



Final Revised (Phase 1 and 2) Waste Electrical and Electronic Equipment (WEEE) Program Plan

Appendices

July 10, 2009

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Appendix 1: Ontario Regulation 393/04

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ONTARIO REGULATION 393/04

WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Consolidation Period: From July 10, 2008 to the e-Laws currency date.

Last amendment: O. Reg. 245/08.

This Regulation is made in English only.

Interpretation

1. In this Regulation,

“waste electrical and electronic equipment” means a device that is waste, that required an electric current to operate and that is,

- (a) a household appliance, whether used inside or outside a home, including any device listed in Schedule 1,
- (b) information technology equipment, including any device listed in Schedule 2,
- (c) telecommunications equipment, including any device listed in Schedule 3,
- (d) audio-visual equipment, including any device listed in Schedule 4,
- (e) a toy, leisure equipment or sports equipment, including any device listed in Schedule 5,
- (f) an electrical or electronic tool, including any device listed in Schedule 6, but not including a large-scale stationary industrial tool, or
- (g) a navigational, measuring, monitoring, medical or control instrument, including any device listed in Schedule 7, but not including any implanted or infected medical instrument. O. Reg. 393/04, s. 1.

Designation

2. Waste electrical and electronic equipment is prescribed as a designated waste for the purposes of the Act. O. Reg. 393/04, s. 2.

Industry funding organization

3. Ontario Electronic Stewardship is continued and is designated as the industry funding organization for the waste diversion program for waste electrical and electronic equipment approved by the Minister under section 26 of the Act. O. Reg. 245/08, s. 1.

Composition

4. (1) Ontario Electronic Stewardship is composed of the members of its board of directors who shall be appointed in accordance with section 5. O. Reg. 245/08, s. 1.

(2) Despite subsection (1), the members of the board of directors who hold office immediately before Ontario Regulation 245/08 comes into force are deemed to have been appointed to the board in accordance with this Regulation and shall continue to hold office until notice that all members have been appointed under section 5 is published on Ontario Electronic Stewardship's website. O. Reg. 245/08, s. 1.

Appointed members

5. (1) The board of directors shall be composed of the following members:

1. Four members appointed by Electronics Product Stewardship Canada.
2. Three members appointed by Retail Council of Canada.
3. One member appointed jointly by Electronics Product Stewardship Canada and Retail Council of Canada. O. Reg. 245/08, s. 1.

(2) If an appointment is not made under paragraph 3 of subsection (1), the chief executive officer of Ontario Electronic Stewardship may appoint an individual as a member of the board of directors. O. Reg. 245/08, s. 1.

(3) A member appointed under subsection (2) shall hold office until the appointment is made under subsection (1). O. Reg. 245/08, s. 1.

Alternate members

6. Alternate members may be appointed and shall act in accordance with the following rules:

1. Electronics Product Stewardship Canada may appoint alternate members and, in the absence of a member appointed under paragraph 1 of subsection 5 (1), one of those alternate members may participate in a board meeting and vote on matters before the board.
2. Retail Council of Canada may appoint alternate members and, in the absence of a member appointed under paragraph 2 of subsection 5 (1), one of those alternate members may participate in a board meeting and vote on matters before the board.
3. Electronics Product Stewardship Canada and Retail Council of Canada may jointly appoint alternate members and, in the absence of the member appointed under paragraph 3 of subsection 5 (1), one of those alternate members may participate in a board meeting and vote on matters before the board. O. Reg. 245/08, s. 1.

Qualification

7. (1) An individual may be appointed as a member of the board of directors under section 5 or as an alternate under section 6 only if he or she,

- (a) is a director, officer or employee of a corporation that supplies a product from which waste electrical and electronic equipment is derived;
- (b) is a resident of Canada; and
- (c) is at least 18 years of age. O. Reg. 245/08, s. 1.

(2) Despite subsection (1), an individual shall not be appointed as a member of the board of directors or as an alternate if he or she is a bankrupt or has been found by a court to be mentally incapable of managing property. O. Reg. 245/08, s. 1.

Application of *Corporations Act*

8. Sections 59 and 80 and subsections 283 (4) and (5) of the *Corporations Act* apply, with necessary modifications, to Ontario Electronic Stewardship. O. Reg. 245/08, s. 1.

SCHEDULE 1
HOUSEHOLD APPLIANCES

1. Air purifier
2. Air conditioner
3. Answering machine
4. Barbeque starter
5. Blender
6. Bottle or can dispenser
7. Can opener
8. Carpet sweeper
9. Clock
10. Clothes dryer
11. Clothes washer
12. Coffee grinder
13. Coffee maker
14. Curling iron
15. Dehumidifier
16. Dishwashing machine
17. Electric hot plate
18. Fan
19. Food processor
20. Freezer
21. Fryer
22. Glue gun
23. Hair dryer
24. Heat gun
25. Heater
26. Hot drink dispenser
27. Humidifier
28. Iron
29. Kettle
30. Knitting machine
31. Microwave oven
32. Mixer
33. Radiator
34. Razor
35. Refrigerator
36. Scissors
37. Sewing machine
38. Slicing machine

39. Solid product dispenser
40. Stove
41. Toaster
42. Toaster oven
43. Toothbrush
44. Vacuum cleaner
45. Vacuum sealer
46. Watch
47. Water purifier
48. Weaving machine
49. Weigh scale

O. Reg. 393/04, Sched. 1.

SCHEDULE 2
INFORMATION TECHNOLOGY EQUIPMENT

1. Analog computer
2. Automatic teller machine (ATM)
3. Bar code scanner
4. Calculator
5. CD-ROM drive
6. Computer disk drive
7. Computer keyboard
8. Computer mouse
9. Computer terminal
10. Copier
11. Joystick
12. Mainframe computer
13. Microcomputer
14. Minicomputer
15. Monitor (CRT)
16. Monitor (LCD)
17. Monitor (Plasma)
18. Personal computer (Desktop)
19. Personal computer (Handheld)
20. Personal computer (Laptop)
21. Personal computer (Notebook)
22. Personal computer (Notepad)
23. Personal digital assistant (PDA)
24. Point-of-sale (POS) terminal
25. Printer
26. Computer router

27. Computer flatbed scanner
28. Typewriter

O. Reg. 393/04, Sched. 2.

SCHEDULE 3
TELECOMMUNICATIONS EQUIPMENT

1. Antenna, transmitting or receiving
2. Broadcast equipment (including studio), for radio or television
3. Cable television transmitting or receiving equipment
4. Citizens' band (CB) radio
5. Closed circuit television equipment
6. Fax machine
7. Global positioning system (GPS)
8. Infrared wireless device
9. Intercom system
10. Local area network (LAN) communication equipment
11. Modem
12. Pager
13. PBX (private branch exchange)
14. Satellite television transmitting or receiving equipment
15. Switching equipment
16. Telephone (Cellular)
17. Telephone (Cordless)
18. Telephone (Wire line)
19. Telephone answering machine
20. Telephone carrier line equipment
21. Telephone carrier switching equipment
22. Telex machine
23. Traffic signal
24. Wide area network communications equipment

O. Reg. 393/04, Sched. 3.

SCHEDULE 4
AUDIO-VISUAL EQUIPMENT

1. Amplifier
2. Audio player (tape, disk, digital)
3. Audio recorder (tape, disk, digital)
4. Camera (film, tape, disk, digital)
5. Equalizer
6. Headphone
7. Microphone

8. Mixing board
9. Musical instrument
10. Preamplifier
11. Public address system
12. Radio
13. Receiver
14. Speaker
15. Television (CRT)
16. Television (LCD)
17. Television (Plasma)
18. Television (Rear projection)
19. Tuner
20. Turntable
21. Video player or projector (tape, disk, digital)
22. Video recorder (tape, disk, digital)

O. Reg. 393/04, Sched. 4.

SCHEDULE 5
TOYS, LEISURE EQUIPMENT AND SPORTS EQUIPMENT

1. Action figure and accessories
2. Arts, crafts or hobby device
3. Building set
4. Doll
5. Game or puzzle
6. Infant or preschool toy
7. Learning or exploration toy
8. Outdoor or sports toy
9. Plush toy
10. Vehicle
11. Video game and accessories

O. Reg. 393/04, Sched. 5.

SCHEDULE 6
ELECTRICAL AND ELECTRONIC TOOLS

1. Bender
2. Blower
3. Cutter
4. Disperser
5. Drill
6. Fastener
7. Folder
8. Grinder

9. Hammer
10. Joiner
11. Lathe
12. Lawn mower
13. Mill
14. Nail gun
15. Nibbler
16. Planer
17. Polisher
18. Punch
19. Riveter
20. Router
21. Sander
22. Saw
23. Screwdriver
24. Shear
25. Soldering gun
26. Sprayer
27. Spreader
28. Staple gun
29. Trimmer
30. Vacuum
31. Welder
32. Wrench

O. Reg. 393/04, Sched. 6.

SCHEDULE 7
NAVIGATIONAL, MEASURING, MONITORING, MEDICAL OR CONTROL INSTRUMENTS

1. Alarm system
2. Analyzer
3. Automatic environmental controller or regulator
4. Cardiology equipment
5. Dialysis equipment
6. Drafting instrument
7. Fertilization tester
8. Fire detection and alarm system
9. Freezer
10. Hearing aid
11. Heating regulator
12. Humidistat
13. Instrument for industrial process control

14. Irradiation equipment
15. Laboratory analytical instrument
16. Laboratory equipment for in-vitro diagnosis
17. Medical equipment, ultrasonic
18. Medical radiation therapy equipment
19. Meteorological instrument
20. Meter
21. Nuclear medicine equipment
22. Oscilloscope
23. Process controller
24. Pulmonary ventilator
25. Radiation detection or monitoring instrument
26. Radiotherapy equipment
27. Refractometer
28. Scanner (CT/CAT)
29. Scanner (MRI)
30. Scanner (PET)
31. Smoke detector
32. Soil testing or analysis instrument
33. Surgical support system
34. Surveying instrument
35. Temperature instrument
36. Thermostat

O. Reg. 393/04, Sched. 7.

Appendix 2: OES Incorporation Letters Patent

This space is for
Ministry Use Only
Espace réservé à
l'usage exclusif
du Ministère de
l'Ontario

Ontario Corporation Number
Numéro de la société
1746040

Ministry of Government Services
Ministère des Services gouvernementaux

LETTERS PATENT
This application constitutes the charter of the corporation which is issued by these Letters Patent dated this

LETTRES PATENTES
La présente demande forme la charte de la société constituée en personne morale par lettres patentes daté le

SEPTEMBER 20 SEPTEMBRE, 2007

Minister of Government Services
[Signature]
per/par **Director / Directrice**

Le ministre des Services gouvernementaux

Form 2
Corporations
Act
Formule 2
Loi sur les
personnes
morales

APPLICATION FOR INCORPORATION OF A CORPORATION WITHOUT SHARE CAPITAL
REQUÊTE EN CONSTITUTION D'UNE PERSONNE MORALE SANS CAPITAL-ACTIONS

1. The name of the corporation is: (Set out in BLOCK CAPITAL LETTERS)
Dénomination sociale de la société : (Écrire en LETTRES MAJUSCULES SEULEMENT)

O	N	T	A	R	I	O	E	L	E	C	T	R	O	N	I	C	S	T	E	W	A	R	D	S	H	I	P

2. The address of the head office of the corporation is:
Adresse du siège social:

Suite #1120, 220 Laurier Avenue West

(Street & Number or R.R. Number & if Multi-Office Building give Room No.)
(Rue et numéro ou numéro de la R.R. et, s'il s'agit d'un édifice à bureaux, numéro du bureau)

Ottawa

Ontario

K	1	P	5	Z	9
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(Name of Municipality or Post Office)
(Nom de la municipalité ou du bureau de poste)

(Postal Code)
(Code postal)

3. The applicants who are to be the first directors of the corporation are:
Requérants appelés à devenir les premiers administrateurs de la personne morale :

First name, middle names and
surname
*Prénom, autres Prénoms et nom de
famille*

Address for service, giving Street & No. or R.R. No., Municipality,
Province, Country and Postal Code
*Domicile élu, y compris la rue et le numéro, le numéro de la R.R. ou
le nom de la municipalité, la province, le pays et le code postal*

Sean C. De Vries

5770 Ambler Drive
Mississauga, Ontario L4W 2T3

Frances C. Edmonds

5150 Spectrum Way
Mississauga, Ontario L4W 5G1

Diane J. Brisebois

1255 Bay Street, Suite 800
Toronto, Ontario M5R 2A9

4. The objects for which the corporation is incorporated are:
Objets pour lesquels la personne morale est constituée:

1. the establishment and operation of an association of interested corporations and other organizations to act as an industry funding organization within the meaning of and for the purposes of the *Waste Diversion Act, 2002 (Ontario)* and its successor and amending legislation from time to time (the "Act"), and for such purpose to undertake all actions, assume all obligations and exercise all powers, rights and authorities of an industry funding organization under the Act, and for greater certainty and without in any way limiting the generality of the foregoing:
 - a. to act as an industry funding organization for the administration of provincial and local programs for the reduction, reuse and recycling of waste electrical and electronic equipment ("WEEE"), as defined pursuant to the Act;
 - b. to operate a waste diversion program for WEEE in the Province of Ontario, as required by the Act;
 - c. to develop a program for the reduction, reuse and recycling of WEEE on an environmentally responsible basis;
 - d. to work with governments and government agencies to develop guidelines and standards for environmentally responsible re-use and recycling of WEEE;
 - e. to sponsor or conduct research and development into materials and methods to support and increase the effectiveness and efficiency of WEEE diversion;
 - f. to develop or promote products that result from the waste diversion program;
 - g. to develop and manage a consumer awareness and education program to promote understanding and support for the activities of the Corporation;
2. to provide a forum for the discussion and the dissemination of information regarding WEEE issues of importance or interest to members of the Corporation, including, but not limited to, technical, economic and standardization issues;
3. to organize and promote educational opportunities for members;
4. to represent the members and to advocate the position of the Corporation before administrative tribunals, municipal government, provincial ministries, federal departments and their agencies; and
5. for such other complementary purposes that are not inconsistent with these objects.

5. The special provisions are:
Dispositions particulières:

The corporation shall be carried on without the purpose of gain for its members, and any profits or other accretions to the corporation shall be used in promoting its objects.

La personne morale doit exercer ses activités sans rechercher de gain pécuniaire pour ses membres, et tout bénéfice ou tout accroissement de l'actif de la personne morale doit être utilisé pour promouvoir ses objets.

1. to enter into agreements with governments, Waste Diversion Ontario, municipalities and their agencies, boards and commissions, for the development and implementation of a waste diversion program, as contemplated by the Act;
2. to establish and collect fees from stewards under the Act;
3. to invest and reinvest the funds of the Corporation in such manner as determined by the Board of Directors from time to time;
4. to employ any investment manager or managers to invest money that is required to be invested and to pay the compensation of such investment manager or managers from the capital and/or income of such invested money as is deemed appropriate;
5. to establish one or more common trust funds in which donations, grants or other sums of money received by the Corporation, whether or not designated, are combined for the purpose of facilitating investment and to operate such fund or funds in accordance with terms of reference established by the board of Directors from time to time;
6. to employ and pay such assistants, clerks, agents, representative, and employees, and to establish, equip, furnish, maintain, operate, manage and staff appropriate offices, facilities and programs complementing such purposes, and to incur such reasonable expenses as may be necessary therein;
7. to accumulate from time to time part of the fund or funds of the Corporation or the income therefrom subject to any statutes or laws when applicable;
8. to exercise all voting rights and to authorize and direct the execution and delivery of proxies in connection with any securities or obligations in any company, corporation, trust, partnership or other form of business entity ("Entity") held by the Corporation;
9. to take up proportions of any increased capital of an Entity in which the Corporation may at any time hold securities or obligation, to purchase any additional securities or obligations in such Entity; to join in any plan for the reconstruction, re-organization or amalgamation or for the sale of assets of any Entity, or part thereof; to enter into any pooling or other agreement in connection with the securities or obligations of an Entity held by the Corporation; and to give consent to the creation of any mortgage, lien or indebtedness of any Entity whose securities or obligations are held by the Corporation;

5. The special provisions are:
Dispositions particulières:

10. to require payment of all sums of monies and claims to any real or personal property in which the Corporation may have an interest, and to compromise in any such claims, and to pursue payment in its corporate name through whatever means are available at law;
11. to draw, make, endorse, execute and issue cheques and other negotiable instruments; and,
12. to perform any manner of actions as are incidental or conducive to the attaining of the above-mentioned objects of the Corporation.

6. The names and address for service of the applicants:

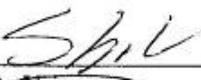
4.

Nom et prénoms et domicile élu des requérants :

First name, middle names and surname <i>Prénom, autres Prénoms et nom de famille</i>	Address for service, giving Street & No. or R.R. No., Municipality, Province, Country and Postal Code <i>Domicile élu, y compris la rue et le numéro, le numéro de la R.R. ou le nom de la municipalité, la province, le pays et le code postal</i>
Sean C. De Vries	5770 Ambler Drive Mississauga, Ontario L4W 2T3
Frances C. Edmonds	5150 Spectrum Way Mississauga, Ontario L4W 5G1
Diane J. Brisebois	1255 Bay Street, Suite 800 Toronto, Ontario M5R 2A9

This application is executed in duplicate.
La présente requête est faite en double exemplaire.

Signatures of applicants
Signature des requérants


Sean C. De Vries

Frances C. Edmonds

Diane J. Brisebois

6. The names and address for service of the applicants:
Nom et prénoms et domicile élu des requérants :

4.B

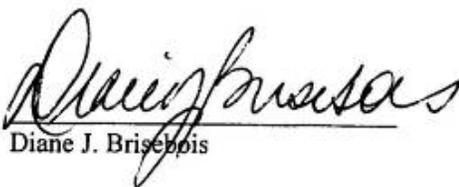
First name, middle names and surname <i>Prénom, autres Prénoms et nom de famille</i>	Address for service, giving Street & No. or R.R. No., Municipality, Province, Country and Postal Code <i>Domicile élu, y compris la rue et le numéro, le numéro de la R.R. ou le nom de la municipalité, la province, le pays et le code postal</i>
Sean C. De Vries	5770 Ambler Drive Mississauga, Ontario L4W 2T3
Frances C. Edmonds	5150 Spectrum Way Mississauga, Ontario L4W 5G1
Diane J. Brisebois	1255 Bay Street, Suite 800 Toronto, Ontario M5R 2A9

This application is executed in duplicate.
La présente requête est faite en double exemplaire.

Signatures of applicants
Signature des requérants

Sean C. De Vries

Frances C. Edmonds


 Diane J. Brisebois

Appendix 3: Minister's Program Request Letter

06/12/2007 13:48

416-325-4243

MCE WMPB

PAGE 01/07

Ministry
of the
Environment

Office of the Minister

135 St. Clair Ave. West
12th Floor
Toronto ON M4V 1P5
Tel (416) 314-6790
Fax (416) 314-6748

Ministère
de
l'Environnement

Bureau du ministre

135, avenue St. Clair ouest
12^e étage
Toronto ON M4V 1P5
Tél (416) 314-6790
Téléco (416) 314-6748



JUN 11 2007

Ms. Gemma Zecchini
Chair
Waste Diversion Ontario
45 Sheppard Ave. E., Suite 920
North York, ON M2N 5W9

Dear Ms. Zecchini:

I am pleased to write to the Board of Directors of Waste Diversion Ontario (WDO) to provide the final requirements for Ontario's Waste Electrical and Electronic Equipment Diversion Program (WEEE Program).

In a letter dated December 20, 2004, the former Minister of the Environment requested WDO to develop a WEEE Program, pursuant to subsection 23(1) of the *Waste Diversion Act, 2002* (WDA). The letter indicated that a final Minister's Program Request Letter would be provided at a later date. This letter, including the attached Addendum, constitutes the final Program Request Letter in respect to Phase One and Phase Two, sent pursuant to subsection 23(1) of the WDA and replaces the letter dated December 20, 2004.

Pursuant to clause 23(3) (b) of the WDA, I am requiring WDO to develop the WEEE Program in co-operation with a new Industry Funding Organization (IFO) incorporated by WDO under Part III of the *Corporations Act* for the purposes of the waste diversion program. WDO should include industry stewards directly affected by the WEEE Program on the IFO Board.

Ontario Regulation 393/04 prescribed seven categories of WEEE materials as a designated waste for the purposes of the WDA. However, after careful consideration of the *Waste Electrical and Electronic Equipment Study* results and WDO's recommendations, I have decided to require a phased-in approach to Program development that focuses initially on some of the items included in Schedule 2, Information Technology Equipment, of Ontario Regulation 393/04 (including desktop and portable computers, monitors, printers and peripherals), and Schedule 4, Audio-Visual Equipment, of Ontario Regulation 393/04 (including televisions). This initial focus will be referred to as Phase One of the WEEE Program. Similar to other program requests, an addendum to this letter has been attached which highlights the full list of items for Phase One and additional areas to be addressed in the proposed Program submission.



07E1G (03/01)

100% Recycled Chlorine Free. Made in Canada.

