

E-waste management in the VET environment

Virginia Waite

NORTH COAST TAFE

Participant in the NCVET Building Research Capacity
Community of Practice Scholarship Program 2009

NATIONAL VOCATIONAL EDUCATION
AND TRAINING RESEARCH AND
EVALUATION PROGRAM
OCCASIONAL PAPER



Australian Government

Department of Education, Employment
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About the research

E-waste management in the VET environment

Virginia Waite, North Coast TAFE

Building the research capacity of the vocational education and training (VET) sector is a key concern for the National Centre for Vocational Education Research (NCVER). To assist with this objective, NCVER supports a community of practice scholarship program, whereby VET practitioners without research experience are given the opportunity to undertake their own research to address a workplace problem. Scholarship recipients are supported by a mentor, and NCVER publishes their research results.

Virginia Waite participated in the 2009 community of practice. Virginia is an information technology teacher at the Kempsey campus of the North Coast TAFE. Her research draws on the Australian literature on the management of e-waste and then examines the results of a survey, distributed to campus managers and project coordinators throughout the North Coast TAFE, to uncover what practices they currently have in place to deal with e-waste.

Virginia finds that, at the local level, there is a willingness to sort, store and dispose of e-waste in a more sustainable way rather than disposal via landfill. However, TAFE employees face issues with storage and transport of e-waste.

Tom Karmel
Managing Director, NCVER

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Introduction

Digital technology has permeated all aspects of modern life. Business practices have changed due to the use of internet technologies, while social networking has changed the way we communicate. Across the globe most countries have fully embraced the advancement of digital technology. In terms of world standards Australia is very 'e-ready'; however, one issue concerning the uptake of technology that Australia is yet to address is how to dispose of digital technology in an environmentally sound manner.

The recycling of electronic waste (e-waste) has become a global issue. European countries have introduced legislation to address the issue and, while this legislation has had some initial problems, it has at least put into practice a level of policy. Australia is looking to follow suit and to introduce legislation that deals with the responsible disposal of e-waste, including for regional and rural areas, and returns the cost of recycling back to the producers of the electronic equipment.

Many Australian industry groups have recognised the need for a 'cradle to the grave' approach to managing e-waste, as well as the need to address the environmental issues of using landfill for e-waste disposal. However, some have argued, based on high recycling costs and the impact on the environment of transportation from rural and regional areas, that landfill use should be continued for smaller items of e-waste.

The Australian Government has recently released a National Waste Policy (NWP) aimed at introducing a level of regulation for the recycling of toxic waste and the phasing-out of landfill use for some waste streams, as well as a reduction in the use of the toxic materials used in the manufacture of electronic equipment. The national policy lists the government's aims and principles in regards to a national approach to waste management and offers an overview of the proposed timeframes for its implementation.

This impending legislation will affect all Australians by regulating how they dispose of unwanted technology, including computers and televisions. No longer will these items be accepted in landfill and users may be directed to designated collection points when disposing of these larger items. Organisations, both large and small, may need to look at introducing in-house policies that cover the storage and eventual transport of e-waste and that adhere to this new legislation.

VET institutions have a history of implementing new initiatives into their curriculum. The VET organisation at the core of this study is one such institution. Some of these initiatives include research and development labs and computer network labs, as well as campus-based initiatives that give IT students hands-on experience during their training by offering a service and repair facility to fellow students and staff.

The North Coast Computer Project (NCCP) in partnership with TAFE is another innovative practice. This project trains students in IT by getting them to repair and refurbish computers for sale into the local area. These initiatives all generate e-waste, which then needs to be stored and disposed of in accordance with in-house and government policy.

This paper outlines the issues of dealing with e-waste in a sustainable way, taking into account the proposed roles of importers, manufacturers and end users in relation to disposal methods and costs. It draws on literature from areas of previous research, international legislation and proposed national legislation. This paper looks at current disposal methods within a regional community and how

legislative changes might affect such a community. It uses a survey technique within a particular workplace to assess current practices and attitudes, as well as perceived needs for dealing with e-waste in the future.

E-waste management is a fast-changing policy and regulatory area, but all information presented in this paper was up to date at the time of the research.

Australians and technology

From gadgets to gizmos, smart goods to smart phones, notebooks to Nanos, if it plugs in, turns on, uses Bluetooth or Wi-Fi, chances are Australians will want it.

According to the Economist Intelligence Unit, Australia ranked fourth out of 70 countries for its 'e-readiness'. E-readiness is a measure of a country's information and communications technology (ICT) and the ability of businesses and consumers to use ICT to their advantage. In 2008 Australia ranked first in the category of social and cultural environment, which covers such aspects as level of education, level of internet literacy, entrepreneurship and degree of innovation. (Department of Foreign Affairs and Trade 2008)

By all accounts Australians know what technology is and know how to use it. From e-mailing to e-learning, e-shopping to e-banking, Australians of all ages have embraced technology. They dabble in e-commerce and travel the world using e-passports.

The Household Electrical and Electronic Survey conducted by the NSW Government (Katos & Hoya 2005) shows that each Australian household owned an average of 22 electronic devices, a total of 92.5 million across the country. The same survey indicates that Australians are amassing electronic devices at a greater rate than they are disposing of them.

This means that the issue of electronic waste in Australian households is a growing one. E-waste is an unwanted side effect of digital technology.

The latest information from the Australian Bureau of Statistics (ABS; 2007) shows that there are approximately nine million computers, five million printers and two million scanners in use in Australia. Yet Australia is one of the only developed nations in the world that has no legislation regarding the disposal of outdated technology. It is still legal in this country to dispose of e-waste in landfill. Not only is this a waste of useful resources, it is arguably environmentally unsound and ecologically unsustainable.

