

Recycling Report 2003

Computer Products Recycling

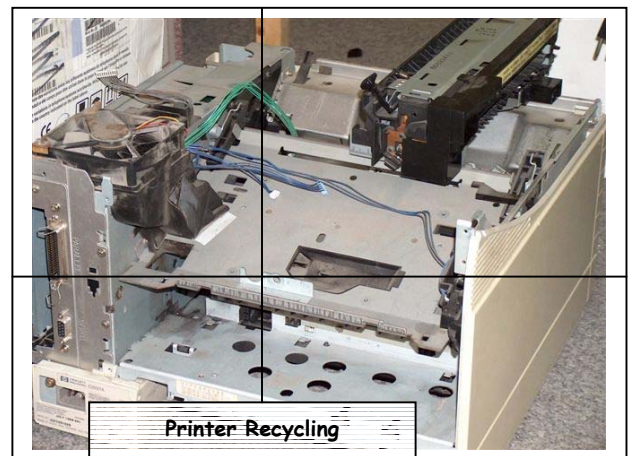


Powerland Computers invites the government, all businesses and consumers to send their end-of-life computer equipment to Powerland for recycling. Powerland offers free recycling on most computer products. Powerland also offers to collect, refurbish and distribute computers to schools and charities at no cost to the government. The schools and charities would continue to pay the refurbishing and administrative costs at the rates being charged by charities. In addition, tax receipts will be available through local charities for the value of computers donated for use by schools and charities.

Why would Powerland make such an invitation? Recycling has to do with our history. About 20 years ago Powerland began manufacturing computers. Shortly afterward our customers began bringing us good used computers to trade on new computers. Customers were paid for the value of their trade-in. Powerland refurbished the trade-in computers and sold them. Where the computers were not saleable, Powerland took them apart and used the parts in the repair of other older computers. Powerland continues this practice, especially for our customers, to this day.

While Powerland continues to trade-in computers we have also noted many changes over the years. The value of computers has decreased so the trade-in values are not as high. There has been a build-up of older computer equipment as customers retained their old computers along with newer computers. Older computers became the second or third computer in people's homes. In businesses the computers were moved to give more employees access to computer technology. As homes and businesses filled with computers there has been a buildup of very old computer equipment. When this equipment lost its usefulness to the company or individual it was often put into storage. Some of it has been scavenged for repair parts. Over the past five years Powerland has been receiving an increasing amount of very old computer equipment. We continue to work at developing ways and means to reuse and recycle these computer products.

According to a Statistics Canada 2002 publication by Fred Wong, Information Technology accounted for 7.6% of Canada's Gross Domestic Product and supported a workforce of 308,000. In the same report Mr. Wong goes on to say that Canada has a \$19.6 billion trade deficit in IT, mostly found in mass produced goods.ⁱ These imported mass produced Computer products will, at the end of their lives, end up being a Canadian responsibility. According to a 2001 report by the Canadian Environmental Industry Association, it is estimated that 2.6 million computers became obsolete in Canada in 1998. It is estimated that 86% of these computers were destined for landfill disposal.ⁱⁱ If this research is accurate, between 80,000 and 90,000 computers reached their end of life in Manitoba in 1998, with about 69,000 of these reaching the landfills.



Powerland Computers continues to invite individuals and organizations alike to drop off computer equipment at our shipping entrance at the rear of our 170 Marion St operation. We see recycling computer equipment as part of our history. We see recycling computer equipment as part of our future as a profitable Manitoba company.



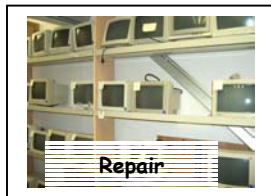
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How can Powerland Computers offer to recycle computer products at no cost? HP and Dell both have a recycling program. Both charge the customer a minimum of \$50 per computer for recycling. Powerland believes that by *using some common sense* we can offer computer recycling to Manitoba consumers, companies and organizations at no cost. Powerland does reserve the right to charge for recycling computer equipment. We will charge to recycle computer equipment that has been stripped of value by a third party and/or where a third party has already received compensation for work surrounding computer removal and disposal. We also reserve the right to charge for picking up computer equipment. To date, Powerland has never exercised the option to charge for recycling.