Addendum to the Minister's Request for a Waste Diversion Program for Waste Electrical and Electronic Equipment

1. Waste Diversion Ontario (WDO) shall develop a Waste Diversion Program (Program) for Waste Electrical and Electronic Equipment (WEEE) in accordance with the *Waste Diversion Act, 2002* (WDA).
2. In developing the Program, WDO shall consider the Canada-Wide Principles for Electronics Product Stewardship as issued by the Canadian Council of Ministers of the Environment to the extent that the principles are consistent with the WDA and the Program request letter.
3. WDO shall implement the Consultation Plan, which includes all affected parties and members of the public, submitted to the Minister on April 22, 2005, amended appropriately to reflect the product phasing schedule outlined in Item 14 below.
4. The Program shall provide for WEEE generated by residential and industrial, commercial and institutional (IC&I) sources.
5. Designated stewards shall be responsible for payment of all Program costs. At a minimum, Program costs shall include the costs incurred for the following activities:
 - a) Collecting, storing, transporting, processing and marketing all WEEE that is collected for diversion and actually diverted;
 - b) Collecting, storing, transporting, processing and disposing all WEEE that is collected for diversion but not diverted (residual waste material);
 - c) Research and development activities to support and increase the effectiveness and efficiency of WEEE collection and diversion;
 - d) Activities to develop and promote diversion of WEEE, generated from electrical and electronic equipment items identified under the Program, that is available for collection under the Program; and
 - e) Educational and public awareness activities to support the WEEE Program.
6. Funding Rules, for Phase One of the phase-in schedule:
 - a) Consistent with the WDA, the proposed funding rules should designate and define as stewards under the Program, brand owners, first importers, and/or assemblers of non-branded products for sale and use in Ontario that result in WEEE. Such products shall be referred to as "Electrical and Electronic Equipment";

- b) The proposed funding rules will clearly identify Electrical and Electronic Equipment included under the Program for which potential fees are payable;
 - c) Potential fees payable in respect of Electrical and Electronic Equipment under the Program shall be applicable to Electrical and Electronic Equipment produced in Ontario or arriving into the province, for sale to and use by the consumer in Ontario, regardless of the selling technique used, including internet sales;
 - d) Potential fees collected during Phase One of the Program shall be used to pay for Program activities.
 - e) In addition potential fees collected during Phase One of the Program shall also consider capital costs to meet Phase One Program accessibility targets;
 - f) The Program shall consider options with respect to internalizing Program costs based on the results of the *Waste Electronic and Electrical Equipment Study* and determine which option is most appropriate for Ontario as part of the Program; and
 - g) Potential fees shall be used to maximize the management of WEEE through reduction, reuse and recycling and not to fund the burning, landfilling or land application of WEEE unless the 3R options are not available or technically feasible.
7. WDO shall develop and adopt a set of vendor qualification requirements to ensure WEEE is processed in a safe and environmentally sound manner that satisfies local, provincial, and national regulations and international obligations, including the *Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal*. The set of vendor qualification requirements should form part of the WEEE Program submission.
8. The Program submission shall identify a tracking and auditing mechanism for WEEE from the point of collection through to its final destination, including verification of processing, in accordance with Phase One of the phase-in schedule.
9. At a minimum, the Program submission shall describe and include an assessment of the following elements in accordance with Phase One of the phase-in schedule:
- a) A breakdown of the quantity of electronic equipment items sold;
 - b) An estimate of the quantity of each WEEE generated under the Program, that is available for collection;
 - c) The anticipated collection and diversion targets for each WEEE item for the first five years of the Program, taking into account reduction of the quantity of WEEE available for collection as a result of the Program;

- d) Program accessibility targets to ensure that the Program is convenient and accessible to all Ontarians, including, but not limited to: high-density urban areas, rural communities and northern Ontario, and the proposed methodology for defining the appropriate accessibility targets;
 - e) The methodology for expanding and improving the existing collection and diversion infrastructure for WEEE to meet the capture and accessibility targets;
 - f) A description of any WEEE diversion and recovery infrastructure in place;
 - g) Descriptions of markets for all recovered WEEE items;
 - h) A list of benchmarks and performance measures used to encourage 3 E's, promote best practices and encourage the development of innovative diversion techniques;
 - i) A detailed breakdown of financial payments including,
 - i. specific incentives directed to collecting, transporting, processing, marketing, disposing and capital to improve the existing collection and diversion infrastructure;
 - ii. criteria to be applied to determine incentive eligibility; and
 - iii. the procedure for eligible parties to request and receive incentives.
 - j) A tracking and audit mechanism to ensure overall Program compliance.
10. The Program shall consider incentives encouraging stewards to initiate measures designed to reduce waste resulting from their products, increase recyclability of products and increase use of recycled content of products.
11. Where limited re-use and recycling options are available, the WEEE diversion Program should encourage sufficient re-use and recycling capacity to maximize management of WEEE.
12. The WEEE Program shall also include provisions to establish and/or expand the availability of WEEE collection programs and sites to make it convenient and accessible to all Ontarians, including, but not limited to: high-density urban areas, rural communities and northern Ontario.
13. The Program shall include provisions for stewards to report both residential and Industrial, Commercial and Institutional (IC&I) sales beginning upon commencement of Phase 1 of the Program.
14. Of the waste prescribed in Ontario Regulation 393/04 the Program shall include the following:

Phase-In Schedule:

- a) Phase One of the Program shall include:

- Schedule 2
- Information Technology Equipment
- 5. CD-ROM drive
- 6. Computer disk drive
- 7. Computer keyboard
- 8. Computer mouse
- 9. Computer terminals
- 13. Microcomputer
- 14. Minicomputer
- 15. Monitor (CRT)
- 16. Monitor (LCD)
- 17. Monitor (Plasma)
- 18. Personal computer (Desktop)
- 20. Personal computer (Laptop)
- 21. Personal computer (Notebook)
- 22. Personal computer (Notepad)
- 25. Printer

- Schedule 3
- Telecommunications Equipment
- 6. Fax machine

- Schedule 4
- Audio-Visual Equipment
- 15. Television (CRT)
- 16. Television (LCD)
- 17. Television (Plasma)
- 18. Television (Rear Projection)

b) Phase Two of the Program shall include all items listed in Phase One of the Program, along with:

- Schedule 2
- Information Technology Equipment
- 10. Copier
- 19. Personal computer (Handheld)
- 23. Personal digital assistant (PDA)
- 27. Computer flatbed scanner
- 28. Typewriter

- Schedule 3
- Telecommunications Equipment

11. Modem
12. Pager
16. Telephone (Cellular)
17. Telephone (Cordless)
18. Telephone (Wire line)
19. Telephone answering machine

Schedule 4

Audio-Visual Equipment

1. Amplifier
 2. Audio player (tape, disk, digital)
 3. Audio recorder (tape, disk, digital)
 4. Camera (film, tape, disk, digital)
 5. Equalizer
 10. Preamplifier
 12. Radio
 13. Receiver
 14. Speaker
 19. Tuner
 20. Turntable
 21. Video player or projector (tape, disk, digital)
 22. Video recorder (tape, disk, digital)
15. The remaining items listed from all seven (7) categories of Ontario Regulation 393/04 are to be phased-in, in accordance with future request letters. WDO is encouraged to submit their recommendations on the remaining items.

Appendix 4: Clarification Letter on WEEE Diversion

08/16/2007 16:24 416-325-4243

MDE WMPB

PAGE 02/03

Ministry
of the
Environment

135 St. Clair Avenue West
Toronto ON M4V 1P5

Ministère
de
l'Environnement

135, avenue St. Clair ouest
Toronto ON M4V 1P5

RECEIVED

AUG 17 2007



Ms. Glenda Gies
Executive Director
Waste Diversion Ontario
45 Sheppard Ave. E., Suite 920
North York, ON M2N 5W9

August 13, 2007

Dear Ms. Gies:

Further to our recent discussions regarding the development of a Waste Electrical and Electronic Equipment Diversion Program (WEEE Program) for Ontario, I would like to take this opportunity to clarify some aspects of the Minister's Program Request Letter, dated June 11, 2007, in respect to consideration of reduction, re-use and recycling activities, and associated targets and performance measures.

The Minister's Program Request Letter for the WEEE Program states that consideration of existing legitimate diversion activities must be taken into account during development of the WEEE Program. This includes, but is not limited to:

- activities of reuse organizations that collect, refurbish and distribute used electronic products for community and charitable purposes, and
- take-back programs organized by electronic products manufacturers.

It is expected that WDO will identify and assess existing WEEE diversion activities in the Province, and identify how these activities will be incorporated into the overall program plan.

Furthermore, Section 10 of the Addendum to the Program Request Letter states, where limited re-use and recycling options are available, the WEEE Program should encourage sufficient re-use and recycling capacity to maximize management of WEEE.

Detailed program requirements in the Program Request Letter Addendum related to targets and performance measure include:

- Section 9(c): an assessment of anticipated collection and diversion targets for each WEEE item for the first five years of the Program, taking into account reduction of the quantity of WEEE available for collection as a result of the Program;



07610E (10/07)

100% Recycled Chlorine Free, Made in Canada

- Section 9(h): a list of benchmarks and performance measures used to encourage 3Rs, promote best practices and encourage the development of innovative diversion techniques.

To clarify, the position of the Ministry of the Environment is that *diversion* includes the 3Rs – reduction, re-use and recycling – and as such, it is expected that the WEEE Program Plan submitted by WDO will include targets for:

- Reduction for each WEEE item for the first five years of the Program;
- Re-use for each WEEE item for the first five years of the Program, and
- Recycling for each WEEE item for the first five years of the Program.

Similarly, benchmarks and performance measures that are proposed as part of the program should encourage WEEE reduction, re-use and recycling.

I trust that this information sufficiently clarifies the Minister of the Environment's intent, in respect to the scope of activities that are to be included as part of an Ontario WEEE diversion program. Should you have any questions regarding this, or any other matter, in respect to the WEEE Program Request Letter, please do not hesitate to contact me.

Sincerely,



John Vidan
Director, Waste Management Policy Branch
Ministry of the Environment

Appendix 5: Memorandum of Agreement for Phase 1 Program Plan

MEMORANDUM OF AGREEMENT

THIS MEMORANDUM OF AGREEMENT made in duplicate is effective as of this 17th day of October, 2007.

B E T W E E N:

WASTE DIVERSION ONTARIO, a corporation without share capital incorporated by the *Waste Diversion Act, 2002*

(hereinafter referred to as "Waste Diversion Ontario")

- and -

ONTARIO ELECTRONIC STEWARDSHIP, a corporation without share capital incorporated under the laws of the Province of Ontario

(hereinafter referred to as "Ontario Electronic Stewardship")

WHEREAS according to Subsection 5 (a) of the *Waste Diversion Act*, Waste Diversion Ontario shall develop, implement and operate waste diversion programs for designated wastes in accordance with the *Act*;

AND WHEREAS Waste Diversion Ontario is required under section 24 (1) to cause a corporation without share capital to be incorporated under Part III of the *Corporations Act* for the purpose of a waste diversion program;

AND WHEREAS Waste Diversion Ontario has caused Ontario Electronic Stewardship to be incorporated to serve as the Industry Funding Organization established under Section 24 of the *Act* for the purposes of developing and implementing a waste diversion program for Waste Electrical and Electronic Equipment designated under the *Act* in consideration of the premises and mutual agreements contained herein and subject to the terms and conditions hereinafter set forth;

NOW THEREFORE, the parties covenant and agree as follows:

1. PURPOSE OF THE MEMORANDUM OF AGREEMENT

1.1 The purpose of this Memorandum of Agreement between Waste Diversion Ontario and Ontario Electronic Stewardship is to:

- (a) Define the roles and responsibilities of the parties during development of a diversion program plan for Waste Electrical and Electronic Equipment;
- (b) Set out the operating relationships between the parties; and
- (c) Ensure openness and transparency to serve the public interest.

2. DEFINITIONS AND INTERPRETATION

2.1 Terms beginning with capital letters and used herein without definition shall have the meanings given to them in the *Act*, unless otherwise specified.

2.2 When used in this Memorandum of Agreement, the following words and expressions have the following meanings:

- (a) "**Act**" means the *Waste Diversion Act, 2002*, S.O. 2002, c. 6, as same may be amended from time to time;
- (b) "**Business Day**" means any working day, Monday to Friday inclusive, excluding statutory and other holidays, namely: New Year's Day; Good Friday; Easter Monday; Victoria Day; Canada Day; Civic Holiday; Labour Day; Thanksgiving Day; Remembrance Day; Christmas Day, Boxing Day and any other day which the Government of Ontario has elected to be closed for business;
- (c) "**Documentation**" means, for purposes of Section 8 of this Memorandum of Agreement, correspondence, documentation pertaining to consultation during development of the Waste Electrical and Electronic Equipment Program Plan, minutes of meetings of the Board of Directors and subcommittees, internal reports, consultants' reports, agendas and other information and data obtained, created or maintained by Ontario Electronics Stewardship but excluding any documentation which is the subject of attorney-client privilege;
- (d) "**Final Program Request Letter**" means the letter dated June 12, 2007 from the Minister issued to Waste Diversion Ontario following submission of the Waste Electrical and Electronic Equipment Study dated July 20, 2005;
- (e) "**FIPPA**" means the *Freedom of Information and Protection of Privacy Act*, R.S.O. 1990, c. F.31, as amended;
- (f) "**Memorandum of Agreement**" means this Memorandum of Agreement and includes all attached schedules and any amendments thereto;
- (g) "**Minister**" means the Minister of the Environment, Province of Ontario;
- (h) "**Ontario Electronics Stewardship**" means the Industry Funding Organization established by Electronic Products Stewardship Canada and Retail Council of Canada under Section 24 of the *Act*;
- (i) "**Operating Agreement**" means the Operating Agreement entered into between Waste Diversion Ontario and the Minister;
- (j) "**Procedures for Industry Funding Organizations**" means the procedures to guide establishment of an Industry Funding Organization and development of a Waste Diversion Program approved by Waste Diversion Ontario;

- (k) "**Program Agreement**" means the Program Agreement to be entered into between Waste Diversion Ontario and Ontario Electronics Stewardship prior to approval by Waste Diversion Ontario of the Waste Electrical and Electronic Equipment Program Plan;
- (l) "**Program Request Letter**" means the letter from the Minister of the Environment dated December 22, 2004 requesting Waste Diversion Ontario to develop a Waste Electrical and Electronic Equipment Program Plan;
- (m) "**Waste Diversion Program**" means a program referred to in Sections 23 and 25 of the *Act*;
- (n) "**Waste Electrical and Electronic Equipment**" means waste materials defined under Ontario Regulation 393/04;
- (o) "**Waste Electrical and Electronic Equipment Program Plan**" means the Waste Diversion Program with respect to Waste Electrical and Electronic Equipment prepared by Waste Diversion Ontario in cooperation with Ontario Electronics Stewardship for the approval of the Minister.

2.3 In this Memorandum of Agreement,

- (a) Words denoting the singular include the plural and vice versa and words denoting any gender include all genders;
- (b) The word "including" or "includes" shall mean "including [or includes] without limitation";
- (c) Any reference to a statute shall mean the statute in force as at the date hereof, together with all regulations promulgated thereunder, as the same may be amended, re-enacted, consolidated and/or replaced, from time to time, and any successor statute thereto, unless otherwise expressly provided;
- (d) When calculating the period of time within which or following which any act is to be done or step taken, the date which is the reference day in calculating such period shall be excluded; if the last day of such period is not a Business Day, the period shall end on the next Business Day;
- (e) All dollar amounts are expressed in Canadian dollars;
- (f) Any tender of notices or documents under this Memorandum of Agreement shall be made upon the relevant party at the address set out in Section 12;
- (g) The division of this Memorandum of Agreement into separate sections and subsections, and the insertion of headings are for convenience of reference only and shall not affect the construction or interpretation of this Memorandum of Agreement; and

- (h) Except as specifically defined or provided for in this Memorandum of Agreement, words and abbreviations which have well known or trade meanings are used in accordance with their recognized meanings.

2.4 The parties acknowledge that the recitals to this Memorandum of Agreement are true and correct.

3. TERM OF MEMORANDUM OF AGREEMENT AND AMENDMENT

3.1 The term of this Memorandum of Agreement shall commence immediately and shall remain in effect, unless terminated earlier in accordance with Section 16 of this Memorandum of Agreement, until approval of the Waste Electrical and Electronic Equipment Program Plan by the Minister of the Environment and designation of Ontario Electronic Stewardship by regulation as the Industry Funding Organization for Waste Electrical and Electronic Equipment, at which time the Program Agreement between Waste Diversion Ontario and Ontario Electronics Stewardship will take effect.

3.2 Any changes to the terms of this Memorandum of Agreement shall be by written amendment signed by both parties. No changes shall be effective or shall be carried out in the absence of such an amendment.

4. ROLES OF THE PARTIES

4.1 Waste Diversion Ontario represents and warrants that it has accepted the submission by the Electronics Products Stewardship Canada and Retail Council of Canada under Waste Diversion Ontario's Procedures for Industry Funding Organizations Phase I as the basis for operation of Ontario Electronic Stewardship and development of the Waste Electrical and Electronic Equipment Program Plan, subject to the following.

4.2 Waste Diversion Ontario agrees with Ontario Electronic Stewardship to be bound by this Memorandum of Agreement and to perform the terms of this Memorandum of Agreement including:

- (a) Complying with all obligations arising from the Act and the Final Program Request Letter;
- (b) Implementing the programs, policies and procedures identified as the responsibility of Waste Diversion Ontario in the Act, the Final Program Request Letter and Procedures for Industry Funding Organizations; and
- (c) Providing to Ontario Electronic Stewardship actual costs to June 30, 2007, as outlined in Schedule A, and estimates from time to time of the following: (i) the costs incurred or expected to be incurred by Waste Diversion Ontario in respect of preparing the Waste Electrical and Electronic Equipment Consultation Plan and Study dated July 8, 2005 and developing the Waste Diversion Program in respect of Waste Electrical and Electronic Equipment; and (ii) a reasonable share of the other costs incurred or expected to be incurred by Waste Diversion Ontario in carrying out its responsibilities under the Act, provided that such costs will not be

invoiced to Ontario Electronic Stewardship until the date ninety days following commencement of the Waste Electrical and Electronic Equipment Program Plan.

4.3 Ontario Electronic Stewardship agrees with Waste Diversion Ontario to be bound by this Memorandum of Agreement and to perform the terms of this Memorandum of Agreement including:

- (a) Acting as the Industry Funding Organization legally responsible under the *Act*.
- (b) Co-operating fully with Waste Diversion Ontario in the development of a Waste Electrical and Electronic Equipment Program Plan;
- (c) Complying with all obligations arising from the *Act* and the Final Program Request Letter;
- (d) Complying with the Procedures for Industry Funding Organizations established by Waste Diversion Ontario including completion of Phases II, III and IV utilizing the information submitted to Waste Diversion Ontario under Phase I, taking into account the requirements of the Memorandum of Agreement;
- (e) Submitting the following to Waste Diversion Ontario for review and acceptance prior to use:
 - (i) Conceptual outline of the diversion program options to be considered;
 - (ii) Method by which the advantages and disadvantages of each diversion program option will be assessed;
 - (iii) Method by which the economic implications of each diversion program option will be assessed.
- (f) Implementing the Waste Electrical and Electronic Equipment Consultation Plan revised by Waste Diversion Ontario following receipt of the Final Program Request Letter;
- (g) Developing a Waste Electrical and Electronic Equipment Program Plan in accordance with the revised schedule and workplan appended as Schedule B to the Memorandum of Agreement;
- (h) Arranging for technical reviews of the draft Waste Electrical and Electronic Equipment Program Plan as reasonably required by Waste Diversion Ontario from time to time;
- (i) Reporting on the assessment of economic implications of preferred program option(s) in relation to Subsection 5(c) of the *Act* for all types of stakeholders referenced in the consultation plan;
- (j) Negotiating a program agreement with Waste Diversion Ontario prior to acceptance of the draft Waste Electrical and Electronic Equipment Program Plan by Waste Diversion Ontario; and

- (k) Including the following in the Waste Electrical and Electronic Equipment Program Plan:
 - (i) activities to reduce, reuse and recycle the designated waste as defined in Ontario Regulation 393/04, the Final Program Request Letter and the letter of clarification dated August 13, 2007 from Mr. John Vidan, Director, Waste Management Policy Branch.
 - (ii) research and development activities relating to the management of the designated waste.
 - (iii) activities to develop and promote products that result from the waste diversion program.
 - (iv) educational and public awareness activities to support the waste diversion program.

4.4 Notwithstanding the composition of the Board of Directors of Ontario Electronic Stewardship set out in its charter documents, Waste Diversion Ontario shall have the right to require reasonable and appropriate changes in the composition of the Board of Directors of Ontario Electronic Stewardship, subject to the requirements of the Minister's Final Program Request Letter, if Waste Diversion Ontario determines in good faith that such changes are required in order to ensure reasonable representation of stewards affected by the development of a Waste Diversion Program in respect of Waste Electrical and Electronic Equipment or to ensure that the objectives of the *Act* are accomplished.

4.5 Ontario Electronic Stewardship will consult with Waste Diversion Ontario as requested from time to time during the course of developing the Waste Electrical and Electronic Equipment Program Plan and will comply with all reasonable and appropriate directions and instructions given by Waste Diversion Ontario with respect to the design of such Plan.

4.6 Ontario Electronic Stewardship agrees to indemnify and hold Waste Diversion Ontario harmless in respect of any losses, costs, claims, damages or expenses incurred or suffered by Waste Diversion Ontario in relation to the development of the Waste Electrical and Electronic Equipment Program Plan resulting from any failure by Ontario Electronic Stewardship to satisfy its payment or other obligations to suppliers, consultants or other third parties, provided that the obligation to indemnify shall extend only to such losses, costs, claims, damages or expenses that WDO is legally obligated to pay.