On average a computer system is made up of 23% plastic, 32% ferrous metals, 18% non-ferrous metals (lead, cadmium, antimony, beryllium, chromium and mercury), 12% electronic boards (which include gold, palladium, silver, lead and platinum) and 15% glass. A standard-size cathode ray tube (CRT) monitor contains more than 2kg of lead. The toxicity of lead has been well known for centuries. Lead is also a non-renewable resource, with the world supply estimated to be exhausted within 40 years (Angel & Brindley 2009).

Each computer and monitor consumes approximately 1.8 tonnes of raw materials in manufacture. One 17-inch monitor alone requires 240 kg of fossil fuels, 22 kg of chemicals and 15 000 kg of water – about the same amount of resources as it takes to manufacture a medium-sized car. Yet in 2006, there were approximately 1.6 million computers disposed of in landfill across Australia and a further 7.1 million placed into storage. Only 500 000 were recycled. Later estimates put the figures at 70 million computers and peripherals either already in landfill or on their way, with a total of 234 million individual items of e-waste sent to landfill by the end of 2009 (Angel & Brindley 2009). It is estimated that less than 4% of printers, digital cameras, DVD players and phones are recycled, which is well below the estimated 9% recycling rate of televisions and computers.

There are compelling reasons to divert e-waste from landfill:

- Preventing contamination of the environment is perhaps the most commonly nominated reason for legislating against the disposal of e-waste in landfill. Simulated studies of landfill conditions on electronic circuit boards shows that the waste will leach lead into the surrounding environment at a rate that exceeds the values set by state and territory governments (Angel & Brindley 2009).
- Numerous studies have shown the rapid depletion of the earth's natural resources. Indium, used in flat screen monitors and televisions, could be depleted within five years, according to Cohen (2007). The same study shows that lead could be depleted within 40 years and zinc within 30. These elements are commonly used in the manufacture of televisions and computer systems.
- The reduction of greenhouse gas (GHG) emissions is also a reason to divert e-waste from landfill. Each manufactured device has embodied greenhouse gas emissions. These emissions are created during the extraction and refinement of materials, as well as from the energy created during manufacture. If this device is then sent to landfill, more GHG emissions are created to extract and refine new materials for replacement devices. If e-waste is recycled, then most of this energy is recovered. It is estimated that in 2007–08, 484 000 tonnes of greenhouse gas emissions were lost when 88 000 tonnes of televisions and computers were dumped in landfill (Angel & Brindley 2009).

There are many reasons why Australians have a less than satisfactory approach to e-waste recycling. E-waste recycling facilities currently available in Australia are concentrated in metropolitan areas. Regional Australia is poorly serviced with regard to permanent e-waste recycling options, having to rely instead on local council e-waste collection days or e-waste disposal through local refuse centres. This can be problematic because not all local councils offer e-waste recycling, even in major cities. An independent survey conducted by CNET Australia in April 2008 showed that, of the 37 councils in Sydney, only eight offered e-waste recycling, with another four offering yearly e-waste cleanup days (Carroll & Pereira 2008).

The lack of government legislation concerning e-waste only reinforces the attitude that recycling is a voluntary option for e-waste disposal.

Arguments against recycling e-waste challenge the more intrinsic values of human nature as opposed to the economic rationalisation of costs alone. Such arguments claim that consumers have been conditioned to believe that the latest technology is a necessary part of our working or social lives, so they upgrade to new versions of technology when their old devices still work. The perception that the latest device is as much a status symbol as a useful and convenient tool persists in modern society. One outcome of this point of view centres on the idea that it is consumers who need to push the manufacturers to not only reduce the number of electrical items in production but also to offer upgrading, or a form of trade-in, of superseded devices instead of recycling, especially in terms of smaller more mobile technologies such as mobile phones.

In 2007 *CIO* magazine published an article written by Elgan offering five reasons why recycling e-waste is bad for the environment. These reasons are summarised below:

- 1 Recycling pollutes.

The amount of transport of waste to recycling centres, the amount of power consumed during recycling and the labour-intensive nature of the process are the arguments given to support this claim.

2 Recycling does not cut gadget consumption.

Elgan believes that environmental groups should concentrate on encouraging consumers to demand that manufacturers make fewer devices instead of relying on e-waste recycling alone.

3 Recycling demands virtue and individual sacrifice.

Elgan argues that, human nature being what it is, these sacrifices are likely to be short lived.

4 Recycling does not improve products.

The 'feel good' nature of recycling could actually work against the production of high-quality products and feed the 'throw away' culture prevalent in modern society.

5 Recycling feeds 'lazy storage'.

This suggests that time constraints inadvertently lead to the storage of smaller items, with consumers knowing that the recycling of those items is something that can be put off for the future.

There is also the argument that landfill is less harmful to the environment than the transport of waste from regional and rural areas of Australia to the nearest recycling centre. There is also little incentive for companies to set up recycling options, as the value of the recovered material is often less than the cost of collection, transport and processing. The cost of collection and transport from regional Australia has been estimated at \$590 per tonne (excluding GST) as opposed to \$130 per tonne (excluding GST) in metropolitan areas (PricewaterhouseCoopers 2009).