Powerland produces income through five value recovery activities. Firstly, Powerland performs services surrounding computer removal and disposal. These activities include removing computer equipment from offices, securely erasing data from Hard Disk Drives, removing asset tags and other identification information, asset management recording, and refurbishing computers for charitable organizations. Powerland uses the income from these activities to fund our computer recycling activities.



equipment can be resold.

Secondly, Powerland repairs useable defective products. Most shipments of computer equipment that we receive for recycling contain some useable, but broken, products. They have been placed with the recycling because they have stopped working and the retail cost of repairs is too high. Using other old equipment for parts, Powerland technicians can repair these products at a reasonable cost. We have found that about ½ of all computer monitors sent for recycling are repairable. Once repaired these monitors and other computer

Thirdly, Powerland refurbishes and markets working computer products. We are aware that products that have no use to one person may still be valuable to other people. In addition to marketing these products, Powerland also refurbishes and sells end-of-life computer products for Not-for-Profit organizations as part of their fundraising activities. Powerland is pleased to be associated with the Mennonite Central Committee Morris Relief Sale and Auction.

Fourthly, Powerland disassembles computer equipment and removes the useable components. Most of the components are used to repair defective computer equipment. On occasion we are able to sell components. In the past we have sold used computer equipment and components on ebay.

Fifthly, Powerland disassembles computers and sorts the metals for sale to metal recyclers. The CBC Marketplace report shows 33 elements that compose a typical computer and monitor. Eight elements with 1% or higher concentrations make up 98.7% of the total weight. The other 25 elements make up 1.3% of the total weight. The elements, ranked by weight, are Silica (24.9%), Plastic (23%), Iron (20.4%), Aluminum (14%), Copper (6.9%), Lead (6.3%), Zinc (2.2%) and Tin (1%).ⁱⁱⁱ Our experience in recycling, sorting and selling metals shows that 42% of our metal recovery income comes from precious metals found on computer mainboards. This is followed by 21% for scrap metal, 9% for aluminum, 13% for copper, and 6% each for iron and tin.

Powerland is able to efficiently recover value from computer equipment targeted for disposal through use of our existing staff, student technicians and our sales and charitable relationships. Powerland technical and warehousing staff perform computer product recycling activities during their non-peak times. This helps us retain staff for our peak seasons which in turn helps us be more efficient in our core business. Powerland also uses the computer refurbishing activities for training technical students. Over 100 students receive work experience at Powerland each year.

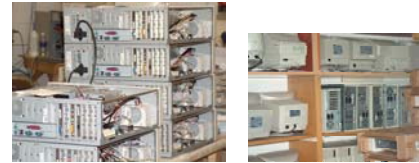


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What are the issues that Powerland faces when recycling computers? There are four main issues that confront us as we recycle computer products. Firstly we need to assure donor customers of the confidentiality of their donations and the secure removal of any data left on the computers. Confidentiality and security is a key issue to the release of computers to any recycling program. As specified by the donor client, Powerland removes all corporate and asset tag information from the computer. In most cases this means the removal of “permanent” stickers. Occasionally we have to remove engraved or branded corporate information. Data security is ensured by hard drive erasure. Special data erasure software first completely overwrites the drive with data. It then erases the data. This procedure is repeated up to seven times, as specified by the client. The software then verifies the complete data destruction and is able to produce a report for the client. Not all donor clients require confidentiality and security measures to be performed on their computers. Powerland will provide these services to clients for a fee.



Client Security

A second issue involves the potential for PCBs, batteries and other toxic wastes to be generated by computer product recycling. We have not had to deal with PCBs (Polychlorinated Biphenyls) because PCBs were banned in manufacturing in Canada by the early 1980s. Personal computer production began on a large scale during the mid to late 1980s. There have been no recorded discoveries of PCBs discovered in personal computer equipment waste. However, in the unlikely event that we encounter items containing PCBs at levels deemed to be toxic we have prepared an environmental plan. We will segregate the equipment and all saturated parts of the work environment in a dry and safe environment. We will then contact Miller Environmental Corporation and arrange for the pickup of the items. We will also have them review our procedures and check our work areas for safety.