4.7 Waste Diversion Ontario agrees to request an extension from the Minister to the date specified in the Final Program Request Letter for delivery to the Minister of the Waste Electrical and Electronic Equipment Program Plan from February 1, 2008 to March 31, 2008. If the Minister agrees to extend the date for delivery of the Waste Electrical and Electronic Equipment Program Plan as specified in the Final Program Request Letter, Waste Diversion Ontario agrees to extend the date for the completion of Milestone 17 as set out in Schedule B hereto (and to adjust the dates for completion of the preceding milestones) accordingly. Notwithstanding the foregoing, Ontario Electronic Stewardship shall be obligated to deliver the Waste Electrical and Electronic Equipment Program Plan

not later than February 1, 2008 unless and until the Minister agrees to extend the date for delivery thereof.

5. TRANSPARENCY

- 5.1 Ontario Electronic Stewardship will maintain an Internet website accessible by the public. Subject to confidential or proprietary considerations, and provided that information is available in electronic format, Ontario Electronic Stewardship's website is to include information on, or contain the appropriate electronic links to, the Waste Electrical and Electronic Equipment Consultation Plan dated July 2007 all background documents and reports relevant to the consultation process and draft versions of the Waste Electrical and Electronic Equipment Program Plan, when available.

6. INFORMATION SHARING

- 6.1 Subject to confidential and proprietary considerations, Ontario Electronic Stewardship shall provide data and information obtained in the course of developing or implementing the Waste Electrical and Electronic Equipment Program Plan to Waste Diversion Ontario upon request. The parties acknowledge and agree that data and information which might be confidential or proprietary in relation to one steward (as defined in the rules made by Ontario Electronic Stewardship pursuant to the Act and the Final Program request Letter) may cease to be proprietary or confidential if aggregated with data and information relating to more than one steward, provided that after such aggregation it will not be possible to identify individual stewards within the aggregated information. Information to be shared shall include, without limitation, comments received from stewards and stakeholders with respect to the Waste Electrical and Electronic Equipment Program Plan. The parties agree to negotiate in good faith with a view to agreeing upon an information sharing protocol to implement the provisions of this Section 6.1.
- 6.2 Ontario Electronic Stewardship acknowledges that information provided by Waste Diversion Ontario to the Minister is under the control of the Minister within the meaning of FIPPA. Waste Diversion Ontario shall retain full control over all other information obtained, created or maintained by Waste Diversion Ontario.
- 6.3 Any data or materials provided by Ontario Electronic Stewardship to Waste Diversion Ontario which are confidential and are to remain confidential shall be clearly marked as confidential. In the event that the Minister receives a request under FIPPA relating to the disclosure of any such confidential information which has been provided by Waste Diversion Ontario to the Minister and provides notice thereof to Waste Diversion Ontario, Waste Diversion Ontario agrees to provide Ontario Electronic Stewardship with notice to that effect and agrees to transmit representations received from Ontario Electronic Stewardship on the matter to the Minister. Notwithstanding the foregoing, Ontario Electronics Stewardship acknowledges that the Minister is bound by FIPPA and may be required by order of a court or tribunal to disclose confidential information provided by Ontario Electronic Stewardship to Waste Diversion Ontario which has in turn been provided by Waste Diversion Ontario to the Minister.
- 6.4 Each of the parties agrees to hold data and information received from the other which are marked confidential in confidence, unless:

- (a) Such party is required to disclose such data or information by applicable law or by the order of any court or tribunal of competent jurisdiction provided that, if practicable, each of the parties shall provide advance written notice to the other of any proposed or potential order of any court or tribunal of competent jurisdiction requiring disclosure and an opportunity to obtain an appropriate protective order;
- (b) Such data or information have become generally available to the public without breach of this Memorandum of Agreement;
- (c) Such data or information were developed independently by the recipient without the use of such confidential data or information or were lawfully received from another source having the right to furnish such data or information; or
- (d) Such data or information were previously known to the recipient free of any restriction as evidenced by documentation in the recipient's possession.

7. STAKEHOLDER AND PUBLIC CONSULTATION

- 7.1 Waste Diversion Ontario will require Ontario Electronic Stewardship to provide opportunities for consultation with stakeholders, including the public, who may be affected by a Waste Electrical and Electronic Equipment Program Plan. Such consultation is to be open, accessible and responsive to concerns expressed.

8. ONTARIO ELECTRONICS STEWARDSHIP RESPONSIBILITY FOR DOCUMENTATION AND AUDIT

- 8.1 Ontario Electronic Stewardship shall be responsible for maintaining Documentation in carrying out its responsibilities under this Memorandum of Agreement, in a responsible and complete manner. Documentation may be maintained in paper or electronic format, as permitted by applicable law.
- 8.2 Without limiting the generality of the foregoing, the Board of Directors of Ontario Electronic Stewardship shall maintain the following:
 - (a) All Documentation relating to its consultation activities, comments and responses received and a notation of whether and how comments and responses were addressed; and
 - (b) All Documentation relating to funds collected and disbursed.
- 8.3 The receipt and disbursement of funds will be reflected in the audited financial statements of Ontario Electronic Stewardship. The audited financial statements are to be prepared in accordance with generally accepted accounting principles, accompanied by the auditor's report thereon and submitted to Waste Diversion Ontario no later than three months following the fiscal year end or April 1 of the following year, whichever occurs first.

- 8.4 Ontario Electronic Stewardship agrees to implement and maintain measures to ensure the security and integrity of the Documentation and to protect the Documentation against loss, alteration and destruction.

9. COMPLAINTS AND INQUIRIES HANDLING

- 9.1 Waste Diversion Ontario shall be responsible for handling all complaints and inquiries it receives in the following manner:
- (a) Waste Diversion Ontario will be responsible for determining if the complaint and/or inquiry is related to:
 - (i) its responsibilities as set out under the *Act* or as set out in this Memorandum of Agreement;
 - (ii) any other action of Waste Diversion Ontario; or
 - (iii) Ontario Electronic Stewardship;
 - (b) If the complaint/inquiry is related to Waste Diversion Ontario's responsibilities as set out under the *Act* or as set out in this Memorandum of Agreement, or to any other action of Waste Diversion Ontario, Waste Diversion Ontario will be responsible for addressing the complaint or responding to the inquiry;
 - (c) If the complaint/inquiry is related to Ontario Electronic Stewardship, Waste Diversion Ontario shall forward the complaint/inquiry to Ontario Electronic Stewardship asking Ontario Electronic Stewardship to address the complaint or respond to the inquiry, and report to Waste Diversion Ontario within one calendar month and every calendar month thereafter until the complaint/inquiry is resolved;
 - (d) With respect to any other complaint or inquiry, Waste Diversion Ontario will be responsible for forwarding the complaint or inquiry to the appropriate person.

10. INSURANCE

- 10.1 Ontario Electronic Stewardship shall put into effect and maintain throughout the term of this Memorandum of Agreement all the necessary and appropriate insurance for a prudent not-for-profit corporation.
- 10.2 Without limitation to the generality of the foregoing, Ontario Electronic Stewardship shall obtain and maintain directors and officers liability insurance in amounts which are customary for a prudent not-for-profit corporation.

11. ASSIGNMENT

- 11.1 Ontario Electronic Stewardship shall not assign or subcontract any of its rights or obligations under this Memorandum of Agreement or any part thereof without the prior written consent of Waste Diversion Ontario.

12. NOTICES

12.1 All notices to or upon the respective parties hereto shall be in writing and shall be delivered to the party to which such notice is required to be given under this Memorandum of Agreement at the respective address set out below by personal delivery, facsimile with confirmation of transmission, or pre-paid registered post. All notices shall be deemed to have been duly given:

- (a) one (1) Business Day after such notice is received by the other party when delivered by personal delivery or by facsimile; or
- (b) five (5) Business Days after posting by prepaid registered post. In the event of a postal disruption, notices must be given by personal delivery or by a signed back facsimile and all notices delivered within one (1) week prior to the postal disruption must be confirmed by a signed back facsimile to be effective.

Notices to Waste Diversion Ontario shall be delivered to:

Waste Diversion Ontario
45 Sheppard Avenue East, Suite 920
North York, Ontario M2N 5W9

Attention: Executive Director, Waste Diversion Ontario

Facsimile: 416-226-1368

Notices to Ontario Electronic Stewardship shall be delivered to:

Ontario Electronic Stewardship
C/O Sean De Vries
Environmental Manager, Customer and Product Assurance
Panasonic Canada Inc.
5770 Ambler Drive
Mississauga ON L4W 2T3

Attention: Sean De Vries, President, Ontario Electronic Stewardship

Facsimile: 905-238-2415

Either party may, by written notice delivered to the other party, designate a new address or facsimile number for these notices.

13. WAIVER

13.1 No term, condition or provision hereof shall be or be deemed to have been waived by either party by reason of any act, forbearance, indulgence, omission, or event. Only an express written waiver by a party shall be binding on it and each such waiver shall be conclusively deemed to be limited to the circumstances, right or remedy therein specified.

14. SEVERABILITY

- 14.1 In the event that any provision of this Memorandum of Agreement or any part of such provision shall be determined to be invalid, unlawful or unenforceable to any extent, such provision or part thereof shall be severed from the remaining terms and conditions of this Memorandum of Agreement which shall continue to be valid and enforceable to the fullest extent permitted by law.

15. DISPUTE RESOLUTION

- 15.1 Ontario Electronic Stewardship shall include a dispute resolution mechanism in all contracts to which Ontario Electronic Stewardship is a party with the exception of contracts for goods and services in the ordinary course of business.

- 15.2 If any dispute arises between Ontario Electronic Stewardship and Waste Diversion Ontario as to their respective rights and obligations under this Memorandum of Agreement, the parties shall use the following dispute resolution procedures to resolve such disputes:

- (a) The parties shall attempt to resolve disputes in the spirit of mutual co-operation through discussions and negotiations between the designated representatives of the parties within thirty (30) days of the date upon which written notice of the dispute was first given by one party to the other or as otherwise agreed upon;
- (b) If the parties are unable to resolve the dispute in the manner aforesaid, either party shall have the right, on notice in writing to the other, to require that such dispute be submitted to the Executive Director of Waste Diversion Ontario and the Executive Director of Ontario Electronic Stewardship for discussion and resolution within thirty (30) days of the date of the notice requiring such dispute to be submitted to them or as otherwise agreed upon;
- (c) In the event that the Executive Director of Waste Diversion Ontario and the Executive Director of Ontario Electronic Stewardship are unable to resolve such dispute, either party shall have the right, on notice in writing to the other, to require that such dispute be submitted to the Chair of the Board of Directors of Waste Diversion Ontario and the Chair of the Board of Directors of Ontario Electronic Stewardship for discussion and resolution within thirty (30) days of the date of the notice requiring such dispute to be submitted to them or as otherwise agreed upon;
- (d) If the Chair of the Board of Directors of Waste Diversion Ontario and the Chair of the Board of Directors of Ontario Electronic Stewardship are unable to resolve the dispute, either party shall have the right to refer the matter to binding arbitration in accordance with the provisions of the *Arbitration Act, 1991*, S.O. 1991, c. 17, as amended and the Rules of Procedure for Arbitration outlined in Schedule C to this Memorandum of Agreement. Each party shall bear the cost of its own counsel and witnesses but the costs of the arbitration including the fees of the arbitrator(s), the cost of court reporters and transcripts and the cost of the arbitration facility

shall be borne equally by the parties. The arbitration shall take place in Toronto, Ontario, Canada, before a single arbitrator to be chosen jointly by the parties;

- (e) Subject to the provisions of Schedule C hereto, the parties may determine the procedure to be followed by the arbitrator(s) in conducting the proceedings, or may request the arbitrator(s) to do so; and
- (f) Each party agrees to continue performing its obligations under the Memorandum of Agreement pending the resolution of any dispute.

16. TERMINATION

16.1 If, in the reasonable opinion of Waste Diversion Ontario, there has been a breach of this Memorandum of Agreement by Ontario Electronic Stewardship, Waste Diversion Ontario may terminate this Memorandum of Agreement after giving Ontario Electronic Stewardship sixty (60) days prior written notice of the breach or default if Ontario Electronics Stewardship fails to remedy such breach or default by the expiry of the sixty (60) day period. In the event that Ontario Electronic Stewardship reasonably requires more than sixty (60) days to remedy such breach or default, Ontario Electronic Stewardship shall so advise Waste Diversion Ontario without delay and provide a revised time line. Waste Diversion Ontario shall notify Ontario Electronic Stewardship in writing as to whether the revised time line is acceptable and, if it is, the revised time line to remedy such breach will apply. Notwithstanding the foregoing, in the event of a payment default, Waste Diversion Ontario may terminate this Memorandum of Agreement if Ontario Electronic Stewardship fails to remedy such default within thirty (30) days following written notice of the default.

16.2 Notwithstanding subsection 16.1, Waste Diversion Ontario may terminate this Memorandum of Agreement upon ten (10) days prior written notice to Ontario Electronic Stewardship if:

- (a) Ontario Electronic Stewardship assigns or subcontracts any of its rights or obligations under this Memorandum of Agreement or any part thereof except as expressly provided for herein;
- (b) Ontario Electronic Stewardship does not comply with the *Act*, the Final Program Request Letter or directions from Waste Diversion Ontario arising from the *Act* or the Final Program Request Letter;
- (c) Ontario Electronic Stewardship makes a voluntary assignment or a proposal under the *Bankruptcy and Insolvency Act* or a petition or any other proceeding shall be filed, instituted or commenced with respect to Ontario Electronic Stewardship under any bankruptcy, insolvency, debt restructuring, reorganization, liquidation, winding-up or similar law now or hereafter in effect, unless such proceedings are commenced by a party other than Ontario Electronic Stewardship and are being diligently contested by Ontario Electronic Stewardship and are stayed within 30 days from the date of notice of such proceedings being received by Ontario Electronic Stewardship; or

(d) A receiver or trustee is appointed for any part of the assets of Ontario Electronic Stewardship.

16.3 This Memorandum of Agreement shall terminate automatically upon approval of the Waste Electrical and Electronic Equipment Program Plan by the Minister of the Environment and designation of Ontario Electronic Stewardship by regulation as the Industry Funding Organization for Waste Electrical and Electronic Equipment, provided that the Program Agreement between Waste Diversion Ontario and Ontario Electronic Stewardship has been executed and delivered and has come into effect.

17. MEMORANDUM OF AGREEMENT BINDING

17.1 This Memorandum of Agreement shall enure to the benefit of and be legally binding upon the parties hereto and their respective permitted successors and assigns.

18. ENTIRE MEMORANDUM OF AGREEMENT

18.1 This Memorandum of Agreement embodies the entire Memorandum of Agreement between the parties with regard to the operation of Ontario Electronic Stewardship and supersedes any prior understanding or Memorandum of Agreement, collateral, oral or otherwise, existing between the parties at the date of execution of this Memorandum of Agreement.

19. PUBLIC ANNOUNCEMENTS

19.1 Neither Waste Diversion Ontario nor Ontario Electronic Stewardship shall make any press release or other formal public announcement which refers to the role of the other in the development and implementation of the Waste Electrical and Electronic Equipment Program Plan without first consulting the other concerning the contents of such proposed press release or public announcement. The parties agree that prior consultation shall not be required in respect of routine communications or other general information provided by either of the parties to the public with respect to the implementation of the Waste Electrical and Electronic Equipment Program Plan.

20. GOVERNING LAW

20.1 This Memorandum of Agreement shall be construed and interpreted in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein and the parties hereby agree that any dispute arising out of or in relation to this Memorandum of Agreement shall be determined in Ontario.

20.2 Each of the parties shall cause its respective officers, directors and staff to comply with all laws, ordinances, rules and regulations which apply to the parties under the Act or the regulations made thereunder.

IN WITNESS WHEREOF the parties hereto have executed this Memorandum of Agreement as of the date first stated above.

WASTE DIVERSION ONTARIO

Per: _____
Name: Gemma Zecchini
Title: Chair

**ONTARIO ELECTRONIC
STEWARDSHIP**

Per: _____
Name: Sean De Vries
Title: President

Schedules

A - Waste Diversion Ontario Costs Related to Waste Electronic and Electrical Equipment Program Development to June 30, 2007

B – Waste Electronics and Electrical Equipment Program Plan Governance, Workplan and Budget

C - Arbitration Guidelines

SCHEDULE A

WASTE DIVERSION ONTARIO COSTS RELATED TO WASTE ELECTRONIC AND ELECTRICAL EQUIPMENT PROGRAM DEVELOPMENT TO JUNE 30, 2007

	2004	January 1 to December 31, 2005	January 1 to December 31, 2006	January 1 to June 30, 2007	Total December 22, 2004 to June 30, 2007
Board meetings	\$0	\$2,965	\$0	\$10	\$2,975
Committee meetings	\$0	\$254	\$0	\$0	\$254
Consulting	\$0	\$174,305	\$0	\$0	\$174,305
Legal fees	\$0	\$19,197	\$0	\$112	\$19,309
Municipal Datacall	\$375	\$16,595	\$13,979	\$1,851	\$32,800
Office and general	\$76	\$1,355	\$739	\$265	\$2,435
Staffing	\$206	\$36,544	\$13,121	\$7,255	\$57,126
Telephone	\$0	\$263	\$149	\$13	\$425
Travel and business dining	\$12	\$883	\$256	\$90	\$1,241
Total direct program costs	\$669	\$252,361	\$28,244	\$9,596	\$290,870
WEEE's share of WDO's unattributable costs	\$0	\$101,935	\$92,822	\$37,759	\$232,516
Total due from WEEE	\$669	\$354,296	\$121,066	\$47,355	\$523,386

SCHEDULE B

WASTE ELECTRONIC AND ELECTRICAL EQUIPMENT PROGRAM PLAN

GOVERNANCE, WORKPLAN AND BUDGET

Governance Considerations

Governance Principles

We propose to operate a single industry funding organization to manage all Phase 1 products through a single WEEE diversion program.

The IFO board will ensure the program operates in compliance with the requirements of the Minister's Final Program Request Letter, the Waste Diversion Act, and approved program plan.

Governance principles include:

- **Level playing field:** Ensure obligated stewards cannot obtain a competitive advantage over another through the application of the WEEE diversion program, beyond potential incentives encouraging stewards to reduce waste, increase recyclability, and increase use of recycled content
- **Harmonization:** Attempt, where feasible, to harmonize with WEEE diversion programs in other provinces to maximize environmental benefit and economic efficiencies.

Governance Structure during the Plan Development Process

In the program development stage, board members will be nominated by the industry organizations who have stepped forward to create the IFO. Each organization will establish nomination rules which may take into consideration such factors as market share, sector representation, industry/technical knowledge, and capability to contribute.

The board will consist of the following voting members:

- 4 members nominated by EPSC that are phase 1 obligated stewards
- 3 members nominated by RCC that are phase 1 obligated stewards.
- 1 Ontario-based business entity representing industry at-large that is a phase 1 obligated steward.

The board will consist of the following ex-officio (non-voting members). These will be staff positions from their respective organizations:

- 1 member from EPSC.
- 1 member from RCC.

Selection of those being nominated to the board will be based on the experience that those companies have had in developing stewardship programs across Canada. Those companies that have provided significant contributions to stewardship plan development in Canada will be afforded greater priority in the selection of board members.

The board will include a Chair, Vice Chair, and Secretary/Treasurer elected by the board through nominations reviewed by a nominations committee of the board. A quorum of the board will consist of 5/8 of the voting members of the board.

Notes regarding governance:

1. The board is intended as an initial board and may be subject to adjustment based upon progress with program development and subsequently with Year 1 program implementation.
2. The by-laws of the corporation will define a mechanism to account for the addition/deletion of product sector representation based on future phases of product inclusion into the program.
3. The by-laws will define the rules for nominating and electing directors, the rules and powers of an executive committee, voting and quorum rules, appointment of officers, role of members and AGM, and policy on conflicts of interest.
4. A corporate position would be created defining issues which would require a restructuring of the board such as an increase or reduction of covered products or other considerations that may only become apparent during the course of detailed program development.

The board will establish such other committees of the board that will be required to manage the corporation including audit advisory and nominations committees.

Conceptual Outline of Diversion Options

The consideration of diversion options will be based upon the overall goal of developing programs which will be environmentally responsible, be delivered at the lowest possible cost, and reflect the diversity of solutions necessary in the electronics industry. We will review a variety of options recognizing that the ideal program for a particular sector may include a combination of solutions and that it may be necessary to phase in certain aspects of program implementation.

The program will include reduce, reuse and recycling options as deemed appropriate and will be consistent in achieving the goals and parameters of the Minister's Final Program Request Letter.

While many options have already been explored by industry, our approach will be to ensure all available options are carefully reviewed and considered.

Potential Collection Mechanisms

- Consumer/small ICI generator drop-off at municipal collection points.
- Consumer/small ICI generator drop-off at independent collection sites/depots.
- Special collection provisions for large ICI generators
- Special collection days and mobile collection events.

- Collection by individual stewards or a collective of stewards.
- Collection by contractors.
- Voluntary return to retail and/or return to manufacturer (take back).

Reduce, Reuse and Recycle Options

- Reporting on manufacture initiatives to reduce the use of hazardous materials, and safe recycling of any recovered through the recycling processes
- Reporting on manufacture initiatives to reduce the total quantity of materials used to manufacture products
- Reporting on manufacture initiatives to use recycled material content.
- Promotion of charitable donations and product reuse prior to disposal.
- Disassembly of equipment and recycling of materials

Financing

- Steward fees will be set for each product category to reflect the costs of diverting (collecting and recycling) that product type.
- Steward fees will be remitted directly from stewards to the IFO.
- The program shall consider options with respect to internalizing Program costs based on the results of the *Waste Electronic and Electrical Equipment Study* and will assess what may be appropriate for Ontario over time.