While not a new phenomenon, the ongoing practice of 'planned obsolescence and perceived obsolescence' also plays a part in the amount of e-waste generated. Planned obsolescence can be described as the practice of building a life span into a product and is seen in a range of products from motor cars to light bulbs, to electronic equipment. Perceived obsolescence on the other hand is the need to own the latest trend or fad, usually to stay connected to one's peer group. The desirability of a product, as well as 'creeping featurism', is certainly as much an issue of waste generation as is obsolescence of function.

The argument for and against recycling, whether economic or intrinsic, poses more questions than it does in offering answers and is certainly an area for further study.

The road to legislation

While Australia has been slow in implementing any level of regulation for the disposal of waste from electrical and electronic equipment (WEEE), many studies have been undertaken in an effort to gauge the nation's readiness for regulatory policies.

Some early studies have shown that, in general, respondents are willing to participate in the recycling of e-waste. One such community survey was commissioned by Midwaste, a regional waste forum (Micromex 2007). This study covered 900 residents in the Mid North Coast area of New South Wales from Coffs Harbour in the north to Great Lakes in the south. Published in 2007, the survey showed that 30% of respondents would, and a further 28% might, be prepared to pay an additional charge to recycle a computer rather than send it to landfill.

'RecycleIT!', sponsored by the NSW Government and based in Sydney, was a pilot program for the collection and recycling of e-waste. This study found that respondents expected recycling to be as convenient as possible. The survey showed that end users would choose to recycle if the point of collection was within a 10km radius of their home (Department of Environment and Conservation 2004). A survey conducted by URS Australia (Rolls, Brulliard & Bennett 2009) found that metropolitan respondents were more inclined to pay higher recycling fees upfront, \$3.55 per item, if the collection of waste was kerbside, in preference to taking the waste to designated drop-off points.

Byteback is a scheme funded by the Victorian Government and industry to collect and recycle computers and printers. Run by Sustainability Victoria, the Byteback scheme was founded by a conglomerate of suppliers including Lexmark, Apple, IBM, Canon, HP, Lenovo, Dell, Fujitsu, Epson and Fuji-Xerox in partnership with the Australian Information Industry Association (AIIA). While not a study as such, the Byteback program is estimated to have diverted 1100 tonnes of e-waste from Victorian landfill by 2008. The Byteback service is free to householders and small business and has eight collection points statewide. The service is expected to run until mid-2011 and it is hoped the outcomes from the initiative will help to inform a national approach.

The state of non-regulation has caused some consternation for industry groups concerned with or affected by possible legislation. One such group is Product Stewardship Australia (PSA), formed by the television industry.

Product Stewardship Australia is a not-for-profit organisation established by industry to address the issue of end-of-life electronic and electrical products. Members of this organisation represent 70% (by volume) of TVs supplied in Australia. Product Stewardship Australia aims to provide methods to recover and recycle electronic and electrical components in an environmentally sound way.

Product Stewardship Australia has a fully funded recycling scheme for televisions designed and ready to implement. Funded solely by TV suppliers, the scheme covers collection, recycling and community education. All that is needed for implementation are effective federal regulations that will also deal with 'free riders' or companies indifferent to their environmental obligations.

The implementation of the scheme would see funds collected by the organisation from TV suppliers and importers managed and used to fund a national collection and recycling scheme for TVs and IT equipment. The scheme would place no burden on retailers for the collection of fees, instead hoping to use the Australian Customs Service during importation. Under this proposed approach, each manufacturer will be required to join a 'producer responsibility organisation' (PRO), which will then

charge members for the collection and recycling of televisions and computers. Manufacturers choosing not to join a producer responsibility organisation will be responsible for implementing a scheme of comparable standard. The scheme is expected to be implemented in 2011.

The National Waste Policy

This draft statement was released in November 2009 and is presented in two parts. Part one provides the context for the development of the National Waste Policy and part two presents the policy itself.

The full policy can be viewed at <<http://www.environment.gov.au/wastepolicy/index.html>>.

The policy document states the following as its aims:

- To avoid the generation of waste, reduce the amount of waste (including hazardous waste) for disposal, manage waste as a resource and ensure that waste treatment, disposal, recovery and reuse is undertaken in a safe, scientific and environmentally sound manner, and
- To contribute to the reduction in greenhouse gas emissions, energy conservation and production, water efficiency, and the productivity of the land.

Principles of the policy include:

- Participants in the product supply and consumption chain, rather than the general community, bear responsibility for the costs of resource recovery and waste management
- The environmentally sound management of materials, products and services embracing whole of life cycle strategies and quality assurance practices.

The outcomes include:

- Consistent and clear requirements for disposal of hazardous materials, and for content labelling of manufactured goods, that also provide a level playing field for Australian manufacturers and importers and informs consumers.
- Opportunities to safely manage, reduce and recycle waste are available to all Australians, including approaches that have been tailored to meet the needs of remote and rural communities.

To achieve these outcomes the following directions have been identified:

- taking responsibility
- improving the market
- pursuing sustainability
- reducing hazard and risk
- tailoring solutions
- providing the evidence.

While a move to a legislated National Waste Policy is assured, less well known at this stage is how this legislation will be implemented.

Methodology

While the issue of e-waste has ramifications on global and national levels, this study focuses on e-waste disposal within a regional vocational education and training (VET) institution. TAFE NSW North Coast Institute is the VET institute used for the purpose of this study. North Coast TAFE consists of 17 campuses covering the area from Forster–Tuncurry to the Queensland border. It enrolls nearly 43 000 students per year. North Coast TAFE delivers around 500 Australian Qualifications Framework (AQF) courses at AQF certificates I–IV levels through to diplomas (AQF V) and advanced diplomas (AQF VI). Due to the size and spread of the institute, a questionnaire (see appendix 1) was selected as the most appropriate method of data collection.

