International Cooperation and Development
PBB	Polybrominated Biphenyl – type of brominated flame retardant
PBDE	Polybrominated Diphenylethers – type of brominated flame retardant
PCB	Printed Circuit Board
PCB	Polychlorinated Biphenyl
PSA	Product Stewardship Australia
PVC	Polyvinyl Chloride
SVTC	Silicon Valley Toxics Coalition
TCLP	Toxicity Characteristics Leaching Procedure
WEEE	Waste Electrical and Electronic Equipment

Annex B
References

Reports & Papers - Australia

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Meinhardt Infrastructure & Environment Pty Ltd report for Multimedia Victoria (March 2004): *Electronic Waste Recycling Development Strategy for Victoria*

NSW Department of Environmental Conservation (October 2004): *Recycle IT! Computer Collection Pilot Summary Report*

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Global Futures Foundation report for the U. S. Environmental Protection Agency Region IX (May 2001): *Computers, E-Waste, and Product Stewardship: Is California Ready for the Challenge? A Menu of Policy Options for Computer Extended Product Responsibility*

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Environment Protection and Heritage Council (December 2004): *Industry Discussion Paper on Co-Regulatory Frameworks for Product Stewardship*

Environment Victoria and Total Environment Centre (February 2005): *Submission to EPHC Industry Discussion Paper on Co-regulatory Frameworks for Product Stewardship*

Environmental Standards

Australian Environmental Labelling Association, Inc.: *AELA 24-2005*

Guidance Documents and Manuals

OECD (2001): *Extended Producer Responsibility: A Guidance Manual for Governments*

WISE Briefing Notes (2003): *Extended Producer Responsibility*

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