Methodology for Assessing Advantages, Disadvantages, and Economic Implications

The IFO will:

- Include steward and stakeholder representatives who bring to the table experience gained from implementation in other jurisdictions (both in Canada and globally) and knowledge of corporate stewardship policies.
- Reach out during all aspects of the plan development process to ensure the views of all stakeholders are considered—not just during the formal consultation process.
- Draw upon existing, operational end-of-life electronics management programs in place or under development throughout Canada {Alberta (ARMA), Saskatchewan (SWEEP), British Columbia, (ESABC), Nova Scotia (ACES)}, Europe, Asia, and the US for lessons learned and recommendations as well as from other existing industry stewardship programs in place or under consideration in Canada and Ontario.
- Draw upon the work completed by WDO in gathering baseline statistical data on the electronics industry.
- Draw upon additional background work in Canada already completed in this field including CCME principles, federal studies on e-waste in Canada, EPS Canada studies

and recommended stewardship model, various RIS analyses of e-waste in Canada, the Basel convention, the European WEEE and RoHS directives, OECD guidelines, etc.

Establish the Option Evaluation Process

- Create the necessary work plans with deliverables and milestone approvals at each critical step.
- Ensure the consultation plan allows for consultation on available options as well as the ultimate preferred option.
- Ensure affected organizations are fully consulted.
- Ensure that program options allow for program diversion performance to be properly measured.

Assess the economic impact on all stakeholders for all proposed financing options

- The financial impact on stewards, service providers, municipalities and consumers will be reviewed in relation to the experience of other programs.

The impact of less than 100 per cent compliance will be reviewed in light of the high number of internet and non traditional sales in the electronics industry. Included in this review will be the impact of lost sales tax revenues should consumers move to even greater non traditional sales channels to avoid the shift of end-of-life management costs from property taxes to product costs.

- The financial and environmental impact of varying diversion rates will be reviewed.

The capacity of the collection, transportation and recycling industries will be reviewed and the associated costs incorporated into the stewardship model. In particular the impact of meeting vendor qualification standards will be carefully assessed.

- The contribution towards Ontario's overall waste diversion targets will be calculated.

Workplan

Milestone 1: WDO WEEE Workshop #1

Target date: June 26, 2007 (completed)

Milestone 2: RFP for WEEE Program Plan Development Services Issued

Target Date: June 29, 2007 (completed)

Milestone 3: MOA between EPSC/RCC & WDO tabled for Approval at WDO Board

Target Date: July 18, 2007 (completed)

Milestone 4: Submission of incorporation papers

Target Date: September 11, 2007 (completed)

Milestone 5: Ontario Electronics Stewardship (OES) incorporated

Target date: September 20, 2007 (completed)

- Milestone 6: Selection of Ontario Program Project Manager
Target Date: September 28, 2007 (completed)
- Milestone 7: Posting of program plan documents for Workshop # 2
Target Date: October 6, 2007
- Milestone 8: WDO WEEE Workshop #2
Target Date: October 12, 2007
- Milestone 9: Plan status report to WDO Board Meeting
Target date: October 17, 2007
- Milestone 10: Posting of draft preliminary plan for public comment
Target date: November 8, 2007
- Milestone 11: WDO WEEE Workshop #3
Target date: November 20, 2007
- Milestone 12: Delivery of revised draft preliminary plan (incorporating comments) to WDO for distribution to WDO Board
Target date: December 3, 2007
- Milestone 13: Posting of revised version of draft preliminary plan (incorporating comments) for public review
Target date: December 3, 2007
- Milestone 14: WDO Board meeting to review draft preliminary plan
Target date: December 12, 2007
- Milestone 15: Delivery of draft Final Plan (incorporating comments) to WDO for distribution to WDO board
Target date: January 14, 2008
- Milestone 16: WDO Board meeting to review draft final plan
Target date: January 23, 2008
- Milestone 17: WDO Submission of final WEEE program plan to Environment Minister
Target date: February 1, 2008

Notes:

- meetings facilitated by WDO between WEEE Project Team and Municipal WEEE Task Group will begin in October
- Interim IFO working committee will begin detailed plan development work once contractor is selected on September 28th. Work will include:
 - preparing draft definitions of phase 1 products for review with WDO and MOE staff

- compiling baseline data on quantities sold, quantities available for collection, quantities collection, quantities diverted, associated costs
- preparing Background Paper (per Consultation Plan) for posting
- preparing documents to support Workshop # 2 for posting
- preparing approach to Workshop # 2
- preparing list of stewards/stakeholders for consultation notifications

BUDGET

The following WEEE IFO budget covers costs during the period from the Minister's final program request letter being issued up to the submission of the final plan to the minister for approval. The figures listed below include (but not limited to) the following direct project management costs:

- Liaison with all parties including WDO, MOE, stewards and stakeholders
- Support the IFO industry negotiating team through the completion of the MOA
- Issuing RFP for program plan development work and commencement of options assessment and analysis work
- Planning for consultation
- Continued liaison with all parties including Ministry officials, WDO and members
- Coordinating the work of the program development committees and providing administrative and analytical support as they assess options and develop their preferred programs
- Managing the organization's board meetings, by-laws, minutes etc
- Managing the organization's finances and approving all expenditures
- Establishing the communications program for the organization including web site, media materials, press releases, web cast capability, logos and trademarks, acting as the voice of the organization and conducting the consultation plan
- Coordinating consulting services that may be required to address program technical and program modeling issues
- Managing legal services that may be required including by-laws, contracts management, competition issues, and liaison with regulators

The following is an outline of the anticipated budget

<i>Requirement</i>	<i>Est. Cost</i>
Program Management	\$70,000
Communication & consultations	\$70,000
Plan Development Consulting (secretariat services)	\$150,000
Data & Analysis (ARMA, SWEEP, ESABC, other sources)	\$50,000
Legal services (rules development, etc)	\$100,000
<i>Total</i>	<i>\$440,000</i>

SCHEDULE C

RULES OF PROCEDURE FOR ARBITRATION

The following rules and procedures shall apply with respect to any matter to be arbitrated by the Parties under the terms of the Memorandum of Agreement

Initiation of Arbitration Proceedings

- (a) If either Party to the Memorandum of Agreement wishes to have any matter under the Memorandum of Agreement arbitrated in accordance with the provisions of the Memorandum of Agreement, it shall give notice to the other Party specifying particulars of the matter or matters in dispute and proposing the name of the person it wishes to be the single arbitrator (the "**Arbitration Notice**"). Within 15 days after receipt of such notice, the other Party to this Memorandum of Agreement shall give notice to the first Party advising whether such Party accepts the arbitrator proposed by the first Party. If such notice is not given within such 15 day period, the other Party shall be deemed to have accepted the arbitrator proposed by the first Party. If the Parties do not agree upon a single arbitrator within such 15 day period, either Party may apply to a judge of the Ontario Court, General Division under the *Arbitration Act*, 1991, S.O. 1991, chap. 17, (the "**Arbitration Act**") for the appointment of a single arbitrator (the "**Arbitrator**").
- (b) The individual selected as Arbitrator shall be qualified by education and experience to decide the matter in dispute. The Arbitrator shall be at arm's length from both Parties and shall not be a member of the audit or legal firm or firms who advise either Party, nor shall the Arbitrator be an individual who is, or is a member of a firm, otherwise regularly retained by either of the Parties.

2. Submission of Written Statements

- (a) Within 20 days of the appointment of the Arbitrator, the Party initiating the arbitration (the "**Claimant**") shall send the other Party (the "**Respondent**") a Statement of Issue setting out in sufficient detail the facts and any contentions of law on which it relies, and the relief that it claims.
- (b) Within 20 days of the receipt of the Statement of Issue, the Respondent shall send the Claimant a Responding Statement stating in sufficient detail which of the facts and contentions of law in the Statement of Issue it admits or denies, on what grounds, and on what other facts and contentions of law it relies.
- (c) Within 20 days of receipt of the Responding Statement, the Claimant may send the Respondent a Statement of Reply.
- (d) The Statement of Issue, Responding Statement and Statement of Reply shall be accompanied by copies (or, if they are especially voluminous, lists) of all essential documents on which the Party concerned relies and which have not previously been submitted by the other Party, and (where practicable) by any relevant samples.

- (e) After submission of all the Statements, the Arbitrator will give directions for the further conduct of the arbitration.

3. Meetings and Hearings

- (a) The arbitration shall take place in the City of Toronto, Ontario or in such other place as the Claimant and the Respondent shall agree upon in writing. The arbitration shall be conducted in English unless otherwise agreed by the Parties and the Arbitrator. Including the final hearing, the arbitration shall be concluded within 90 days after delivery of the Arbitration Notice to the Respondent, subject to extension of such time period for a fixed period by written agreement of both Parties or by notice given by the Arbitrator to both Parties because of illness or other cause beyond the Arbitrator's control. Subject to any adjournments which the Arbitrator allows, the final hearing will be continued on successive working days until it is concluded.
- (b) All meetings and hearings will be in private unless the Parties otherwise agree.
- (c) Any Party may be represented at any meetings or hearings by legal counsel.
- (d) Each Party may examine, cross-examine and re-examine all witnesses at the arbitration.

4. The Decision

- (a) The Arbitrator will make a decision in writing and, unless the Parties otherwise agree, will set out reasons for decision in the decision.
- (b) The Arbitrator will send the decision to the Parties as soon as practicable after the conclusion of the final hearing, but in any event no later than 30 days thereafter, unless that time period is extended for a fixed period by the Arbitrator on written notice to each Party because of illness or other cause beyond the Arbitrator's control.
- (c) The decision shall be final and binding on the Parties and shall not be subject to any appeal or review procedure provided that the Arbitrator has followed the rules provided herein in good faith and has proceeded in accordance with the principles of natural justice.

5. Jurisdiction and Powers of the Arbitrator

- (a) By submitting to arbitration under these Rules, the Parties shall be taken to have conferred on the Arbitrator the following jurisdiction and powers, to be exercised at the Arbitrator's discretion subject only to these Rules and the relevant law with the object of ensuring the just, expeditious, economical and final determination of the dispute referred to arbitration.

- (b) Without limiting the jurisdiction of the Arbitrator at law, the Parties agree that the Arbitrator shall have jurisdiction to:
- (i) determine any question of law arising in the arbitration;
 - (ii) determine any question as to the Arbitrator's jurisdiction; determine any question of good faith, dishonesty or fraud arising in the dispute;
 - (iii) order any Party to furnish further details of that Party's case, in fact or in law;
 - (iv) proceed in the arbitration notwithstanding the failure or refusal of any Party to comply with these Rules or with the Arbitrator's orders or directions, or to attend any meeting or hearing, but only after giving that Party written notice that the Arbitrator intends to do so;
 - (v) receive and take into account such written or oral evidence tendered by the Parties as the Arbitrator determines is relevant, whether or not strictly admissible in law;
 - (vi) make one or more interim awards;
 - (vii) hold meetings and hearings, and make a decision (including a final decision) in Ontario or elsewhere with the concurrence of the Parties thereto;
 - (viii) order the Parties to produce to the Arbitrator, and to each other for inspection, and to supply copies of, any documents or classes of documents in their possession or power which the Arbitrator determines to be relevant;
 - (ix) order oral discovery, provided that oral discovery of both Parties shall be completed within a consecutive 14 day period unless agreed otherwise by both Parties;
 - (x) order the preservation, storage, sale or other disposal of any property or thing under the control of any of the Parties; and
 - (xi) make interim orders to secure all or part of any amount in dispute in the arbitration.

6. Costs, Disqualification of Arbitrator

Each Party shall bear the cost of its own counsel and witnesses but the costs of the arbitration including the fees of the arbitrator, the cost of court reporters and transcripts and the cost of the arbitration facility shall be shared equally between the Parties. The Arbitrator shall be disqualified as a witness, consultant, expert or counsel for either of the Parties with respect to the matters of the dispute and any related matters.

8. Arbitration Act

The rules and procedures of the Arbitration Act apply to any arbitration conducted hereunder except to the extent that they are modified by the express provisions of these Rules of Arbitration.

Appendix 6: Maps of Ontario WEEE Management Infrastructure

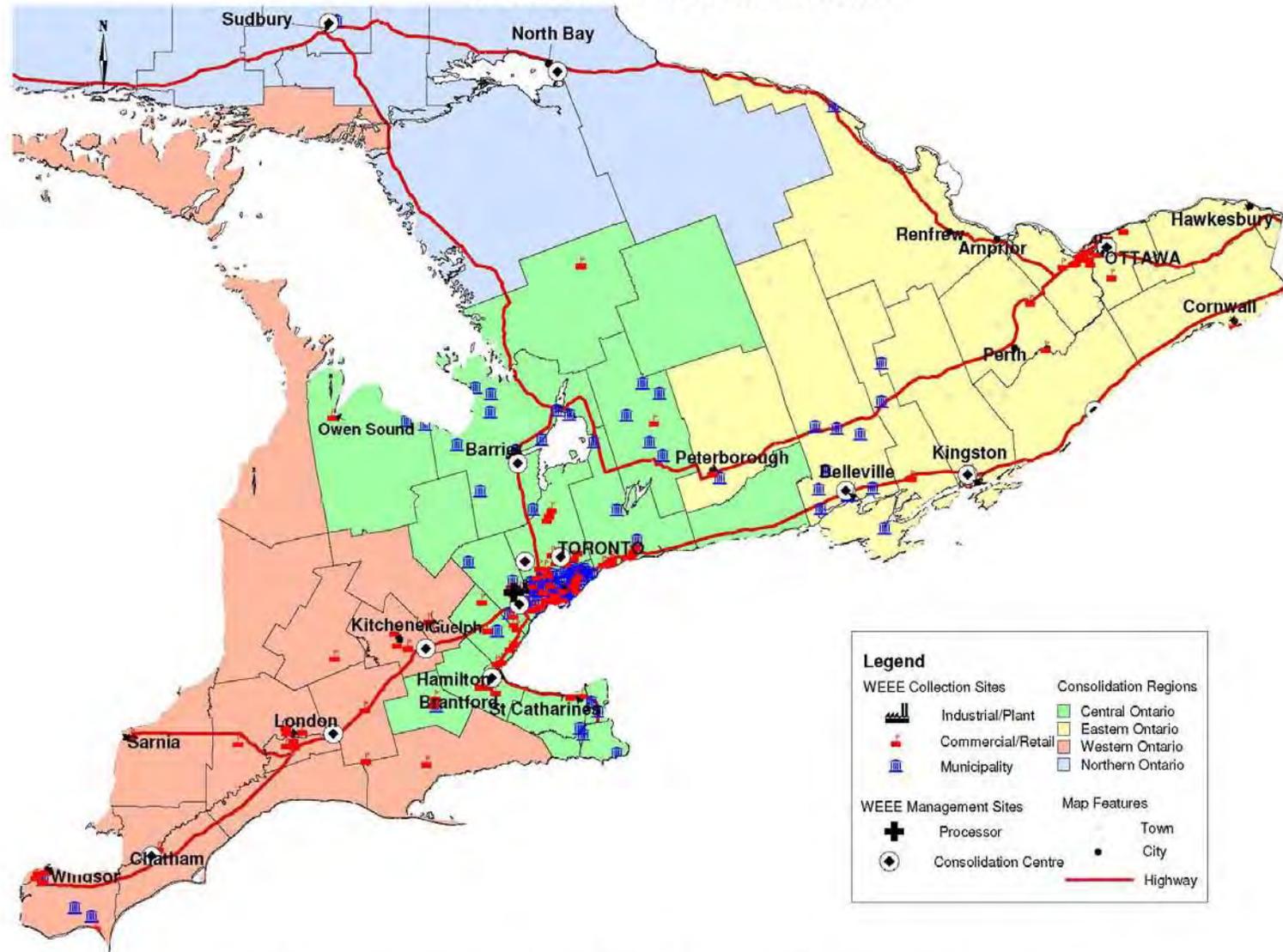
Ontario Consolidation Regions

OES Consolidation Regions	Ontario Counties
Central	Brant, Dufferin, Durham, Grey, Haliburton, Halton, Hamilton, Kawartha Lakes, Muskoka, Niagara, Northumberland, Peel, Simcoe, Toronto, York
East	Elgin, Frontenac, Hastings, Lanark, Leeds and Grenville, Lennox and Addington, Ottawa, Perth, Peterborough, Prescott and Russell, Prince Edward, Renfrew, Stormont, Dundas and Glengarry
Northern	Algoma, Cochrane, Kenora, Nipissing, Parry Sound, Rainy River, Sudbury, Thunder Bay, Timiskaming
West	Bruce, Chatham-Kent, Haldimand-Norfolk, Huron, Lambton, Manitoulin, Middlesex, Oneida, Oxford, Waterloo, Wellington, Essex

For more information on accessibility targets (detailing the number of collection sites), please see Table 5.1 of the Revised Program Plan.

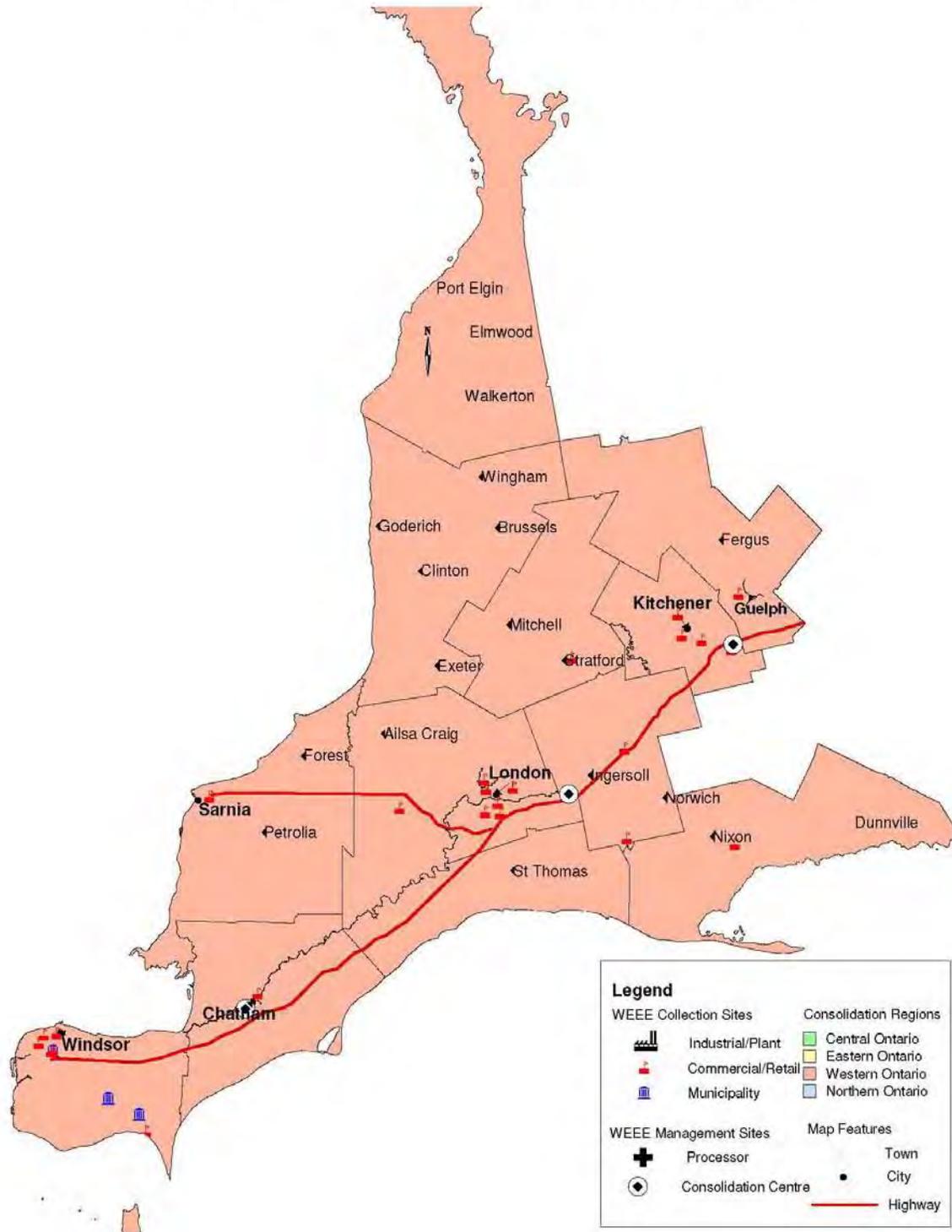
For maps of permanent collection site locations, as well as the locations of consolidators and processors as of June 10, 2009, please refer to the following pages 2 – 6.