The purpose of this study is to examine the issues staff face when dealing with e-waste, given that continual change in educational practices as well as the growing demand for technology-related courses has seen the quantity of digital devices needed for sound educational practices increase dramatically. These devices then need a method of disposal that is practical, sustainable and environmentally sound. Of interest to the researcher is how this is being managed at a local level. Eighteen questionnaires were sent to campus managers and project coordinators in August 2009, with a return date of September 2009, giving each campus a four-week window to complete the questionnaire. Ten took the opportunity to be part of this research.

The questionnaire aimed to capture:

- the amount of e-waste currently in storage across the institute, as well as projected yearly figures
- current practices employed across campuses in regards to dealing with e-waste
- opinions on how those practices may be assisted in the future when legislation dictates how waste is to be disposed
- information regarding local partnerships currently in action by campuses across the institute.

Limitations of the questionnaire:

- Not all campuses could participate in the survey at the time of distribution. Consequently, the survey results provide only a small sample of feedback and may not cover all processes that have been established across North Coast TAFE to deal with e-waste.
- Some questions were multiple choice, so the number of answers could be greater than the number of campuses responding.
- The questionnaire was voluntary. Some reasons for choosing not to take part could be due to institute-wide events occurring during the timeframe of the data collection.
- The project timetable meant that the questionnaire was sent before the draft National Waste Policy was released. At that stage of the research, the WEEE Directive¹ was used as a basis for the questionnaire on the assumption that any policy implemented by the Australian Government to deal with the issue of e-waste would mostly likely be based on this directive. The WEEE Directive specifically lists historical waste (waste that was in the marketplace four years prior to the

¹ The WEEE Directive was introduced in Europe in 2003 with the specific aim of setting targets for member states for the collection, recycling and recovery of waste from electrical and electronic equipment. For further information see appendix 2.

implementation of the directive) as a separate entity and has placed responsibility for this waste according to a 'user pays' principle, whereas the National Waste Policy does not mention the issue of historical waste at all. Question 1 was included to ascertain how much waste was in storage and would need to be recycled with the view of getting quotes for disposal. The National Waste Policy would seem to negate the cost to users of disposal for older waste because regardless of how old the waste is, the manufacturer is still responsible for disposal.

Questionnaire results

E-waste currently in storage

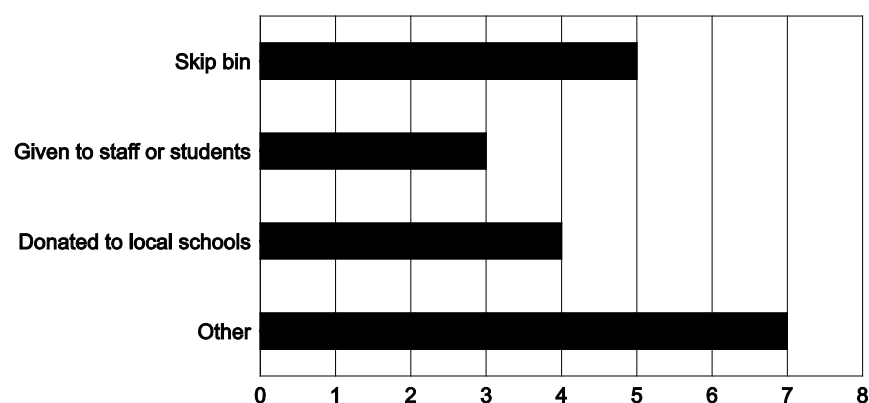
The total waste currently in storage and the future yearly estimates across the ten respondents is shown below:

Table 1 E-waste currently in storage

Item	Currently in storage	Future yearly estimate
System units	169	705
Laptops/notebooks	13	42
CRT monitors	114	35
LCD monitors	92	549
Keyboards	310	644
Mouses/trackballs	99	544
Loose circuit boards (including RAM)	594	800
Loose HDDs (hard disk drives)	90	61
Printers/scanners	37	16
Switches/hubs/routers	20	10
PDA's (personal digital assistants)	4	4
Other mobile devices	2	0
Audio/visual devices	1	0
Other	0	0
Total	1545	3410

Previous disposal methods of obsolete systems or components

Figure 1 Previous disposal methods – obsolete systems



Of the ten campuses that replied to this question:

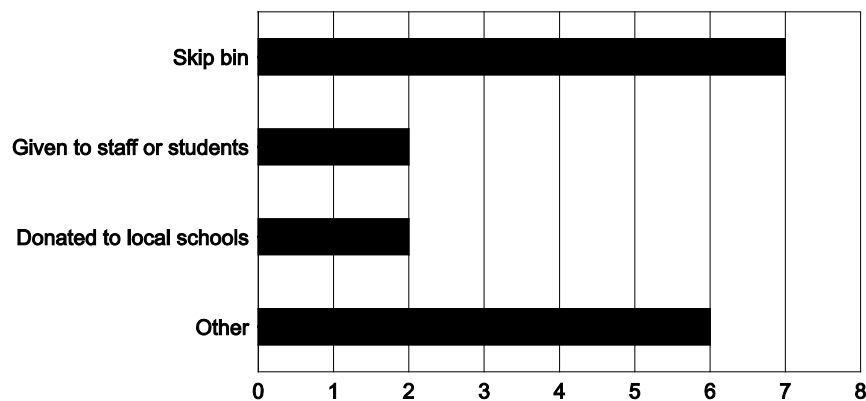
- Five have previously used a skip bin for disposal of obsolete computers.
- Three campuses allowed staff or students to take the computers.
- Four donated the computers to local schools.