Small batteries are part of every computer. When computers are taken apart for recycling we remove the small batteries and store them. When we have collected a sufficient amount of batteries we take them to the Battery Man, a licensed handler of unwanted batteries. We also ship larger batteries found in Uninterruptable Power Supplies and in laptops to the Battery Man. We expect that the Battery Man, as a licensed handler of battery waste, properly disposes of battery wastes. In the event that we ship whole computer products to metal recyclers we require specific permission from them to not remove batteries. The metal recyclers are then responsible to remove all batteries as part of their separation process.



The third main issue that Powerland faces when recycling computers is the recycling and disposal of leaded glass. Computer CRT (cathode-ray tube) displays are made up of a plastic skin and base, frame / emissions shield, plastic composite mainboard, electronic components, power supply, and CRT (picture tube). CRT glass contains an average of 4 lbs. of lead^v. The main concern about the lead is its potential for leaching into groundwater when the leaded glass is rained on. The mix of lead oxide in CRTs varies by manufacturer. The panel glass is comprised of up to 2.5% lead oxide and accounts for 66.1% of lead oxide by weight in a monitor^v. The Funnel glass is comprised of 22% lead oxide and accounts for 26% of the lead oxide by weight in a monitor^v. The Neck is comprised of 30% lead oxide and accounts for .5% of the lead oxide by weight in a monitor^v. The Stem is comprised of 29% lead oxide and accounts for 7.4% of the lead oxide by weight in a monitor^v. The Frit is a type of glass solder that uses a more soluble type of lead oxide^{vi}. The Frit is comprised of 70% lead oxide^v and is a significant issue in lead leaching.



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The lead used in a CRT is leachable. The Frit contains the most leachable lead. Samples of CRT Funnel Glass with and without Frit were compared^{vii}. The glass with Frit contained between 45 and 50 times more lead than the sample without Frit. Additionally, larger granules leached significantly less lead than small granules. All tests, with the Frit included, show results that exceed the Canadian regulations for lead leachate.

Powerland has tried to find economical uses for leaded glass in Canada. We contacted Noranda, a Canadian company with a lead smelter in the Maritimes that uses leaded glass from CRTs as flux.^{viii} Noranda requires regular minimum quantity shipments of 20 tons. Noranda assumes a neutral value for leaded glass aggregate. This means that in addition to finding 20 tons of CRT glass at least 4 times each year we would need to pay the shipping costs for the glass. Our contacts with other lead smelters in Canada have not met with interest. It needs to be noted that the production of lead also significantly impacts the environment.

Two other recycling companies in Canada use glass for asphalt and road materials^{viii}. Unfortunately, this option may allow for lead leaching into unprotected groundwater.

Powerland continues to take leaded glass to the Brady Landfill. Landfill mass in Manitoba, given the speculative numbers of Computers sent to the landfill, would add about 1,030,860 lbs. – or 468 metric tons – of leaded glass to Manitoba landfills each year. Using a conversion factor of about (1/1.7) cubic meters/metric ton, the landfill volume added each year would be about 275 cubic meters (0.275 meters of height per hectare). Brady Rd. Landfill in Winnipeg is a 790-Hectare class 1 landfill. This landfill accepts all types of solid, non-hazardous wastes from households, commercial businesses and industry. The landfill also has two areas where materials, which can be recycled or reused, are stored. Presently the landfill accepts leaded glass and whole CRTs. Tipping fees for the glass could be as high as \$13,185.00 per year. Transportation to the landfill also needs to be factored into the cost of landfill disposal.

Cost recovery for recycling CRTs, excluding repair and reuse, is negligible. Presently a lack of consistent volume and high shipping costs detract from moving leaded CRT glass to Noranda for use in the lead smelting process. It also must be noted that shipping causes significant environmental pollution.