WEEE MANAGEMENT INFRASTRUCTURE

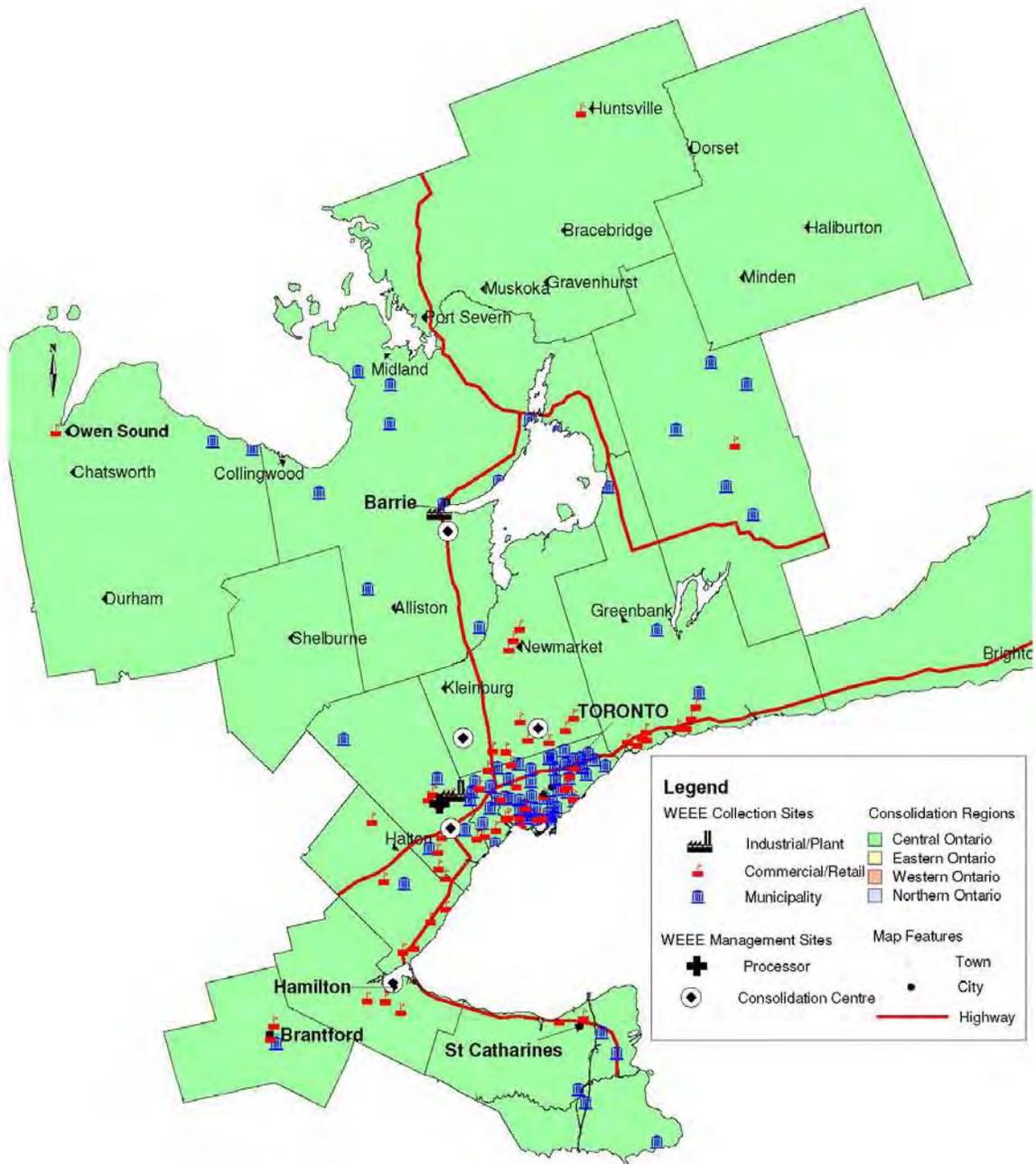


Note: A second processor is registered with the WEEE program and operating out of Laval in Quebec

WEEE MANAGEMENT INFRASTRUCTURE - WESTERN ONTARIO



WEEE MANAGEMENT INFRASTRUCTURE - CENTRAL ONTARIO

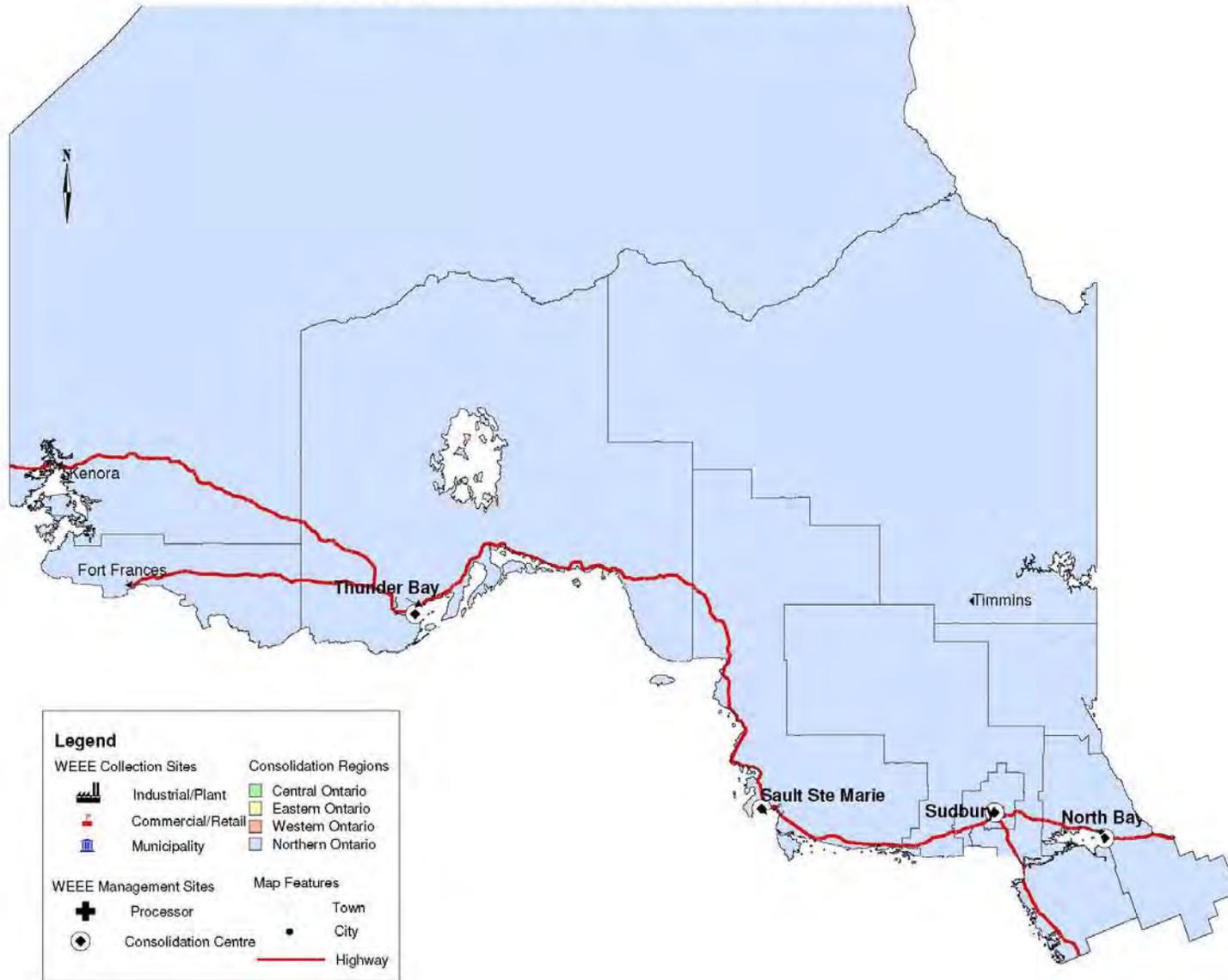


WEEE MANAGEMENT INFRASTRUCTURE - EASTERN ONTARIO



Note: A second processor is registered with the WEEE program and operating out of Laval in Quebec

WEEE MANAGEMENT INFRASTRUCTURE - NORTHERN ONTARIO



Ontario Electronic Stewardship

Revised Electronics Recycling Standard



Last updated June, 2009

PREAMBLE

The OES Electronics Recycling Standard (ERS) defines the minimum requirements to become an OES-Approved end-of-life (EOL) electronics processor. In order to be fully implemented, the ERS must be read in conjunction with the Recycling Standard Guidance Document (Appendix 7b) and the Ontario-Specific Compliance Requirements (Appendix 12).

The ERS does not absolve processors from any federal, provincial and/or municipal legislation and regulations applicable to their business operation, and it is the responsibility of the processor to be aware of and abide by all such legislation and regulations. The ERS shall guide processors by ensuring EOL electronics are managed in an environmentally sound manner that safeguards worker health and safety and the environment from the point of primary processing to the point of final disposition.

Approved recycling programs shall reserve the right to engage a qualified auditor to verify EOL recycler conformance to this Standard. For further details on the application of the Standard, please refer to the Electronics Recycling Standard Guidance Document.

The ERS and accompanying documents shall be reviewed in 2012, and every three years thereafter.

CONFIDENTIALITY

All information provided to the Program Manager as part of the qualification process is considered confidential and shall not be released to any other party without the written consent of the processor.

PART I – REQUIREMENTS

1. General Requirements

All processors shall:

- 1.1. Possess Comprehensive or Commercial General Liability Insurance including coverage for bodily injury, property damage, complete operations and contractual liability with combined single limits of not less than \$2,000,000 per occurrence, \$2,000,000 general aggregate.
- 1.2. Possess workers compensation coverage through either a provincial program or through a private insurance policy.
- 1.3. Ensure that whole units and separated components of EOL electronics goods are stored and/or processed at minimum in a fully covered area that conforms to all current applicable legislation and where:
 - 1.3.1. Unauthorized access to the premises and storage areas is controlled or otherwise prohibited through security measures;
 - 1.3.2. Any electronic scrap, as outlined in Table 1, that are stored outside must be covered to prevent exposure to environmental elements, and;
 - 1.3.3. Any Substances of Concern, as outlined in Table 1, are protected from exposure to weather and leaching into the surrounding natural environment through indoor storage.

- 1.4. Maintain a documented and operational environmental, health and safety (EHS) management system consistent with the ISO 14001 framework to ensure adequate control over the environmental impacts associated with the facility's operations, with the following minimum features:
 - 1.4.1. A written policy approved by senior management outlining corporate commitment to EHS management and continuous improvement;
 - 1.4.2. A documented process for identifying and addressing corrective actions, and;
 - 1.4.3. A documented annual review of the EHS management system.
- 1.5. Maintain a documented process to identify, assess and ensure compliance with this standard and all applicable regulatory requirements, including but not limited to:
 - 1.5.1. Environmental regulations, including permits or certifications for operating, air emissions, or other discharges;
 - 1.5.2. Occupational health and safety regulations;
 - 1.5.3. Transportation regulations, and;
 - 1.5.4. Hazardous waste management regulations (storage, handling, and shipping).
- 1.6. Maintain evidence of applicable transportation service provider's regulatory permits if transporting materials regulated as hazardous.
- 1.7. Implement and maintain an emergency response plan to prepare for and respond to emergencies including fires, spills, and medical.
- 1.8. Document the downstream flow and handling of EOL electronics from receipt at the processor's facility to each Point of Final Disposition, including details on how the goods are processed at each point, and the percentage of processed materials sent to each downstream processor.
- 1.9. Maintain a documented process to evaluate and select downstream processors through to the Point of Final Disposition that assesses the environmental, health and safety impacts of their operation
- 1.10. Maintain all records for a minimum of three years, including manifests, bills of lading, waste records, and chain of custody of all EOL electronics processed.
- 1.11. Maintain a process to provide certificates of recycling for all program material processed.
- 1.12. Maintain a process to provide written notice to the Program Manager of any fines; regulatory orders; environmental incidents such as spills; and loss of data storage products that has occurred at The Primary or downstream processor within 5 business days of such incident.
- 1.13. Not make use of prison labour.
- 1.14. Maintain a documented closure plan that identifies at a minimum the financial requirements upon closure and the financial mechanism for ensuring the availability of such funds, such a security/performance bond or other similar financial instrument.

2. Occupational Health and Safety

All processors shall implement and maintain an Occupational Health and Safety (OHS) program to ensure compliance with applicable OHS legislation. Notwithstanding any legislated requirements, this program shall entail the following minimum features:

- 2.1. Maintain a worker committee that monitors and evaluates the effectiveness of the OHS programs and makes recommendations to management for improvements. The committee must conduct documented meetings at least on a monthly basis.
- 2.2. Conduct a documented annual risk assessment of hazards and worker exposure to lead and other toxic substances through air, absorption, ingestion, or other means.
- 2.3. Safeguard hazardous mechanical processes to prevent worker injury.

- 2.4. Provide Personal Protective Equipment (PPE) to reduce injury or exposure to dusts and metals that may contact the skin and/or lungs either through airborne dusts or handling materials, and enforce the use of this equipment.
- 2.5. Maintain a process to identify health and safety training needs and provide regular documented OHS training, including at minimum new hire and refresher training, information from the risk assessment required, safe material handling, spill prevention, engineering controls, equipment safety, use and care of PPE.
- 2.6. Conduct air sampling and analysis for airborne contaminants such as metal content and dusts, and ensure compliance with applicable exposure requirements at a frequency determined through the risk assessment.
- 2.7. Conduct annual facility sampling to detect worker exposure to lead and other toxic substances through medical examinations, air sampling, and sampling of surfaces in communal areas.
- 2.8. Implement policies and procedures for hygiene, eating and drinking to reduce worker exposure to lead and other toxic substances.
- 2.9. Conduct an analysis of noise levels and post results in processing areas, and ensure adequate hearing protection is provided when those levels exceed applicable regulated requirements.
- 2.10. Perform regular fit-test and provide user training when personal respiratory protection equipment is used.
- 2.11. A thorough housekeeping program, which includes regular planned and documented OHS inspections.

3. EOL Electronics Processing and Handling

- 3.1. Data storage products and components, such as hard drives, shall be stored and the recycling process managed in such a manner to ensure the security of the products/components and to prevent any unauthorized access and use of the information stored on these components/products. At a minimum, the processor shall:
 - 3.1.1. Maintain a documented process to destroy information contained on data storage products through either physical means or use of industry recognized software.
 - 3.1.2. Maintain security measures to prevent the unauthorized access and removal of data storage products from the facility.
 - 3.1.3. Provide employee training on the data storage product destruction process.
 - 3.1.4. Data destruction processes by primary processors shall be reviewed and validated by an independent third party on an annual basis.
- 3.2. EOL electronics may be separated using manual, mechanical, chemical or heat treatment processes provided the operation is in compliance with this Standard and all applicable regulatory requirements, including permits.
- 3.3. Facilities employing mechanical material processing and separation activities shall be equipped with:
 - 3.3.1. A dust collection system/apparatus engineered to reduce a) environmental emission of; and, b) worker exposure to; toxic substances and particulate matter.
 - 3.3.2. An emergency shut-off system.
 - 3.3.3. Fire suppression equipment.
- 3.4. If mechanical processing of any component that is deemed through the risk assessment to pose a health and safety risk, they shall be removed prior to mechanical processing of intact EOL ELECTRONICS, including but not limited to mercury bearing lamps, ink and toner cartridges, and batteries contained within EOL ELECTRONICS.

3.5. Separated materials shall be managed according to Table 1.

Table 1: Separated materials and unacceptable Point of Final Disposition

	Materials	Minimal Acceptable Process	Unacceptable Point of Final Disposition
Non-Hazardous	Ferrous metal	Metal recovery	Landfill, export to non-OECD/ non-EU countries*
	Non-ferrous metal	Metal recovery	Landfill, export to non-OECD/ non-EU countries*
	Other metals (brass, bronze, metal fines)	Metal recovery	Landfill, export to non-OECD/ non-EU countries*
	Separated plastics	Pelletizing, plastic product feedstock	Use as raw material for food containers or toys, export to non-OECD/ non-EU countries*
	Mixed plastics	Pelletizing, plastic product feedstock, energy recovery	Use as raw material for food containers or toys, export to non-OECD/ non-EU countries*
	Wood	Energy recovery	Export to non-OECD/non-EU countries*
	Glass (non-leaded)	Glass product feedstock	Export to non-OECD/non-EU countries*
Electronic Scrap	Cables and wires	Metal recovery	Landfill, incineration, export to non-OECD/non-EU countries*
	Printed circuit boards and analog boards	Metal recovery	Landfill, incineration, export to non-OECD/non-EU countries*
	Metal and plastic laminates	Metal recovery	Landfill, incineration, export to non-OECD/ non-EU countries*
	Components, including hard drives, optical drives, LCD/PDP panels, processors and chips, and other electronic components;	Metal recovery	Landfill, incineration, export to non-OECD/ non-EU countries*
Substances of Concern	Cathode Ray Tubes (CRT), CRT frit, leaded plasma display or other leaded glass	Metal recovery	Landfill, incineration, export to non-OECD/ non-EU countries*
	Leaded glass cullet	CRT manufacturing, metal recovery	Landfill, incineration, export to non-OECD/ non-EU countries* for use as glass cullet in CRT manufacturing IF NOT washed in an OECD country prior to export and destination country has not provided written determination that the material is not waste
	CRT Phosphor powder	Hazardous waste disposal	Landfill, incineration, export to non-OECD/ non-EU countries*
	Ethylene glycol in CRT projection tubes	Hazardous waste disposal	Landfill, incineration, export to non-OECD/ non-EU countries*
	Mercury-bearing lamps in LCD displays, projection units, and scanning equipment	Mercury recovery	Landfill, Landfill of stabilized mercury, incineration, export to non-OECD/ non-EU countries*
	Non-rechargeable batteries	Metal recovery	Landfill, incineration, export to non-OECD/EU countries*
	Rechargeable batteries	Metal recovery	Landfill, incineration, export to non-OECD/ non-EU countries*
	Battery processing effluent	Permitted recovery or disposal	Unpermitted discharge
Ink and toner cartridges	Materials recovery, energy recovery	Landfill, incineration, export to non-OECD/ non-EU countries*	

**Unless the primary processor can demonstrate that any/all downstream processors meet or exceed environmental, health and safety standards equal to Ontario requirements.*

PART II – DEFINITIONS

“Downstream Processor” means an entity that receives material from a primary recycler or other downstream processors for additional processing and/or disposition.

This includes entities that:

- Bulk and blend materials that are sent to other vendors for additional processing;
- Shred and separate materials that are sent to other vendors for additional processing;
- Process materials into new products;
- Process materials to recover metals, energy, and/or other resources;
- Disposal by landfill and/or incineration with or without energy from waste (EFW) recovery;
- Any other contracted party that handles, processes or disposes of materials on behalf of the primary recycler.

“EIHWHRMR” refers to the Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulation under the Canadian Environmental Protection Act. Information is available at the following website: www.ec.gc.ca/drgd-wrmd

“Energy Recovery” or Energy from Waste (EFW) means the heat treatment of material in which the heat produced is used to produce electricity or steam or reduce the energy already required in a process.

- This includes the use of plastics as a fuel substitute.
- This does not include direct incineration.

“Environmental Management System” is a system used to identify and control the impact of the organization’s activities, products, and services on the natural environment. The system typically includes an environmental policy to provide guidance to the organization on controlling environmental matters as well as procedures outlining how environmentally significant tasks are to be conducted to ensure compliance with applicable environmental legislation.

“EOL” means end-of-life (electronics)

“Hazardous Material” means a material that is classified as a hazardous waste or hazardous recyclable material under the local governing authority. Components of EOL electronics that could fall under the definition of hazardous material include batteries, mercury-bearing products, leaded glass, and other materials defined as hazardous by applicable regulatory authorities.

“Incineration” means disposal that involves the combustion of organic materials and/or substances.

“Non-EFW incineration” means incineration without the capture of heat generated to produce electricity.

“Point of Final Disposition” means a point in the downstream flow of materials where the separated materials generated from the processing of EOL electronics become commodities used to produce new products, or they are disposed.

This includes:

- Use as a raw material in the production process of new products
- Recovery of metal, energy and/or other resources;
- Pelletization of plastics;
- Landfill and incineration disposal.

This does not include:

- Bulk and blend materials that are sent to other vendors for additional processing;
- Processing to prepare materials for use as a raw material, such as size reduction for feedstock in mills to be processed

“Processor” means an entity where EOL electronics are dismantled to separate materials for further processing by downstream processors. This does not include consolidation, cross-docking, or brokering of received material without processing.

“Program Manager” means the entity utilizing this Standard

“Substances of Concern” mean substances or components making up EOL electronics that in their normal state and under normal conditions of handling by a consumer pose little or no risk to human health or the environment but when handled, processed or transformed in large volumes at a recycling facility may merit special environmental and safety controls, and may be subject to specific regulatory requirements such as hazardous designation. These materials could include mercury-containing devices, PCB capacitors, leaded glass, batteries, ink and toner cartridges, etc.

“OECD Member Country” means a country that is a recognized member of the Organisation for Economic Co-operation and Development and is listed on the website www.oecd.org.

“Qualified Auditor” means an individual or agency trained and certified through an authoritative body to be an environmental auditor, who possesses a strong understanding of the ISO 19 011 Standard, the regulatory requirements in the jurisdiction of the processor, the Electronics Recycling Standard, and the Electronics Recycling Standard Guidance Document.

Appendix 7b: Recycling Standard Guidance Document



Ontario Electronic Stewardship

Guidance Document – Environmentally Sound Recycling of Electronics

This Guidance Document was developed to serve as an educational document to inform interested parties about the environmental, legal, health and safety hazards associated with recycling end-of-life (EOL) electronics to allow recyclers to develop environmentally sound recycling processes and to allow environmental auditor with a knowledge based for conducting assessments of electronics recyclers.

NOTE: This guidance document will be revised in tandem with revisions to the EPSC Recycling Standard Guidance document, and thus will be subject to change. OES will inform stakeholders via the OES website when changes are made.

DISCLAIMER: This document is intended for information purposes only and is not intended to constitute or to provide legal advice. It does not address all of the legal, environmental, health, safety or scientific aspects of end-of-life (EOL) electronics recycling and may not address new technologies that are available. Any application of this information must be in accordance with applicable legal and regulatory requirements. Processors of EOL must exercise due diligence in ensuring that they remain up-to-date on applicable laws and regulatory requirements as well as scientific and technological advancements and industry best practices.