- Seven campuses selected ‘other’. Of these campuses:
 - Four disposed of their obsolete computers through the North Coast Computer Project.
 - Four disposed through local council e-waste days.
 - One campus did both.

Overall, the findings from the survey show a willingness at a local level to sort, store and dispose of e-waste if the technology is old or not in working order in preference to disposal via landfill. This is shown by the majority of respondents in question 2 nominating more than two methods of disposal for e-waste. Question 2 also shows that the four campuses that use the local council e-waste days did not use the skip bin for disposal. Only one campus used the skip bin for disposal of all e-waste.

Previous disposal methods of non-functional systems or components

Figure 2 Previous disposal methods – non-functional systems



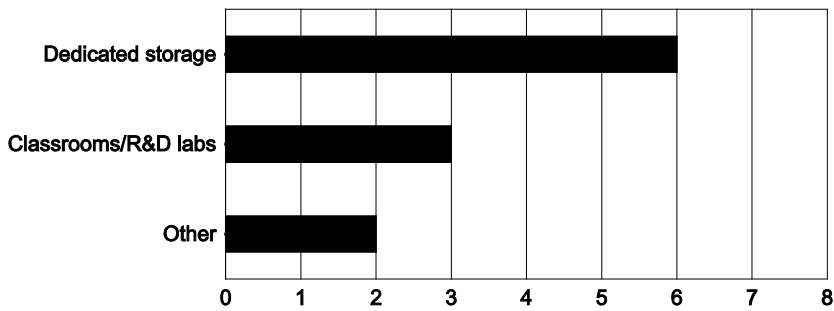
Of the ten campuses that replied to this question:

- Seven campuses have previously disposed of non-functional systems using a skip bin.
- Two campuses allowed staff or students to take the systems.
- Two donated to local schools.
- Six chose ‘other’. Of these campuses:
 - Three gave the systems to the North Coast Computer Project.
 - Three used the local council e-waste days.

While five of the ten respondents used the skip bin to dispose of obsolete computers, this figure rises to seven out of the ten for non-functional computers. It could be argued that there are various levels of ‘non-functional’: from computers missing one or two internal components and which could be made functional again, to those stripped of all major components. The survey did not attempt to ascertain the level of non-functional computers vis-a-vis the waste for disposal.

Current storage practice

Figure 3 Current storage practice

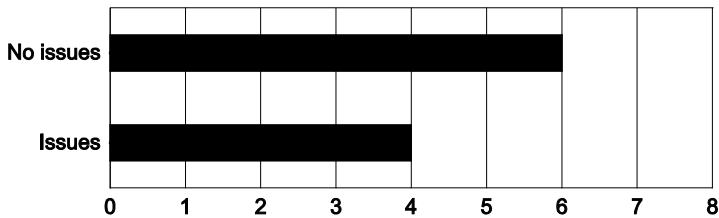


Of the ten campuses that replied to this question:

- Six campuses have a dedicated storage area for e-waste, with one campus also using space in research and development labs or classrooms for extra storage.
- Three campuses with no dedicated storage areas stored e-waste in classrooms and research and development labs.
- Two campuses do not store e-waste on the campus at all.

Storage issues

Figure 4 Storage issues

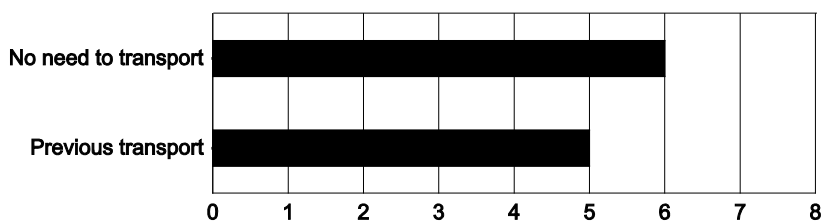


Of the ten campuses that responded to this question:

- Six campuses report no issues with storage.
- Four campuses report issues such as flooding, shortage of storage space, cumbersome administration process and excess manual handling as issues confronted. Occupational, health and safety issues were also a concern, with some storage being above waist height, posing risks when moving waste in and out of storage.

Transport of electronic equipment

Figure 5 Transport of electronic equipment



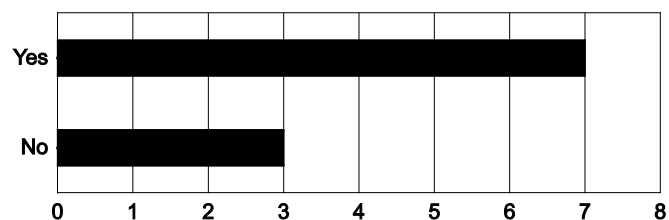
Of the ten campuses that replied to this question:

- Six campuses report no need to transport e-waste, with one campus reporting incoming computers arrived via campus car with a TAFE staff member.
- Five campuses reported transporting their unwanted/outdated technology using campus cars and staff of two of those also reported using a courier for transportation.
- One stated that they had no need at present to transport e-waste, although previously waste had been transported by staff.

Transport of unwanted technology seems to fall on staff using campus vehicles while travelling to other campuses. In addition, two campuses have used couriers to transport unwanted computer systems. While this transport method may be suitable for small amounts of e-waste, it may prove to be unsustainable for larger amounts.