Powerland continues to consider options for CRT recycling in Manitoba. We propose the following options. Our primary option is to repair as many CRTs as possible. Our experience is that about 20% of older monitors are repairable and worth repair. About 50% of newer, non-functioning monitors are repairable. This is potentially a growth opportunity for the Manitoba IT sector. With up to 70,000 monitors taken out of use in Manitoba each year, the critical mass exists for business development. When coupled with a recycling program for monitors with no value and no function, this business could build skilled professional employment, produce an export product and reduce the environmental impact of obsolete CRTs on the Manitoba environment.

A secondary option for CRTs is to segregate them at the Landfill. Materials with limited value today may have significant value in future generations. Brady Landfill already has areas set aside for the collection of recyclable and reusable materials (metals, scrap tires, used propane tanks, wood waste materials and used appliances). In addition they have a composting program. We would propose requesting that the city and the province explore designating an area for leaded glass (including the necessary safeguards). We expect that at such a time as enough mass of material is developed, and that the need for the material has matured, an industry could be attracted to Manitoba to recover and use this material.



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Powerland also recommends that Manitoba continue to explore alternative uses for CRT Glass. Manitoba currently imports leaded glass ornaments, light fixtures and art objects. It may be possible to start production of these types of objects in Manitoba especially for export.

Manitoba currently has no glass-products manufacturers that are accepting broken glass from CRTs. The Technical report by Patricia Dillon (attached and referred to in the annotated bibliography) suggests the following possibilities:

- Use in glass panels for industrial applications, like large windows in skyscrapers, where the leaded glass would provide radiation protection;
- Use of recycled CRT glass as the base layer for masonry-like building products (tile) (When this tile is adhered to a building, the leaded glass is securely sealed between the building and the top layer of “clean” glass product.), and;
- Use of CRT glass to make X-ray shielding products.

Each of these, and likely many other possibilities, would involve promoting business startups in Manitoba. As an example, the tile option would use up to 22,000 tons of glass cullet each year to manufacture 5 million square feet of product while employing 35 – 40 people^{ix}. Manitoba may have the potential leaded-glass capacity to make this feasible.

In addition, we would propose that the Manitoba government, in conjunction with Manitoba’s universities and colleges, run a contest to develop creative alternate uses for CRT leaded glass (either whole or crushed). We suspect that such a contest could develop realistic homegrown Manitoba alternatives to sending the glass to the landfill.

Powerland Computers continues to work at finding alternate uses for CRT glass. We are pursuing relationships with Manitoba manufacturers that can produce goods from leaded glass. We also continue to consider alternatives such as using the leaded glass a ballast in a plastic sea-wall block.

The fourth issue facing Powerland is the recycling and/or disposal of computer related products cannot. There is no uniformity of plastic even between various models may also have limited reuse value as defectives. There is some value use. This involves some uses may include mixing the down form) with aggregate for gravel for commercial roofing, and mixing it with concrete. We have checked with Manitoba companies that could use plastic aggregate and have found no interest.



when recycling computer products plastics. Molded plastics used in be reused in their highest form. shapes between manufacturers or by one manufacturer. The plastics spare parts for replacing potential for secondary lower-level of product breakdown. Such plastic (in shredded or broken roadway bases, using it in place of

Closed-loop remanufacturing seems like the best idea for computer plastics in the waste stream. It seems reasonable to expect manufacturers to use the plastic polymers from their obsolete products in making new products. Some monitor manufacturers have started closed-loop manufacturing. They accept plastics from their brands of monitors for use in the manufacturing of new monitors. We have no local, or even Canadian, monitor manufacturers.

Reusing plastics in general manufacturing is also possible. There are three issues with reuse. Firstly, the plastics collected need to be separated by type. Various plastic polymers are used in a single computer. The monitor housing is likely a different polymer than the computer faceplate. The plastics found inside a



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computer are yet another polymer. These polymers are not necessarily consistent even within a brand of computers over time. Up to eight different resins were found by MBA Polymers in the make-up of plastics used in computers^x.