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MATERIAL SEPARATION

Recycling of electronics includes disassembly and processing to recover raw materials such as metals, glass and plastics. Ferrous and non-ferrous materials, including steel, aluminium, copper, wires and cables are often sold to smelters for the production of raw materials. Leaded glass from CRTs can be processed and sold to CRT manufacturers for use in new CRTs or can be sent to lead smelters for lead recovery. The market for recycling plastics used in electronics is slowly developing as a result of design for the environment initiatives and advancements in plastic recycling technology. Alternately, plastics are sometimes used in non-IT applications, often incinerated with waste to energy recovery or used as a coal fuel substitute in the smelting process with adequate emissions controls to remove dioxins and furans, or disposed in landfills.

Prior to being processed to recover raw materials, EOL electronics must often be dismantled manually or by a combination of manual and mechanical dismantling process. Manual dismantling and separation involves the use of hand tools (not heating or shredding), in conjunction with adequate engineering controls and personal protective equipment (PPE), such as safety glasses and ergonomic workstations, while mechanical means of dismantling and separation include shredding, heating and grinding.

Facilities engaged in electronics dismantling and processing should track, on a shipment specific basis, the fate of materials that are received. Transactions that involve the transboundary shipment (export) of materials resulting from electronics processing should be conducted in accordance with applicable legislation, including international conventions such as the Basel convention.

The following components must be removed from EOL electronics prior to mechanical processing and managed separately:

- Mercury containing components such as lamps and switches (e.g. light bulbs found in scanners & laptops);
- All batteries, including coin cell batteries on motherboards;
- Toner cartridges, liquid and pasty, as well as colour toner and ink cartridges, and.
- Other materials specified by the processor that may pose environmental, safety, or mechanical risks.

Mechanical dismantling and separation processes as well as improper manual techniques can result in the release of hazardous substances, such as lead and beryllium in dust. As a result, appropriate controls preventing worker exposure and environmental releases must be implemented and maintained. At a minimum, personnel should have adequate knowledge with regards to material and equipment handling, hazard exposure and control, control of releases, and safety and emergency procedures.

Any dismantling or separation operations, as well as storage areas for components that may contain a hazardous substance, must be located in an indoor area equipped with adequate containment systems such as impervious floors. Storage areas should be adequate to hold all processed and unprocessed inventory.

A financial instrument should be maintained to assure that sufficient funds are available in the event of major pollutant releases, gross mismanagement, or closure of the facility. The facility itself should conduct regular audits and/or inspections of its environmental compliance.

SUBSTANCES OF CONCERN

Nearly all of the substances of concern in EOL electronics are no cause for concern for human exposure or release into the environment during ordinary use and handling. None of these substances will be released through normal contact, including transportation and manual disassembly. However, human health and environmental concerns may arise if EOL electronics are improperly handled, landfilled, incinerated, shredded, ground, or melted. All of these exposures can be mitigated through appropriate work practices and engineering controls, such as combustion and air emission control systems.

Circuit Boards

Substances of concern (note this is not an exhaustive list)

- **Antimony:** Contained in some lead solder
- **Beryllium:** Small amount in the form of a copper-beryllium alloy (typically 98% copper, 2% beryllium) is used for connectors.
- **Cadmium:** Small amounts in plated contacts and switches
- **Chlorine and/or Bromine:** Brominated and inorganic flame retardants may be present in the plastic in printed circuit boards.
- **Corrosive liquids:** Contained in solid state capacitors present on some circuit boards
- **Lead:** Contained in solder and some board components,
- **PCBs:** Known to be used in some capacitors on old main frames and printers.

Printed circuit board may contain lead in solder and board components that can be released as a fine particulate if shredded or as a fume if heated to remove components. To protect worker safety, shredding processes should be equipped with dust collection systems and workers may need to be provided personal protection equipment to reduce exposure dependant on air monitoring results. Most Canadian jurisdictions require employers to implement a control programs to limit worker exposure to certain substances such as lead. Printed circuit boards may also contain small amounts of antimony and beryllium which can be released as a fine particulate from shredding, which can cause respiratory ailments such as berylliosis

Heating of plastics on circuit boards to recover components can cause the halogens (chlorine and bromine) to be released in the form of dioxins and furans, so adequate ventilation to remove toxins is required in processes that involve heating of circuit board.

Capacitors may also be present on the circuit boards and are solid state devices. Small electrolyte capacitors may contain corrosive liquids and may be classified as hazardous waste. Although their historic use in personal computers is not clear, it is known that PCB capacitors have been used in larger computer equipment such as mainframes and large printers.

Batteries

Substances of concern

- **Cadmium:** Contained in nickel cadmium (Ni-Cd) batteries,
- **Lead:** Contained in sealed lead acid batteries
- **Lithium:** Contained in coin cell and lithium ion batteries.
- **Mercury:** Small amounts contained with several battery chemistries.

Motherboards contain a small lithium cell battery often referred to as a coin cell battery. When lithium coin cells are sheared in the presence of oxygen and moisture heat is generated which may cause a fire, therefore they should be removed from the motherboard prior to shredding. Once separated, coin cells

should not be accumulated in quantity without physical separation from each other so that uncontrolled electrical discharge will not occur. Separation can be achieved by using insulating tape on the contacts. Coin cells may be thermally processed with appropriate combustion and emission controls. Lithium can be recovered, after it has been fully discharged to eliminate potential reactivity, by shredding and gravity separation.

Nickel cadmium (Ni-Cd), nickel metal hydride (NiMeH), lithium ion and lead acid batteries must be removed before shredding and sorted by type. All battery cells must be managed to avoid inadvertent external short circuits and current flows, and large inventories of batteries should be avoided. Some Canadian jurisdictions restrict storage of hazardous wastes for long periods, therefore it is recommended to contact the Provincial environment department to determine maximum storage volumes and timeframes. Batteries can be recycled to recover the metal content. Lithium ion batteries do not have the fire hazard problem associated with lithium metal coin cell batteries because the lithium is in the stable form of lithium hydroxide. Care should be taken by workers if lithium ion batteries are opened or broken, as lithium hydroxide is somewhat corrosive. The lithium contained in these batteries can be recycled.

Cathode Ray Tube (CRT), Leaded Plasma Display Glass, and Other Leaded Glass

Substances of concern

- **Antimony:** May be present in the screen and/or cone glass of CRTs.
- **Barium Oxide:** May be contained in the getter plate of the electron gun and deposited on the interior surface.
- **Cadmium Sulfide:** Has been used in phosphors in some older CRTs.
- **Lead:** Contained in the CRT glass in the form of lead oxide (PbO).
- **Phosphors:** A phosphor coating, typically zinc sulfide and rare earth metals, are used on the interior panel glass of a CRT screen.

The leaded glass in a CRT can be recovered in new CRT manufacture when all non-glass components are removed. These steps require aeration (release of the vacuum) and breaking of the bare CRT and careful separation of the glass parts, i.e., the faceplate, funnel and neck. Workers involved with the breaking of CRTs should be protected from inhalation of dust that may contain lead, barium oxide and phosphors.

The lead in a CRT and other leaded glass can also be recovered as lead by a lead smelter. The glass also serves as a silicate flux in the lead smelting process, and is a substitute for silicate which the smelter would otherwise acquire and use. The leaded glass can also be used as a silicate flux by a copper smelter, again as a substitute for silicate which the copper smelter would otherwise acquire and use. The copper smelter may also have a subsequent procedure in which the by-products from copper smelting and electrorefining are treated for lead recovery.

Practices that would be considered as non-environmentally sound include the use of leaded glass in construction materials (as a substitute for sand) and its use as blasting grit or other abrasive material. Some regions consider the use of leaded glass in making tiles and other ceramics as non-environmentally sound. The contamination of other glass which does normally not contain lead, especially container glass, should be avoided. Non-leaded glass could be used in building products.

Lamps, Bulbs and Switches

Substances of concern

- **Mercury:** Mercury may be present in lighting devices and switches.

Many products use fluorescent bulbs that contain mercury. These bulbs are used for backlighting of LCD panels or the optical scanner of photocopiers, scanners and fax machines. Although the mercury in

fluorescent lamps is in vapour form, to create the light arc, mercury adheres to the phosphor powder contained within the lamps. Mercury is also present in the UHP lamps used in data projectors and rear projection televisions and is contained within a small bulb within the lamp. The amount of mercury per bulb can range from 2.2mg in a fluorescent lamp to more than 30mg in a UHP lamp. Mercury switches are also used in several electronic products. The mercury contained in lamps, bulbs and switches can be released during shredding and therefore should be removed prior to mechanical processing of EOL electronics and sent to a specialized mercury recovery facility for treatment, such as metal recovery operations or thermal treatment at an environmentally sound and appropriately authorized incinerator with modern flue gas cleaning systems. If processing of EOL electronics involves breaking of mercury vapour bulbs, the system should be equipped with a negative pressure dust evacuation system to prevent work exposure, a dust filtration system to remove mercury contaminated phosphor powder, and an activated charcoal filter to remove any other trace elements of mercury. Consideration should also be given to mercury contamination of other materials being processed along with mercury bulbs as well as the equipment used.

Insulated Wire

Substances of concern

- **Cadmium:** Very small amounts in some stabilizers for PVC wire insulation
- **Polyvinylchloride (PVC):** Insulation on wires and cables

The substance of concern is PVC, because of its chlorine content. In the past, the insulation was removed by burning, sometimes in uncontrolled combustion. This is not considered environmentally sound, because the burning may be incomplete, emitting a variety of particles of incomplete combustion, and chlorinated dibenzofurans and dibenzodioxins may form in the exhaust emissions. Insulated electrical wire should be separated if the wire is accessible during dismantling then shredded or chopped (or both) to a relatively small size (typically between one to ten centimetres in length). It can then be burned under controlled combustion and at specific temperatures with an air emission control system designed to prevent formation of chlorinated dibenzofurans and dibenzodioxins. Shredded or chopped wire can also be granulated to separate the insulation from the copper. The resulting mixed material can be separated by a variety of physical means, using water or air. The entire process, when properly executed, will produce clean copper and a plastic fraction which is suitable for plastic recycling.

Plastics

Substances of concern

- **Cadmium:** Very small amounts in some stabilizers for PVC plastic.
- **Chlorine and/or Bromine:** Brominated and inorganic flame retardants may be present in the plastic in plastic housings and circuit boards.

Plastic is one category of material components for which recycling opportunities are currently quite limited. This is because of the numerous resin types used in electronic equipment; some manufacturers' plastic parts are not always labelled accurately according to their type; cannot be sorted and cleaned economically, and the presence of chlorine and bromine compounds, especially in flame retardant plastic resins. A wide variety of brominated flame retardants have been used as additives to some plastic components, or chlorine in PVC insulation, may recombine with carbon and hydrogen in various disposal or recovery processes that involve heat, such as combustion or plastics extrusion, to form other halogenated organic compounds such as dibenzodioxins and furans.

The small amount of cadmium in some plastics may be released in the form of cadmium oxide dust if the plastic is burned prior to or in the course of metal reclamation. When hard plastic components containing brominated flame retardants are shredded, workers can be exposed to dust containing these chemicals. Therefore, measures are required for the protection of human health and the environment in operations

where these plastics are shredded or heated. Shredding operation should be equipped with dust collection system and, if air monitoring shows the need, provide workers with personal protection equipment. Thus, opportunities for recycling need to regard not only the particular resin types of the various parts, but also the types of flame retardants that are present in the plastics, as the safety of the worker may be affected.

HEALTH, SAFETY AND OCCUPATIONAL HYGIENE

The facility should have an occupational hygiene program to identify, assess and control any potential hazards, as well as procedures for monitoring, reporting and responding to actual hazards, pollutant releases and other emergencies, such as fires.

Key elements of the occupational hygiene program should include:

- Risk Assessment
- Sampling, Monitoring and Evaluation
- Engineering Controls
- Administrative Controls
- Personal Protective Equipment (PPE)
- Personal Hygiene
- Emergency Response
- Program Review and Evaluation

Risk Assessment

A risk assessment is a systematic process to identify hazards and evaluate the potential risks associated with them. The risk assessment should consider physical, chemical and ergonomic hazards under both normal and abnormal conditions. When evaluating risks, the facility should consider the probability, potential severity and frequency of the hazard. The documented results of any risk assessments should be used to determine the appropriate level of control necessary to eliminate or effectively control the hazard.

Examples of hazards associated with the processing of EOL electronics include:

- Physical – equipment noise and vibration; sharp or rough surfaces of materials and tools
- Chemical – dust and fume from shredding or grinding; toxic substances such as lead and mercury
- Ergonomic – awkward work posture, heavy lifting, repetitive tasks, excessive force

Sampling, Monitoring and Evaluation

Where occupational exposure limits are regulated or the results of a risk assessment indicate an opportunity for exposure, workplace sampling such as air or noise monitoring may be required.

To identify exposure levels, a qualified individual, such as an industrial hygienist, should conduct the necessary sampling of the affected areas and the results of the sampling activities should be evaluated against recognized industrial hygiene standards and regulatory limits. This evaluation should identify areas where control measures to reduce or eliminate exposure may be required to maintain levels within the permissible limits. In addition, the facility should consider this information as well as regulatory requirements to determine if regular sampling is required, and if so, for establishing the sampling schedule.

Additionally, the facility should maintain a process to consider the potential impact of any process or workplace changes prior to initiation, and should assess actual exposure levels following any significant changes, such as equipment modifications or changes in processing rates.

The results of any sampling, monitoring and evaluations should be used to determine the appropriate types and levels of controls necessary to eliminate or effectively control any hazards.

Control of Risks:

Engineering Controls

Where possible, it is optimal to eliminate hazards altogether at the source. This can be accomplished through process design changes or by substituting hazardous materials or processes with less hazardous alternatives.

If eliminating a hazard is not practical, consideration should be given to isolating the hazard from workers, or removing the hazard from the work area. One of the most effective means to isolate physical hazards is through the use of physical barriers, such as walls, mechanical guards, or acoustic panels, while airborne contamination may be removed from the work area by means of ventilation.

All mechanical controls should be suitably rated or tested to ensure adequate protection from the hazard. Physical barriers must be designed to withstand any process related forces as well as external forces such as those applied by a worker. Ventilation systems must be equipped to remove the intended contaminants and must maintain adequate flow rates.

Wherever mechanical controls are used, suitable preventive maintenance programs should be implemented to monitor performance of the equipment and ensure proper functioning to the approved specifications. Preventive maintenance programs should be developed based upon manufacturer's suggested tasks and frequencies. Specifically for ventilation systems, preventive maintenance tasks should include airflow testing, ductwork inspections and filter replacements.

At minimum, the facility should ensure that all mechanical processes are safeguarded to prevent access to hazardous areas, and adequate ventilation is provided to remove air contaminants and maintain acceptable air quality levels.

Administrative Controls

Where the use of mechanical controls is not practical or if following the implementation of the mechanical controls it is determined that a potential hazard still exists, administrative controls such as safe work procedures and training should be implemented.

Safe work procedures are documented processes that clearly outline the potential hazards associated with performing a task, the approved steps for completing the task to prevent the occurrence of a hazard, as well as appropriate emergency response information in the event of an operational or procedural failure. Safe work procedures should be communicated to all applicable workers and made available for reference at the point of use.

In addition to safe work procedures, workers should be provided with various training to identify and prevent workplace hazards, as is applicable to their responsibilities. Typical examples of training include Workplace Hazardous Materials Information System (WHMIS), Transportation of Dangerous Goods (TDG), as well as process and equipment specific training.

The facility should maintain a process to identify training needs by job function and should maintain records of all training completed. Where appropriate, the facility should implement a process to assess the effectiveness of the training programs, including knowledge retention. Training assessments may include written tests, task observation and worker performance reviews. The results of these activities should be used to establish a training schedule for refresher and upgrade training requirements.

In addition to safe work procedures and training programs, the facility should employ appropriate signs and labels to clearly identify significant items such as the following: restricted or hazardous areas, equipment hazards, hazardous materials, and areas requiring personal protective equipment.

Personal Protection Equipment (PPE)

Where it is determined that engineering and/or administrative controls may not be sufficient to prevent worker exposure to a hazard, the use of personal protective equipment (PPE) is required. PPE may

include the use of safety glasses or face shields where there is a danger of flying parts or debris; hearing protection in areas of elevated noise; gloves for handling sharp or hazardous materials; smocks, uniforms or other specialized clothing for protection from dusts and debris; and respiratory protection where airborne contaminants are present. The facility should use the results of risk assessments and workplace sampling to determine the appropriate type of PPE as well as degree of protection required.

The facility must provide workers with PPE and enforce its use where required. Any workers required to use PPE must be trained in the proper use of and care for the equipment. Where specialized or custom fit PPE such as respirators, prescription safety glasses, or custom hearing protection are used, workers should be periodically re-assessed for proper fit and function.

Any areas requiring the use of PPE should be appropriately identified, and where regulated, exposure levels should be posted, such as noise levels exceeding permissible limits.

Personal Hygiene

Any facility where EOL electronics processing occurs should provide workers with an enclosed environment, separate from processing areas where food consumption is permitted. This area should be independently ventilated from any processing areas, including fresh air makeup, and should be equipped with separate facilities for the removal of contaminated clothing and hand washing prior to entering.

Additionally, the facility should maintain a personal hygiene program that requires the removal of contaminated clothing and hand washing prior to entering this or other clean areas, and further preventing workers from consuming food outside of the designated area. This procedure should also address the need for the removal of contaminated clothing prior to leaving the premises.

Emergency Response

Notwithstanding the overall occupational hygiene program and hazard controls, the facility should maintain adequate procedures for responding to emergency situations. Emergency situations may be identified through the risk assessment process, and may include but are not limited to worker injury and fire.

The facility should maintain a stock of the necessary first aid supplies and ensure an appropriate number of individuals trained in the administration of first aid are available on site. The plan should also provide information on transportation to the nearest hospital or other location for external medical support.

All facilities should be equipped with an emergency notification system, such as pull stations, horns, or bells, to notify workers in the event of an emergency, and where appropriate, facilities should additionally be equipped with a fire suppression system and/or fire extinguishers.

In areas where workers may be exposed to eye injuries from contact with dust, debris or chemical splashes, emergency eye wash stations should be provided. Safety showers should also be provided where workers may be exposed to skin hazards from exposure to toxic or other irritating substances.

All emergency response plans should provide details on when and how to contact external emergency response assistance such as fire or ambulance if required.

Program Review and Evaluation

In order to ensure that the occupational hygiene program effectively controls workplace hazards and prevents worker exposure, the facility should periodically review and evaluate its suitability. Program reviews should consider at a minimum:

- Information collected through risk assessments
- Results of workplace sampling
- Changes in processes or the workplace
- Root causes and outcomes of any emergency situations or near-miss incidents
- Changes to regulatory requirements or industry best practices

The review should determine if the occupational hygiene program is suitable for the facility based on its ability to control workplace hazards, and furthermore should provide direction for addressing opportunities for improvement.

The following resources may be consulted for more information on health, safety and industrial hygiene:

www.ccohs.ca

www.iapa.ca

www.acgih.org

www.cdc.gov/niosh

TRANSPORTATION and EXPORT

Transportation

The transportation of materials classified as “dangerous goods” is regulated under the federal Transportation of Dangerous Goods Act, 1992 (TDGA), which has been adopted by all provinces and territories and establishes the safety requirements for the transportation of these materials.

Components of EOL electronics and/or the materials resulting from the processing of EOL electronics could possess toxic or corrosive characteristics that would classify them as dangerous goods and the requirements of TDGA would apply

Materials classified as “Environmental Hazardous Substances” are regulated under TDGA, which is determined through a Toxicity Characteristic Leaching Procedure (TCLP) leachate test and comparing the results to the criteria on TDGA schedules.

Section 5 of the TDGA states:

No person shall handle, offer for transport, transport or import any dangerous goods unless

- (a) the person complies with all applicable prescribed safety requirements;
- (b) the goods are accompanied by all applicable prescribed documents; and
- (c) the means of containment and transport comply with all applicable prescribed safety standards and display all applicable prescribed safety marks.

Materials that contain lead or mercury could be classified environmental hazardous substances and batteries could be classified as corrosive. It is advised that the facility review their operations and the materials they transport to ensure that they are compliant with the requirements of TDGA. More information on TDGA is available at the following website:

<http://www.tc.gc.ca/acts-regulations/GENERAL/t/tdg/act/tdg.htm#0.2.JZ0KIZ.K1D72S.JJEJED.C5>

Export

The export and import of wastes or recyclable materials that fall under the requirements of TDGA are regulated through the federal Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulation, 2005 (EIHWHRMR) of the Canadian Environmental Protection Act. It is the responsibility of the importer or exporter to ensure the proper classification of their hazardous waste.

The EIHWHRMR was created to transpose Canada’s obligation from ratification of the Basel Convention, which is intended to prevent developed nations from dumping hazardous wastes in developing nations. EOL electronics, components, and some materials generated from processing EOL electronics may be considered environmentally hazardous and/or leachable toxic wastes and are regulated under

EIHWHRMR. Thus, controls are normally applied to the export of hazardous wastes to foreign destinations which involve a “prior informed consent” regime, which requires notification and consent from the recipient government prior to export. In addition to these controls, some countries, such as China, have implemented an import prohibition for certain types of electronic wastes. These prohibitions must be respected when exporting these materials.

EIHWHRMR does exclude certain low-risk recyclable materials from the definition of “hazardous recyclable material”, including electronic scrap, “such as circuit boards, electronic components and wires that are suitable for base or precious metal recovery.” This exclusion ONLY applies if the listed material is exported to an OECD country AND is destined for recycling at an authorized facility, even if it fails a TCLP test for leachability. If these conditions are not met, the requirements of EIHWHRMR apply.