Current practices

Figure 6 Current practices



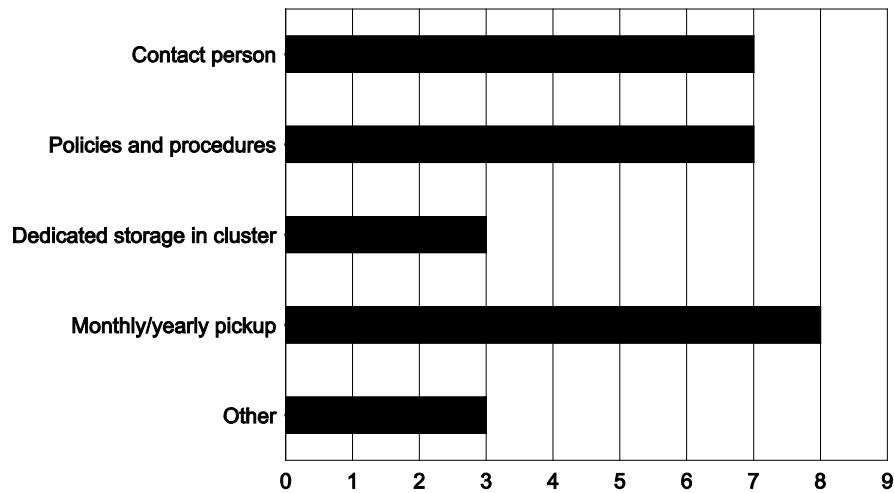
Of the ten campuses that responded to this question:

- Three campuses report no partnership involvement for e-waste.
- Seven campuses are involved in some form of partnership with local industry for e-waste management. Of the seven campuses in partnership:
 - Five are with the North Coast Computer Project.
 - Two are with the local council.
 - One campus had chosen to undergo an audit of waste in order to improve their waste management practices.

The majority of respondents have ongoing partnerships with local industry. These partnerships include local councils, the North Coast Computer Project and community groups offering recycling on a small scale.

Future practices

Figure 7 Future practices



Of the ten campuses that responded to this question:

- Seven campuses requested a contact person to deal with all aspects of e-waste.
- Seven campuses would like to see policies and procedures put in place to help them deal with the problem of e-waste.
- Three requested dedicated storage areas within their cluster.
- Eight requested a set timetable for pickup of e-waste.
- Three campuses chose all four of the listed options.
- Two campuses chose only one of the four listed options, being policies and procedures and a timetable for collection of e-waste.

When asked about future practices regarding the disposal of e-waste, the findings show that a majority of respondents would choose a set timetable of pickup, the introduction of policies and procedures, as well as a central contact point for all e-waste issues, as being the most important to them. Other suggestions were canvassed in regards to future practices and are listed below:

- Send all out-of-date systems to the North Coast Computer Project for refurbishment and sale into community.
- Explore the options of sending out-of-date systems to less developed nations with support for maintenance and training. This needs to be in accordance with the Basel Convention and systems put in place to aid in end-of-life recovery or recycling.

Discussion

While a move to a legislated National Waste Policy is assured, less well known at this stage is how this legislation might be implemented, which makes it difficult to foresee the effects of the policy on end users.

As already explained, Product Stewardship Australia (PSA) has a fully funded scheme for the collection and recycling of e-waste (such as TVs and computers) ready to be implemented. This plan requires all manufacturers to join a producer responsibility organisation. Manufacturers not associated with a producer responsibility organisation will need to implement a system of comparable standard. This could mean that organisations currently using products from more than one manufacturer may be faced with multiple collection points and timetables. This scenario could exacerbate issues of storage and transport of unwanted waste, as shown in the survey. An Australian and New Zealand standard for the collection, storage, transport and treatment of electronic waste will also be developed by Standards Australia. This could have a filter-down effect on how waste is to be managed before collection, adding a further level of complexity to the issue of e-waste management at a local level. For example, who will bear the responsibility for data stored on hard drives of computer systems in the waste chain? Will there be a set of storage requirements that need to be met by the end user, the producer responsibility organisation or their employees to ensure any damaged equipment will not leach toxic materials during collection, storage or transport?

The National Waste Policy will be introduced in stages over the next few years and will undoubtedly present implications for organisations across the nation in regards to policy development and practice. However, the staged timeframe will allow organisations time to consider possible sustainable practices in order to comply with this new legislation. For educational institutions, this will present an opportunity to be community leaders in sustainable practices and include these practices in educational delivery.

Educational institutions may also consider:

- implementing more green skills courses in partnership with local industry
- attaining the ISO 14001 Environmental Management Standard (see appendix 3) and providing mentoring/training to other organisations that wish to do the same
- exploring funding opportunities to assist with education and implementation in their local communities in regards to the introduction of the National Waste Policy
- considering supporting local partnerships with educational material and programs in regards to disposal methods concerning e-waste
- adding e-waste as a specific entity into their sustainability policy and charter
- implementing a holistic approach to e-waste management with a designated contact for information and assistance.

Waste from electronic and electrical equipment has been a recognised global issue for many years (see appendix 2). The rapid advancement of technology, coupled with the decreasing costs and miniaturisation of equipment, as well as the ongoing practice of ‘planned obsolescence’, are the major contributing factors.

Australia has been slow to act on the issue of e-waste by comparison with other nations. However, improvements in waste management as well as in the design and manufacture of electronic equipment as a result of the WEEE Directive in Europe, may benefit this country.