Secondly, plastics need to be completely clean in order to enter the manufacturing stream. When plastics are used they collect particles from materials with which they come in contact. A cleaning process showed that up to a third of a cleaned and separated plastic sample was discarded as waste during preparation for manufacturing. This was in addition to the waste removed during the initial sorting and cleaning.

Thirdly, plastics used in computers are coloured. The amount of tint used is not consistent between manufacturers. In order to produce products with identical colours the manufacturer must account for the tint in the recycled product.



Secondary Use Remanufacturing is another use for computer plastics. Plastics are chipped or ground and combined with other materials as a new product. It may be possible to use the computer plastics with softer plastics to create outdoor-use products such as fence materials, boardwalks, driveway blocks and the like. This process uses softer resins as glue and the harder polymers for strength and filler. There is promise for smaller scale manufacturing industries to take advantage of the recycling feedstock for manufacturing these products. This is a potential growth area

for Manitoba industry.

Recovering plastic polymers is a promising direction for computer plastics recycling. Presently this is a costly process. According to the Minnesota study the plastics must first be separated and cleaned. The plastics are then ground into feedstock. After this they must be further cleaned to remove foreign materials such as metals, paper and other plastics. The cleaned feedstock then must be separated by density so that the most similar polymers are gathered. The product then can be heated and broken into resin streams. These resin streams are now clean and can be sold for reuse. A significant volume of plastic is needed to make a plastic reprocessing plant viable. Our best option in this regard may be to collect the plastic until Manitoba has enough volume to make such a plant viable. Otherwise, in addition to paying for reprocessing, Manitoba recyclers would need to pay shipping charges to the nearest plastic polymer recovery plant.

Powerland currently landfills computer products plastics. We believe that there are reasonable opportunities for recycled-plastics businesses to develop in Manitoba. We also believe that Manitoba needs to gather a large source of computer plastics for reuse and recycling. It is our recommendation that these plastics be segregated in the landfill until there is enough volume and enough need to begin a hard-plastic recycling industry in Manitoba.

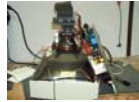
In conclusion Powerland Computers again invites the government, all businesses and consumers to send their end-of-life computer equipment to Powerland for recycling. Powerland offers free recycling on most computer products. Powerland also offers to collect, refurbish and distribute computers to schools and charities at no cost to the government. The schools and charities would continue to pay the refurbishing and administrative costs at the rates being charged by charities. In addition, tax receipts will be available through local charities for the value of computers donated for use by schools and charities.

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recycle



repair



refurbish



resell

ⁱ “Canada’s information technology sector” Fred Wong
Statistics Canada Publication, December 19, 2002

ⁱⁱ “Computer Recycling Infrastructure in Canada”
The Environmental Industry Association, March, 2002

ⁱⁱⁱ Prior to any business case being formalized a complete study of the Manitoba market would need to be completed to determine the accuracy of the above information.

^{iv} See page 4 of “Reclaiming End-of-Life Cathode Ray Tubes (CRTs), and Electronics: A Florida Update” by John L. (Jack) Price.

^v See page 2 of “Potential Markets for CRTs and Plastics from Electronics Demanufacturing...” written by Patricia Dillon for the University of Massachusetts.

^{vi} On page 4 of “Reclaiming End-of-Life Cathode Ray Tubes (CRTs), and Electronics: A Florida Update” by John L. (Jack) Price, there is a diagram of a monitor, illustrating the location of the frit on a monitor.

^{vii} See “3.3 Phase III” on pages 8 and 9 of “Characterization of Lead Leachability from Cathode Ray Tubes Using the Toxicity Characteristic Leaching Procedure” by Timothy Townsend, et al.

^{viii} See page 24 of “Computer Recycling Infrastructure in Canada” by the CEIA (Canadian Environment Industry Association) for Industry Canada Environmental Affairs Branch.

^{ix} See page 13 of Technical Report #6 - “Potential Markets for CRTs and Plastics from Electronics Demanufacturing: An Initial Scoping Report” by Patricia Dillon.

^x See Table 4-5 on page 57 of “Recycling Used Electronics – Report on Minnesota’s Demonstration Project”.