The low risk exemption does not apply to EOL electronics components such as CRT leaded glass and batteries, which must be exported in accordance with the EIHWHRMR control.

Although the United States is an OECD member country, it has not ratified the Basel convention so special consideration should be made to EOL electronics shipment to the USA. If the USA is used as transit of material to other destinations, the full requirements of EIHWHRMR may apply.

In order to export EOL electronics materials that are defined as hazardous waste or hazardous recyclable material, such as CRTs, batteries or materials that do not meet the low risk material recycling exemption, the following steps must be taken:

1. Complete the notification information requirements set out under the EIHWHRMR. The notification requirements include such information as:
 - 1.1. The nature and quantity of hazardous waste or hazardous recyclable material involved;
 - 1.2. The addresses and the sites of the exporter, the importer, and the carrier(s);
 - 1.3. The proposed disposal or recycling of the waste or material;
 - 1.4. Proof of written contracts between exporters and importers;
 - 1.5. Proof of insurance coverage; and
2. Have a signed written contract between the generator and receiver of the hazardous waste or hazardous recyclable material as required by the EIHWHRMR (exports and imports only) and ensure that the Canadian importer or Canadian exporter (as the case may be), and all carriers have valid insurance coverage (all movements) required under the EIHWHRMR.
3. The notification requirements and insurance must be submitted to Environment Canada’s Transboundary Movement Branch for review and approval.
4. Obtain a PERMIT issued by the Minister of the Environment for the export, import or transit of hazardous wastes or hazardous recyclable materials **before** proceeding with any shipments. The valid dates set out in the PERMIT.
5. Use an authorized carrier and authorized recycling/disposal facility set out in the PERMIT to accept the hazardous waste or hazardous recyclable material. Ensure that the volume in the shipment does not exceed the quantity provided and approved in the PERMIT.
6. Ensure that the Movement Document is correctly completed, signed and accompanies each approved shipment of hazardous waste and hazardous recyclable material entering or exiting Canada.
7. Comply with all requirements of the Transportation of Dangerous Goods Regulations (TDGR) during the movement of the hazardous waste or hazardous recyclable material, where applicable.
8. Ensure that a copy of the Movement Document as well as a copy of the Permit is provided to the carrier(s) and both are dropped off at the point of entry/exit to a Canadian Border Services Agency agent.
9. Submit copies of the completed Movement Document and certificate of recycling/disposal to Environment Canada to fulfill your obligations under the EIHWHRMR.

10. Retain the Movement Documents at your place of business in Canada for 3 years following the completion of the movement.

Detailed information on how to complete a notice and meet the requirements of the EIHWHMRR are outlined further in the User Guide to Classification and Implementation, which is available at http://www.ec.gc.ca/tmb/eng/guides_e.html.

In addition to these requirements, some producers or owners of EOL electronics may impose requirements that exceed those listed above, such as only allowing export if the recipient of the EOL electronics material is compliant with applicable local waste handling, storage, and disposal regulations.

MELTING, ENERGY RECOVERY AND DISPOSAL

Smelting is the process often used to recover precious and other metals from end-of-life electronics. Smelting operations require proper furnace combustion conditions and furnace emission control systems, such as acid gas scrubbers and particulate controls. The facility permit regarding air emission controls should specifically authorize the processing of electronic scrap. The presence of halogens (chlorine and bromine) in plastics which will be burned during metal recovery raises concerns which differ from those most commonly associated with copper ores and attention must be given to the possible creation of dibenzofurans and dioxins in the burning processes.

Complete thermal destruction of hydrocarbons will substantially reduce the possibility of formation of dibenzofurans and dioxins in the furnace emission stream. Halogens will be converted to acids, and then to salts in an acid gas scrubber. Likewise, the presence of beryllium and mercury can lead to serious emissions of these metals in vapour form, endangering workers and the local environment. Care must be taken to monitor and reduce such emissions to a minimum. Lead smelters processing leaded glass do not usually have pollution control systems suitable for burning of plastic, so all plastic material should be removed from CRTs prior to smelting. A copper smelter may also have a pollution control system which permits it to burn plastic.

Materials should be recovered wherever possible, however, it is likely that some components cannot be recycled or recovered, such as plastics or resins with halogenated flame retardants or slag from smelting operations. However, recent technology has become available which more appropriately removes halogens from the plastics prior to further material recovery. Efforts should be made to implement these technologies in order to avoid contaminating secondary materials. Non-recoverable materials will need to be disposed of in an environmentally sound manner; preferably combustible fractions would be used for energy recovery, as this method is higher in the waste management hierarchy than burning without energy recovery or landfilling. The lead in silicate slag resulting from copper smelting of CRT glass is immobilized and may be disposed of in an environmentally sound and appropriately authorised landfill.

The incinerator or other combustion unit (with or without energy recovery) should be operated to minimise the formation of furans and dioxins, as well as be equipped with state-of-the-art flue gas cleaning systems. Combustion ash, as well as materials from the processing of materials that cannot be recycled, should be disposed of in an environmentally sound and appropriately authorised landfill.

ENVIRONMENTAL MANAGEMENT SYSTEM

An effective environmental management system is an optimal tool to allow EOL electronics recyclers to safeguard the environment and worker health & safety while ensuring compliance to legal requirements and the Ontario Electronic Stewardship (OES) Electronics Recycling Standard.

Ideally the facility will have an internationally recognized environmental management system that is assessed and approved through a third party, such as an ISO 14001 or EMAS system. If a system of this

nature in not in place the facility should demonstrate that it has implemented elements of an environmental management system that allow it to effectively control the facility's operations on the environment. Elements of an environmental management system include:

Process Flow

To assist in identifying risks and regulatory requirements of the recycling process, a process flow chart should be established that outlines all the incoming materials, the processes used, and the outgoing materials through the entire recycling process. The material flow should outline the flow of materials through downstream vendors to the point of final recycling, destruction, or disposal.

Regulatory Assessment, Permits and Certification

Regulatory permits or certification may be required for accepting, transferring, transporting, processing, or disposing of EOL electronics waste. Additionally, processing permits or certification may be required for air exhausts, water discharges or waste generation. Recyclers must identify and track all applicable regulatory requirements and provide evidence of compliance. Where exemptions to regulations exist, confirmation of the exemption from the regulating authority must be maintained. The facility must also maintain a process to identify changes in regulations, and to re-evaluate regulatory applicability based on changes in operations.

Process Controls

Controls should be implemented on processes that are environmentally sensitive or, if done incorrectly, could lead to a negative impact on the environment or worker health and safety. This can include work instructions on how to perform tasks or handle materials, preventative maintenance, or recycling programs for non-core materials such as packaging and administrative waste.

Hazardous Waste Management

The facility should implement programs to identify and manage hazardous waste generated from processing EOL electronics, such as batteries, mercury bulbs, ink, toner, phosphors and leaded glass. The program should be compliant to regulatory requirements, including the requirements for handling, storage, labelling, transportation, export, processing, and disposal.

Training

The facility should identify areas of training requirements where their absence could lead to a breach in regulatory requirements, damage to worker health & safety, or environmental impairment. Training could include how to handle materials, operate equipment, use personal protection equipment, or maintain equipment. The facility should identify training requirements and provide records of completed training.

Self-Assessments and Corrective Actions

The facility should implement a process to periodically assess conformance of the facility's operating policies and procedures, regulatory and other requirements, such as the OES Electronics Recycling Standard.

Any non-conformances identified through the self-assessment process or other means, such as audits, external communications must be addressed through a corrective action process to correct and prevent reoccurrences.

Change Control

A process should be implemented that allows the facility to evaluate changes in processing or other activities and assess potential impact on the environment, worker health and safety, and regulatory requirements.

Insurance Coverage

Evidence of sufficient amount of general liability and worker compensation insurance coverage is required. This can be in the form of an insurance certificate from the facility's insurance company or broker as well as confirmation of participation in provincial worker compensation plans, or equivalent.

MATERIAL PROCESSING AND END USE ACCEPTABILITY TABLE

The following table outlines which EOL electronics recycling processing, end-use, or method of disposal are considered acceptable by OES.

Materials	Minimal Acceptable Application	Acceptable Process	Unacceptable Point of Final Disposition
End of Life electronics	Material recovery, metals recovery	Manual dismantling and sorting into major material categories, mechanical processing for dismantling and/or material separation with required dust collection and operator protection	Landfill, dismantling using prison labour, exporting to non-OECD/ non-EU countries*
Ferrous and non-ferrous metal	Metal recovery	Manual or mechanical processing, foundry	Landfill, export to non-OECD/ non-EU countries*
Plastics	Pelletizing, plastic product feedstock	Manual or mechanical processing	Use as raw material for food containers or toys if containing BFR, open incineration without proper controls to ensure acceptable temperature and combustion, export to non-OECD/ non-EU countries*
Cables and wires	Metal recovery	Manual or mechanical processing, smelting	Landfill, incineration, export to non-OECD/non-EU countries*
Printed circuit boards and analog boards	Metal recovery	Manual processing, mechanical processing with dust collection and operator protection, smelting complete boards.	Landfill, incineration, export to non-OECD/non-EU countries*
Cathode Ray Tubes (CRT), CRT frit, leaded plasma display or other leaded glass	Glass product manufacturing, metal recovery	Mechanical cutting and crushing with required dust collection and operator protection, manual cutting and crushing	Landfill, manual processing using prison labour, incineration, export to non-OECD/ non-EU countries*
Batteries	Metal recovery	Manual or mechanical processing, smelting	Landfill, incineration, export to non-OECD/EU countries*
Ink and toner cartridges	Remanufacture, Materials recovery	Manual or mechanical processing	Landfill, incineration, export to non-OECD/ non-EU countries*

ACKNOWLEDGMENTS

The information contained in the “Material Separation”, “Substances of Concern”, and “Smelting, Energy Recovery” sections is largely based on the “Technical Guidance Document for the Environmentally Sound Management of Specific Waste Streams: Used and Scrap Personal Computers (ENV/EPOC/WGWPR(2001)3/FINAL)” that was published by the OECD Working Group on Waste Prevention and Recycling.

The information contained in the “Transportation” section is largely based on information obtained from the Transport Canada website for transportation of dangerous goods (www.tc.gc.ca).

The information contained in the “Export” section is largely based on information obtained from the Environment Canada website for transboundary movement branch (www.ec.gc.ca).

Ontario Electronic Stewardship

Recycling Qualification Process



Objective:

The recycling qualification process has three main objectives:

- 1) To ensure all EOL electronics and its waste are handled, transported, processed, stored, and disposed in an environmentally sound manner.
- 2) To ensure that potentially hazardous components of EOL electronics are processed in such a manner that reduces negative impact on the environment and worker health and safety.
- 3) To track the downstream flow of materials through to the point of final processing¹ or disposition to ensure potentially hazardous components of EOL electronics are not sent to developing nations for the purpose of recycling and/or disposal.

Supporting Documentation

Electronics Recycling Standard (ERS): The ERS is the central document in the qualification process that defines the minimum criteria for managing EOL electronics that recyclers must demonstrate conformance to. The ERS outlines criteria for the primary recycler and downstream processors including occupational health & safety and processing requirements such as materials separation, mechanical processing, recovery of electronic scrap materials, and the recycling and/or disposal of hazardous materials.

Guidance Document: The Guidance Document supports the ERS by providing background information on environmental and health & safety concerns associated with processing EOL electronics. This document is intended to educate recyclers on how to develop environmentally sound recycling systems as well as providing ERS auditors with basic information.

Assessment

The assessment process will be completed by qualified² independent third-party auditors under contract with OES.

The assessment process is completed in five stages, listed below. The ultimate goal of the assessment process is to document the downstream flow of materials to the final processing point or disposition and to verify that downstream vendors are in compliance with the applicable requirements of the ERS.

¹ "Point of Final Processing" means a point in the downstream flow of materials where the materials generated from the processing of EOL electronics have been physically or chemically altered into a new product or state. This includes metal, energy and other resources recovery; pelletization of plastics; and landfill and incineration disposal. This does not include bulk and blend materials that are sent to other vendors for additional processing; and shred and separate materials that are sent to other vendors for additional processing.

² "Qualified Auditor" is an individual trained and certified through an authoritative body to be an environmental auditor, and possesses a strong understanding of the ISO 19011 Standards, the regulatory requirements in the jurisdiction of the processor, the Electronics Recycling Standard, and the Electronics Recycling Standard Guidance Document.

Step 1: Mapping the Downstream Flow of Materials

In the initial stage of the assessment, all downstream vendors that handle EOL electronics originating from the primary recycler must be identified and their material handling volume documented. This materials flow can be presented in flow chart format to provide visual representation of the downstream flow of materials or in a manner that sufficiently documents all vendors and processes. Please refer to Appendix A for a sample mapping of downstream flow of materials.

The mapping process begins with the primary recycler³. The materials generated from the primary recycler are classified into three main categories; non-hazardous materials, electronic scrap, and hazardous materials. These materials are either sent directly to brokers for sell as commodities, to sub-vendors for further processing and materials recovery, or to disposal vendors. Materials categorized as electronic scrap and hazardous materials are of particular concern and the all downstream vendors associated with these materials are to be identified through to the point of final processing. The process flow outlined in Appendix B should be used to assist in mapping the downstream flow.

Step 2: Vendor Information and Document Gathering

Once the downstream flow of materials has been mapped, the next stage is to obtain relevant document and other information that will be used in the assessment process to demonstrate conformance to the ERS. The primary recycler will provide this information for their site and assist in gathering the information for all the sub-vendors through to the point of final processing or disposition. This information includes:

- Site information (contacts, site description, organization structure, prior use, etc.)
- A thorough description of the processing method, including a description of controls to safeguard the environment and worker health & safety.
- Copies of regulatory permits, insurance coverage, worker compensation coverage, and ISO 9001/14001 certification.
- Copies of policies and procedures for safeguarding the environment and worker health & safety.
- Details on the downstream flow of materials and vendors used, including volumes of applicable materials processed and sent through to sub-vendors.
- Confirmation that the facility and operations comply with all applicable local and national regulations for handling, transporting, storing, and processing EOLE scrap and materials.
- Identification of any existing or potential environmental liabilities from contamination of ground water or air emissions.

Step 3: Document Audit

All downstream vendors, including processors, brokers and bulkers, will undergo a document audit to determine if the vendor, on paper, is compliant to applicable requirements of the ERS, identify any potential regulatory non-compliance issues, verify commercial arrangements outlined in the mapping of the downstream flow of materials, and verify material volumes that each vendor was reported to handle.

All identified deficiencies must be addressed prior to the vendor being approved.

³ "Primary Recycler" means an entity at the first point of processing EOLE products that accomplishes any of the following upon receipt of EOLE from a point of collection: receiving, sorting, brokering, transporting, arranging transport, dismantling, disassembly, shredding or any other material processing activity, and disposition.

Step 4: Onsite Audit

In addition to document audits, all primary recyclers will have an onsite audit conducted of its operations. Selected processors of electronic scrap and hazardous materials will receive onsite audits based upon the assessment factor as described below.

Only processors of materials classified as either electronic scrap or hazardous materials will be assessed for an onsite audit. If some of the materials resulting from processing electronic scrap or hazardous materials are classified as non-hazardous, the downstream processors of those materials will not be assessed for an onsite audit.

For example, if the primary recycler uses a downstream processor for CRT tubes, that processor would be assessed for an onsite audit. If CRT processing results in hazardous materials (leaded glass, phosphors), electronic components (low-grade circuit boards, cables) and non-hazardous materials (non-leaded glass, ferrous/non-ferrous metals, plastic), downstream processors of non hazardous material that can meet documentation requirements will not require an on site audit.

Selecting downstream processors for an onsite audit will be done through an audit assessment process, as outlined in Table 1. Those processors that score an audit assessment factor of 15 or more will receive an onsite audit. Also, ANY downstream processor receiving a score of 5 for assessment factors #6 or #7 will receive an onsite audit.

Table 1: Audit assessment factors for downstream processors of electronic scrap and hazardous materials.

Assessment Factor	High (5)	Moderate (3)	Low (1)
Processing Operation Factors			
1. Regulatory Oversight	Little Monitoring or Gov't Reporting	Partial Monitoring or Gov't Reporting	Regular Monitoring or Gov't Reporting
2. Environmental Sensitivity of Materials Processed	High Sensitivity (PCBs, Mercury, Batteries)	Moderate Sensitivity (CRTs, leaded-glass, circuit boards)	Low Sensitivity (cables, wires, other components)
3. Processing Method Used	Heat treatment	Mechanical	Manual
4. Years in Operation (company, not just EOLE processing)	Less than 2 years	2 years to 5 years	More than 5 years
5. Processing Volume (by weight)	More than 50% of the material generated from the Primary Recycler	15% to 50% of the material generated from the Primary Recycler	Less than 15% of the material generated from the Primary Recycler
Results from Document Audit			
6. Regulatory Compliance	Regulatory non-compliance issues identified	Potential regulatory non-compliance issues identified	No compliance issues identified
7. ERS Compliance	Identified deficiencies with no plan for closure	Identified deficiencies with acceptable plan for closure	Identified potential or no deficiencies

The stewardship organization reserves the right to audit any downstream processor at any time or when issues arise justifying an on-site audit.

All identified deficiencies must be addressed prior to the processor being approved.

Step 5: Final Assessment

The auditor will compile and evaluate all the collected data and prepare a final report that will be presented to OES. The final report will include:

- Mapping of the downstream flow of materials, including a mass balance of the materials;
- The results of document audits, including any identified deficiencies and the actions taken to address them;
- The results of on-site audits, including any identified deficiencies and the actions taken to address them, and;
- Confirmation of the compliance status of the primary recycler and sub-vendor to the ERS at the time of the assessment.

OES will then review the final report and make a final decision on whether the recycler is qualified for processing EOL electronics collected under the provincial stewardship program. OES may request the auditor follow-up on additional issues once the final report has been issued in order to make a final decision.

Approval Validity and Term

The approval of a primary recycler and downstream vendors is valid for a period of three years. After three years, the primary recycler and downstream vendors require a re-assessment. OES will determine if a full assessment process is required or if targeted document and/or on-site audits are required. This determination is at the sole discretion of OES and will take into consideration any process changes, changing market condition, relationship and history with the primary recycler and downstream vendors, or any other condition OES deems relevant.

Changing Downstream Vendors Handling Electronic Scrap and Hazardous Materials

Primary recyclers must continue to use the qualified vendors handling electronics scrap and hazardous materials for the term of the contract with the provincial stewardship organization. If a change in a downstream vendor is required, the primary recycler must submit a written request to the provincial stewardship organization including the justification (e.g., reduced cost, increased recycling efficiency, improved environmental solution for problematic waste) for this requested change and receive written approval from the provincial stewardship organization. OES will conduct a document audit and determine if the proposed change requires an onsite audit, and the proposed vendor cannot be used until OES has determined them to be qualified. Any costs incurred with the assessment of new vendors will be covered by the primary recycler.

The same principle will apply when requesting change to non-hazardous primary processors. OES needs to be aware of any changes that may impact the primary processor.

Neither OES nor the auditors are permitted to reveal which downstream processors have been verified to the OES Recycling Standard.

Process to change or add a downstream processor

After OES receives a formal request letter, the vendor's application will be un-submitted so that the vendor will be able to add the additional downstream information to it's application.

Changes to Downstream Processors during the Audit

OES will allow companies to amend their application during the audit process outside of the process described above if a downstream processor:

- Refuses the audit
- Goes bankrupt or has gone out of business
- An additional downstream of an identified downstream processor is discovered during a document or on-site audit
- A contract is broken by the downstream processor
- Acquisition by another company

Process to change or add a downstream processor (must meet the above criteria)

After OES receives a formal request letter identifying a reason for the change. The application will be un-submitted so that you can make the necessary changes to your application for review by OES and the auditors.

If the primary process applicant requests to make a change during the audit process for any other reason including:

- Addition of a new downstream processor (reduced cost, increased recycling efficiency, improved environmental solution for problematic waste, etc.)
- Contract replacement initiated by the primary processor
- Other

The primary processor will be obligated to follow the process of Changing Downstream Vendors Handling Electronic Scrap and Hazardous Materials as outlined above.