Early studies (URS and RecycleIT!) have shown that Australians recognise the issues of e-waste and display an interest in being part of a recycling scheme. These studies also indicate a preference for easy and cost-effective recycling. They show that Australians are willing to pay a little more if disposal methods are closer to home, and can be integrated into current kerbside waste pickup as other recycling has been, especially for smaller items such as remote controls and mobile phones.

The challenge of dealing with e-waste rests with each and every one of us. From governments to individuals, producers to suppliers, each of us has a part to play in dealing with what is becoming one of the fastest growing waste streams in the world,

<http://www.unep.or.jp/ietc/Publications/spc/ISWMPlan_Vol2.pdf>, p.2.

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Appendix 1: questionnaire

NATIONAL CENTRE FOR VOCATIONAL EDUCATION RESEARCH
Emerging VET Researchers Program

QUESTIONNAIRE

Currently in storage Future Yearly estimate

1. HOW MUCH E-WASTE IS CURRENTLY IN STORAGE AT YOUR CAMPUS?

Total System Units (Including Servers)	_____	_____
Laptops/Notebooks	_____	_____
Total Monitors		
• CRT	_____	_____
• LCD	_____	_____
Keyboards	_____	_____
Mouse/Trackball	_____	_____
Loose Circuit Boards (inc RAM)	_____	_____
Loose HDDs	_____	_____
Printers/Scanners	_____	_____
Switches/Hubs/Routers	_____	_____
Other Electronic Devices		
• PDA's	_____	_____
• Other Mobile Devices	_____	_____
Other	_____	_____

2. PREVIOUS DISPOSAL METHODS OF OBSOLETE SYSTEMS OR COMPONENTS

Tick as many as are applicable:

- Skip bin
- Given to staff or students
- Donated to local schools
- Other

If Other please elaborate _____

3. PREVIOUS DISPOSAL METHODS OF NON FUNCTIONAL SYSTEMS OR COMPONENTS

Tick as many as are applicable:

- Skip bin
- Given to staff or students
- Donated to local schools
- Other

If Other please elaborate _____

4. CURRENT STORAGE PRACTICE

- Dedicated storage area
- Storage in classrooms, R&D labs or offices
- Other

If Other please elaborate _____

5. STORAGE ISSUES

Our campus has no storage issues

List any issues you currently have with the storage of e-waste (issues may include such things as unsuitable storage space, lack of storage space, transport to storage space, OH&S issues, storing broken or damaged components)

6. TRANSPORT OF ELECTRONIC EQUIPMENT

Our campus has no need to transport e-waste or obsolete computers

In the past if transport of e-waste or obsolete computers to another campus was necessary how was this transport achieved?

7. CURRENT PRACTICES

Is your campus currently engaged in any form of e-waste management, either through on campus activities or through partnerships with local industry?

- No
 Yes

If Yes, please elaborate _____

8. FUTURE PRACTICES

In view of future legislation in regards to recycling e-waste, in your opinion what future practices could NCTafe employ?

Tick as many as are applicable:

A TAFE contact person to deal with all aspects of e-waste

Policies and procedures for staff to follow

Dedicated storage in your cluster for e-waste

Monthly/yearly Timetable for pickup from your campus (or nearest large campus)

Other _____

Thank you for your time in completing this questionnaire.

Please return to the Researcher using the enclosed self addressed envelope.

Appendix 2: the history of e-waste

It is difficult to pinpoint the exact time and place that e-waste became a global issue. Industrialised nations most certainly would have experienced a problem with toxic waste, including e-waste, disposal before developing nations did. However, it will be shown that both the developed and the developing world have suffered, in different ways, as a result of this waste stream.

The need for global regulations was recognised in 1981 when the United Nations Environment Program (UNEP) launched the Montevideo Program. This program sought international cooperation in developing guidelines and principles relating to the transport and disposal of hazardous waste, although at this time e-waste was not mentioned as a stand-alone waste stream and was classed as toxic or hazardous waste, along with many other hazardous substances. Toxic waste took many forms and included solid waste and incinerator ash.

The need for international cooperation was a consequence of the sudden rise in the export of toxic waste to developing nations. This rise was caused by the tightening of regulations in industrialised nations and the subsequent rise in costs of hazardous waste disposal. The term ‘toxic traders’ was used to describe those brokering the sale of waste to developing nations for financial gain.

Two international incidents in the mid-1980s brought the issue of transporting waste to developing nations into the public arena, the voyage of the *Khian Sea* and the Koko Beach incident.

In 1986 the *Khian Sea* set sail from Philadelphia in the United States with 14 000 tons of toxic incinerator ash aboard. The ship was bound for a man-made island in the Bahamas. What eventuated was a voyage lasting 27 months, with the ship changing names on numerous occasions in an effort to hide its true identity, and culminating with 4000 tons of toxic waste being dumped on Haiti under the guise of fertiliser. The remainder of the waste was evidently dumped in the Atlantic and Indian Oceans (<http://www.ban.org/about_basel_ban/chronology.html>).

The second incident occurred in 1987 when an Italian businessman sent 8000 drums of toxic chemical waste to Koko in Nigeria. The waste was labelled as being related to the building trade. After discovery of the true nature of the waste, Nigerian workers attempted to return the waste to Italy. Many of these workers were hospitalised, suffering from chemical burns, nausea and partial paralysis. After pressure from Nigeria, two ships were employed to return the waste to Italy, where they were met with massive protests (<http://www.ban.org/about_basel_ban/chronology.html>).

This incident had ramifications across two nations. As a result of the inappropriate transport and storage of this toxic waste, the entire town of Koko was surrounded by polluted farmland, which had been caused by leaking barrels of waste. The government instigated an evacuation plan, which was met with resistance by local inhabitants who were fearful of the demise of their cultural and ancestral heritage.

When the barrels were shipped back to the port of Livorno in Italy, their condition had deteriorated to the extent that the water around the ship was found to be so contaminated it endangered the plant and animal life in the harbour of Livorno.

Practices such as these have been labelled ‘toxic colonialism’ or ‘toxic terrorism’ by many developing countries. Others, however, have actively pursued the importation of toxic waste in desperation for foreign currency as a means of economic survival.

As a result of the Koko Beach incident, a group of members of the Lome Convention agreed to make it a criminal offence to facilitate the dumping of waste and urged developed nations to tighten control on their exports. Nigeria went as far as to announce the death penalty for toxic traders and urged the formation of 'Dump Watch' in an effort to protect it and neighbouring countries (www1.america.edu/TED/Nigeria.html).

Nigeria's quick reaction and the involvement of the international community brought to a head the covert operations of toxic traders and established the foundation for more stringent controls between developed and less developed nations. This global action led to the creation of the Basel Convention.

The Basel Convention

The Basel Convention is a global agreement that came into force in 1992, with 172 countries involved. The convention aims to address the global issues and challenges of dealing with hazardous waste including toxic, poisonous, explosive, flammable, ecotoxic and infectious wastes.

The key objectives of the Basel Convention are to:

- minimise the generation of hazardous wastes in terms of quantity and degree of hazardousness
- dispose of waste as close to the source of generation as possible
- reduce the movement of hazardous wastes.

A number of countries, including Australia, ratified the convention in the same year. However, Australia is among many countries that have yet to ratify the amendments made to the convention. The Basel Action Network website (<http://www.ban.org>) shows that Australia, as recently as the year 2000, was accused of shipping waste to Africa under the guise of 'research'. Research is one area not covered by the Basel Convention.

The Basel Convention has limitations; not all waste streams are covered under the convention, notably nuclear waste, and the compliance and enforcement of the convention are left to the signatory parties (national governments of signatory countries). In effect, this leaves each country to monitor itself and to introduce and enforce measures aimed at preventing and punishing conduct that contravenes the convention.

While not a signatory to the Basel Convention, the United States of America has recently introduced an e-waste bill, H.R. 2595, which bans the exportation of e-waste unless the exports were intended for repair or reuse, the general idea being that the digital divide could be lessened by sending older technology to developing nations. This exception allows brokers to continue sending waste to those nations under the guise of what can only be loosely described as charity (<http://www.eweekeurope.co.uk>, viewed December 2009).

It was clear from the loopholes in the Basel Convention that more stringent requirements needed to be introduced in order to cope on a global level with the issue of toxic waste. The European Union has introduced such requirements with what is known as the WEEE Directive.

The WEEE Directive

The WEEE Directive was introduced in Europe in 2003 with the specific aim of setting targets for member states for the collection, recycling and recovery of waste from electrical and electronic equipment. Each member state could enforce the directive as they saw fit, as long as set benchmark figures were attained. The benchmark figures were set according to total weight of electrical and electronic equipment sold in each country. Given that electrical and electronic equipment has a lifespan of approximately four years, the directive requires each country to monitor the total recycling weight of electrical and electronic equipment and seek to attain a 65% recycling rate based on the sold weight of four years prior.

One of the aims of the directive was to introduce regulations regarding the use of hazardous materials in the manufacture of electrical and electronic equipment. The WEEE Directive works in conjunction with the RoHS (restriction on the use of certain hazardous substances) Directive to encourage manufacturers to design and build technology that will enable complete end-of-life recycling by restricting the use of hazardous substances. These substances include lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE).

The WEEE Directive lists ten categories of electrical and electronic equipment and each of those categories expands into a definitive list of equipment covered by the directive. The directive is based on producer responsibility and the polluter-pays principle. However, the directive also lists historical waste as a separate entity and applies the user-pays principle to this type of waste.

While nationwide implementation of an e-waste scheme is still in the planning stage, Australia has benefited from what other countries have implemented in a variety of ways, one of which is the improved design and manufacture of electronic equipment due to the RoHS Directive. This means that computer manufacturers have been forced to address the issue of hazardous substances commonly used in the manufacture of electronic equipment if selling into countries enforcing the WEEE Directive. It could be argued that Australia's slow uptake of legislation will ease some of the issues of e-waste disposal, courtesy of the improved design of newer electronic equipment.

Problems with the WEEE Directive

The directive was revised in December 2008 in an attempt to overcome a number of technical, legal and administrative difficulties which became apparent during the first stages of implementation and which resulted in unintended costs and burdens on administrators and participants. For example, originally wholesalers were required to register in each country they supplied, causing administrative problems when those countries employed different implementations of the directive.

New mandatory targets were introduced in the revision of the directive when it was found that the expectations in protecting both the environment and human health could not be achieved at current collection and recycling rates (<<http://www.europa.eu>>, viewed February 2010).

Appendix 3: ISO 14001

The ISO 14001 2004 is an Environmental Management Standard (EMS). Introduced in 2004, ISO 14001 2004 defines a set of environmental management requirements that any organisation can aim to achieve. The purpose of the ISO 14001 standard is to help all kinds of organisations to protect the environment, to prevent pollution, and to improve their overall environmental performance (<<http://www.praxiom.com/iso-14001-intro.htm>>).

Many educational institutions have taken up the challenge of implementing environmental management systems, some of which are based on the ISO 14001 2004 standard, and have also taken an active role in the community in regards to the collection and disposal of e-waste.



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