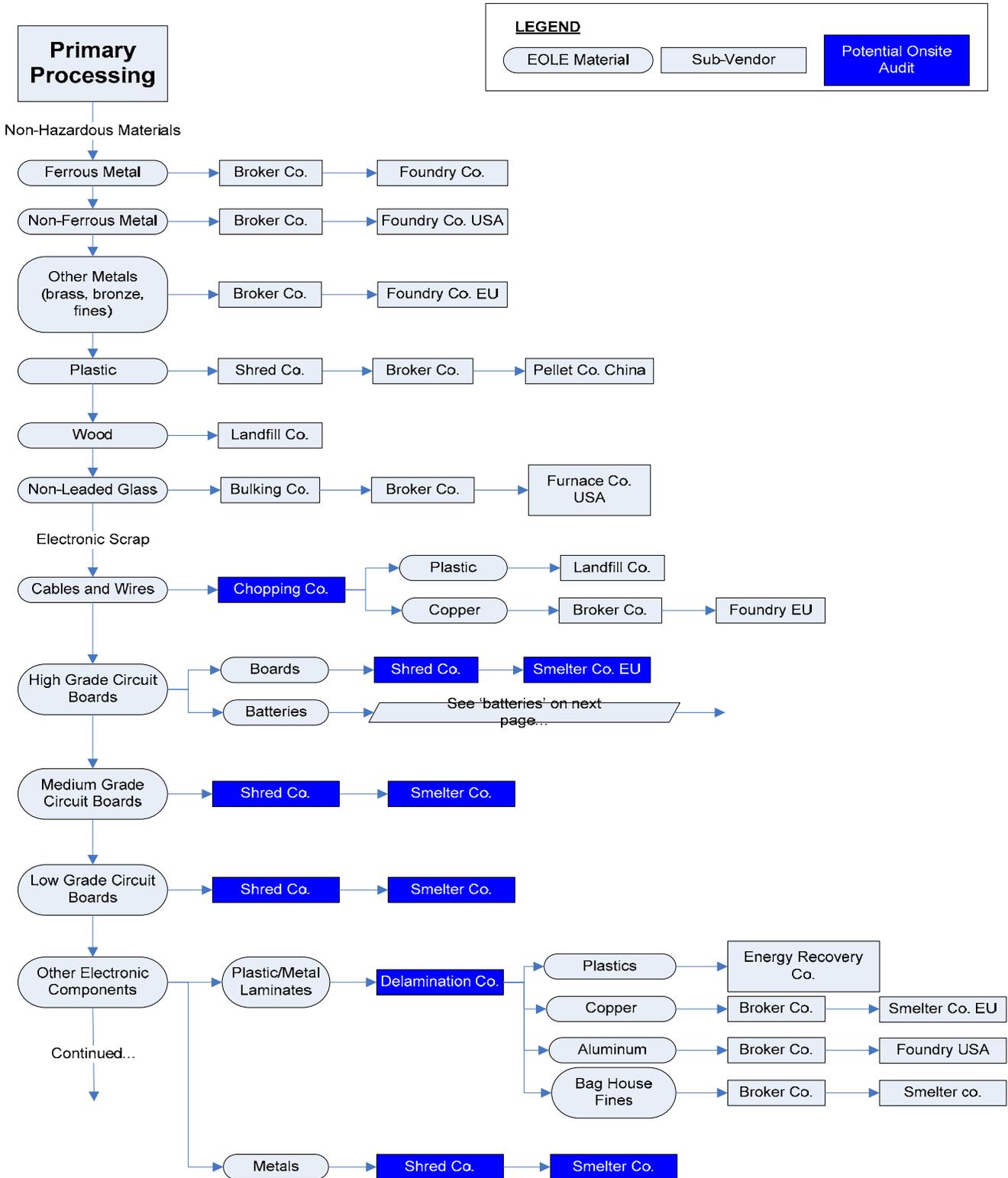
The same principle will apply when requesting changes to non-hazardous primary processors. OES needs to be aware of any changes that may impact the primary processor.

Audit Fee Payment

The provincial stewardship organization will pay for the cost associated with initial qualification process and qualified audits. If a primary recycler wishes to change downstream processors within the three year term and the new downstream processor has not yet been qualified through the assessment process, the primary recycler is responsible for paying the qualification costs.

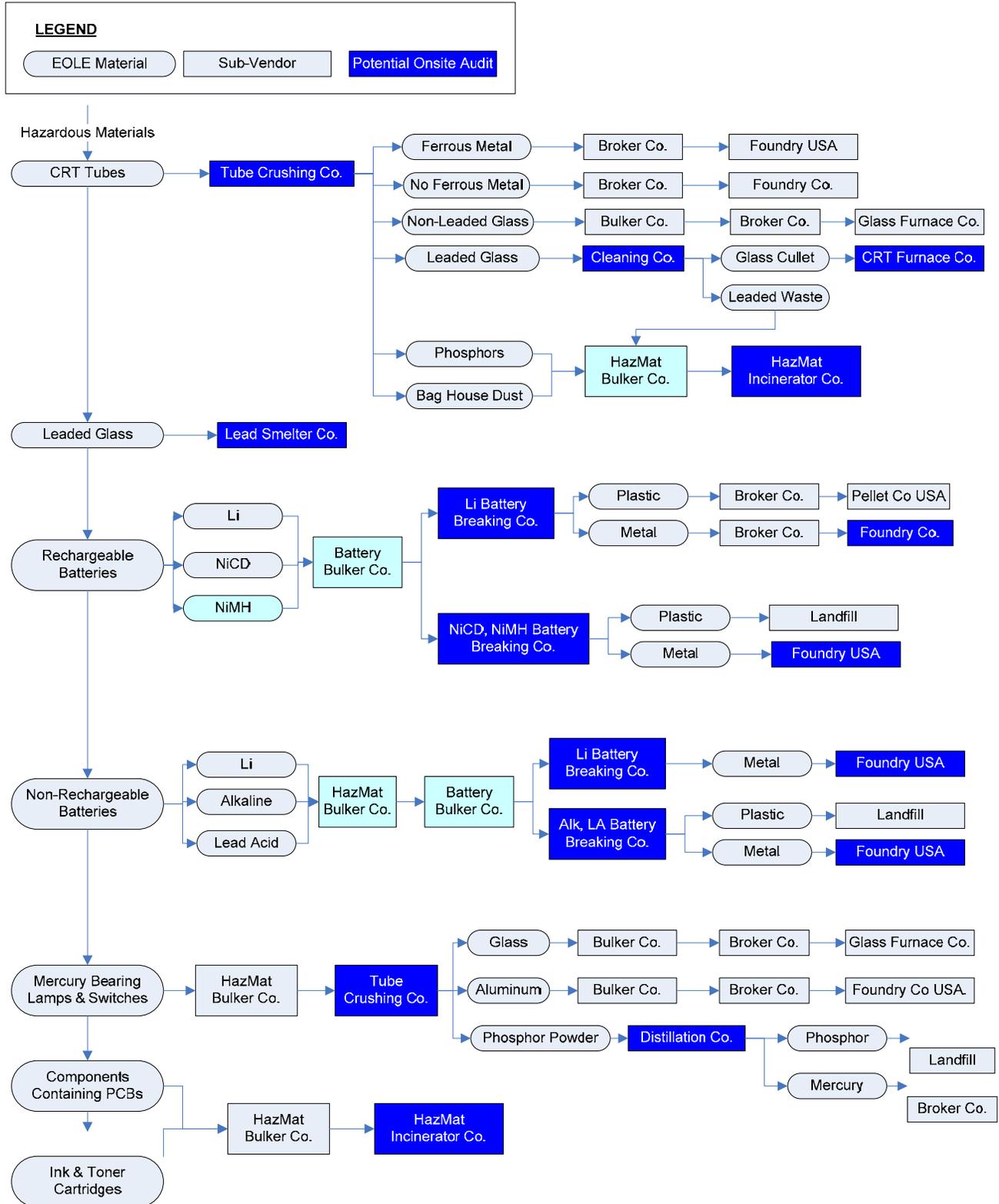
Appendix A

Sample mapping of downstream flow of materials



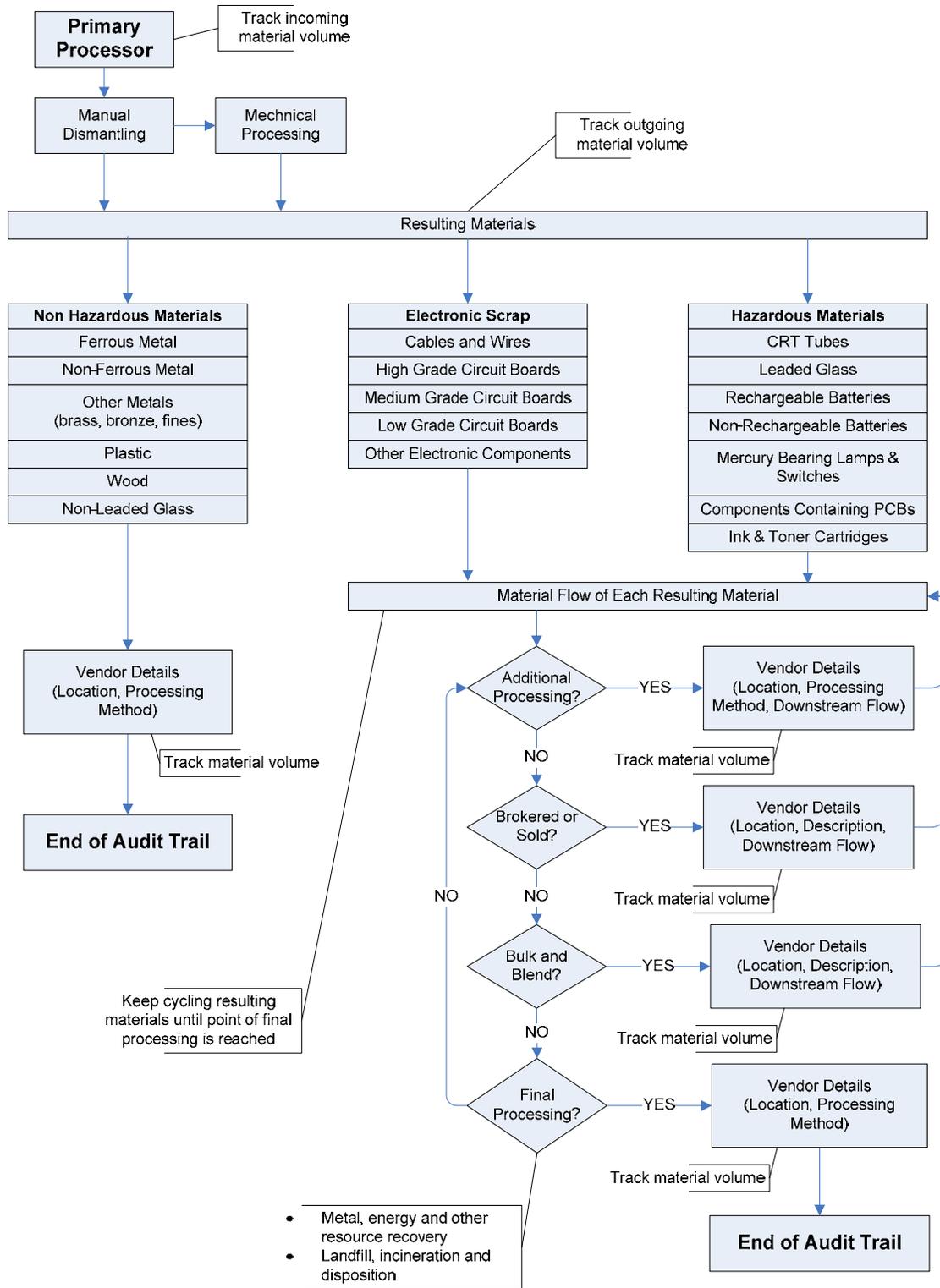
Appendix A

Sample mapping of downstream flow of materials



Appendix B

Process flow to identify all downstream vendors



Ontario Electronic Stewardship



WEEE Reuse and Refurbishment Standard

The Waste Electrical and Electronic Equipment Reuse and Refurbishment (WEEERR) Standard defines the minimum requirements for reuse and refurbishing operations approved under the OES program.

Organizations performing reuse or refurbishing activities shall maintain objective evidence of conformance to this Standard. While this Standard defines the minimum requirements, organizations undertaking these activities are encouraged to follow best practices, in accordance with all local requirements including federal, provincial and municipal.

Definitions:

Reuse – The provision of functioning WEEE to another user for its intended purpose, without hardware repair or modification, and where the reuse activities are limited to non intrusive operation verification; cleaning; replacement of consumable items such as batteries, toners, fusers, etc.; data and other information clearing; and software installation.

Refurbishing – Any disassembly of WEEE for the purpose of internal testing or troubleshooting; or replacement or repair of non-functioning or obsolete parts, not including consumable items such as batteries, toners, fusers, etc.

Recycling – The processing of WEEE by manual or mechanical means for the purpose of resource recovery.

WEEE – Waste electrical and electronic equipment managed under the OES program, including unwanted and discarded items.

1.0 Legal and Other Requirements

Organizations performing WEEE reuse and/or refurbishing shall operate in accordance with all applicable local requirements including federal, provincial and municipal requirements, and shall:

- 1.1 Possess all necessary permits and approvals to operate.
- 1.2 Register annually as a waste generator for any subject wastes under Regulation 347 (Revised Regulations of Ontario 1990), and pay the associated generator registration fees.
- 1.3 Identify and comply with regulatory requirements for storage, handling and transportation of all waste materials, including those in Regulation 347 and the Transportation of Dangerous Goods Regulations (Canada).
- 1.4 Maintain a process to identify environmental, health and safety regulatory requirements on an ongoing basis, as a result of changes in operations or regulatory requirements.
- 1.5 Register with the Workplace Safety and Insurance Board and possess adequate workplace insurance coverage.
- 1.6 Possess Comprehensive or Commercial General Liability Insurance including coverage for bodily injury, property damage, complete operations and contractual liability with combined single limits of not less than \$1,000,000 per occurrence, \$1,000,000 general aggregate.
- 1.7 Maintain a procedure to notify OES of any fines or regulatory orders in the previous 5 years and within 60 days after any subsequent fines or orders.

- 1.8 Not employ prison labour for reuse or refurbishing operations.
- 1.9 Maintain processes to ensure that all software and firmware installations on redistributed equipment are properly licensed and compatible with operating systems.

2.0 Safety and Environmental Risk Assessment

Reuse and/or refurbishing organizations shall maintain processes to:

- 2.1 Conduct an initial risk assessment of their operations to identify any potential environment, health or safety hazards associated with their operations.
- 2.2 Document any potential physical, chemical and ergonomic hazards associated with each material handled and tasks undertaken, as well as the overall operations, during both normal operating conditions and potential emergency situations.
- 2.3 Evaluate any potential environmental, health or safety risks identified through the assessment.
- 2.4 Implement adequate controls for any potential high risk activities, including documented procedures, to protect the environment, and the health and safety of employees and the public.
- 2.5 Schedule and conduct subsequent risk assessments as a result of any applicable operational or regulatory changes.
- 2.6 Maintain a list of products and waste materials that the organization is capable of handling in a safe and environmentally sound manner.

3.0 Training and Awareness

The organization shall provide adequate training to protect employees and the environment, and shall:

- 3.1 Document the training needs for each position or operation.
- 3.2 Provide specific training and written instruction(s) for the proper handling, storage and disposal of WEEE and materials.
- 3.3 Provide specific training and written instruction(s) for responding to accidents, emergencies and environmental releases.
- 3.4 Maintain a record of all training completed.

4.0 Materials Management

To demonstrate adequate management of WEEE, parts and residual materials, the organization shall:

- 4.1 Test all units and parts to ensure workability and that they are capable of performing those functions for which they were designed.
- 4.2 Ensure redistributed items are used in reuse applications (e.g. functioning reused units and parts) at the downstream destination.
- 4.3 Ensure redistributed items are adequately packaged to protect from damage during transport.
- 4.4 Maintain documented procedures for handling, storing, transporting and/or disposing of all WEEE, parts and residual materials.
- 4.5 Ensure WEEE, parts and residual materials are handled and stored in a secured enclosure.
- 4.6 Ensure subject wastes are not stored longer than 90 days without MOE authorization.
- 4.7 Ensure all WEEE, parts and residual materials that are not redistributed are recycled through an OES approved processor.

- 4.8 Ensure non-OES materials are managed in compliance with applicable regulatory requirements.

5.0 WEEE and Information Security

The organization shall develop and maintain a process to communicate to generators and customers a WEEE and information security policy, including employing adequate security measures to:

- 5.1 Protect any WEEE and parts from loss or unintended use.
- 5.2 Destroy any user data contained on and within equipment, including the removal of hard drive data using industry standard practices and software (e.g. US Department of Defence (DoD)), and removal of other identification such as asset tags.
- 5.3 Destroy all WEEE where data destruction cannot be confirmed.

6.0 Records and Reporting

The organization shall maintain records of and report to OES as required the following:

- 6.1 Number of units received for each WEEE category.
- 6.2 Number of units reused by WEEE category and the end-use location.
- 6.3 Number of units refurbished by WEEE category and the end-use location.
- 6.4 Number of parts redistributed.
- 6.5 Number of units or weight of material sent to OES approved processors for recycling.

7.0 Warranty Requirements

The organization shall:

- 7.1 Provide a minimum 30 day warranty for the repair or replacement of all WEEE and parts sold or donated, excluding consumable items such as batteries, toners, fusers, etc.
- 7.2 Affix a label in a visible location on all used and refurbished equipment destined for donation or resale indicating the name and location of the reuse or refurbishing organization.
- 7.3 Provide a means to communicate the warranty policy and its conditions to the customer.

8.0 Consumer Safety of Refurbished Product

In order to ensure adequate consumer safety, refurbishing organizations shall:

- 8.1 Maintain processes to identify and ensure that all parts, components and other materials (i.e. solder) used in the refurbishing processes are compatible with existing equipment and components.
- 8.2 Maintain processes to test and verify the functioning of WEEE in accordance to regulatory requirements and operating specifications.

9.0 Resources

The following resources can be consulted for guidance on demonstrating conformance to the Standard:

- 9.1 EPSC - Guidance Document for Environmentally Sound Recycling of Electronics
www.epsc.ca/recycle
- 9.2 DoD 5220.22-M - National Industrial Security Program Operating Manual
<http://www.dtic.mil/whs/directives/corres/html/522022m.htm>



Ontario Electronic Stewardship

WEEE Reuse and Refurbishment Assessment Process

Objective: To assess and evaluate reuse and/or refurbishing organizations to ensure that they operate in full compliance to the WEEE Reuse and Refurbishment Standard (“the Standard”). This process applies to any reuse and/or refurbishing organization (“the Organization”) seeking approval under the Ontario Electronic Stewardship (“OES”) WEEE diversion program.

ASSESSMENT PROCESS

To achieve the objective above, the assessment process will be conducted in the following stages:

Stage 1: Internal process evaluation

The Organization seeking approval through the assessment process will review the Standard and other supporting documentation and make any necessary process or administrative changes within their operation to ensure these requirements are satisfied. Conducting an internal audit is recommended.

Stage 2: Auditor selection

The Organization will then select and enter a contracted agreement with an auditing firm selected from a list provided by OES to conduct the assessment. Auditing firms recommended by OES will be independent third-party firms that are able to deploy qualified auditor¹ to assess the organization against the auditable criteria of the Standard.

Stage 3: Assessment

The Organization will be assessed by the contracted auditor against the auditable criteria of the Standard. The assessment will involve the review of objective evidence used to demonstrate conformance with the Standard criteria. Objective evidence could include, but is not limited to, policies, procedures, work instructions, shipping records, training records, permits, certificates, memos, employee interviews and general observations.

Stage 4: Corrective Action Request (CAR)

Any issue identified during the assessment will be classified by the auditor as being either **major** or **minor**. Major CARs are determined by the following criteria

1. Regulatory compliance: Issues related to regulatory compliance are considered major.
2. Level of hazard: Issues related to materials defined as hazardous under provincial regulations are considered major.

¹ “Qualified Auditor” is an individual trained and certified through an authoritative body to be an environmental auditor, and possesses a strong understanding of the ISO 14 010 – ISO 14 012 Standards, the regulatory requirements in the jurisdiction of the processor, the Standard, and the Guidance Document for Environmentally Sound Recycling of Electronics.

3. **Responsiveness:** Issues that the Organization appears unresponsive to resolve are considered major. This includes the escalation of minor issues in the event that they are not adequately addressed with the specified time frame.

Major CARs must be addressed prior to approval being granted. The Organization must prepare an action plan that is approved by the contracted auditor for addressing minor CARs within 90 days in order to attain a conditional approval. After the 90 day period, any unresolved minor CARs will be escalated to major CARs and approval will be revoked until written confirmation from the contracted auditor is received by OES indicating they have been closed.

Stage 5: Confirmation of conformance

When the contracted auditor provides written confirmation to OES that the Organization has satisfied the requirements for approval or conditional approval, the Organization will be considered approved under the OES program. If a conditional approval has been granted, the contracted auditor is required to provide follow up written confirmation as to the status of the minor CARs within 90 days to maintain the approval status of the Organization.

ASSESSMENT TERMS AND CONDITIONS

Approval validity and term: A conditional approval is valid for a period of 90 days. If minor CARs are not addressed within that time frame, the minor CARs will be escalated to major CARs and conditional approval revoked. If all minor CARs are addressed, through written confirmation from the contracted auditor, the Organization will be considered approved for a period of 2 years. After the two year period, the Organization must seek approval under the most current version of the Standard that OES has approved for the purpose of assessing reuse and refurbishing organizations.

Changes to the process: If the Organization makes changes to their processes, they must provide written confirmation from their contracted auditor that the revised process is in conformance to the Standard. Conditions for approval validity and term apply to the changed process.

Audit fee payment: The Organization will be responsible for all costs associated with seeking approval, including the costs of the contracted auditor.

SUPPORTING DOCUMENTATION

Guidance Document for Environmentally Sound Recycling of Electronics – Electronics Product Stewardship Canada: This document provides background information on environmental and health & safety concerns associated with handling and processing WEEE. This document is intended to outline best practices and provide auditors with basic information.

*Research and Reporting on Design
Elements that have Reduced the
Environmental Footprint of
Electronics Products in Canada*

2009 Design for Environment (DfE)



Authored by the Green Electronics Council for:

**Electronics Product
Stewardship Canada**

www.epsc.ca

**Recyclage des produits
électroniques Canada**

www.rpec.ca

BY THE GREEN ELECTRONICS COUNCIL

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Green Electronics Council for EPSC

3/16/2009

Version 2.1
Final Report



EPSC Final Report – version 2.1
 3/16/2009 – Final Report for EPSC

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Note from EPSC's Chair

With this release of our second report on Designing for the Environment, the Canadian electronics industry continues to maintain its high standard of co-operation. This report joins other key co-operative efforts, including the highly acclaimed Recycling Vendor Qualification Program, which has been an innovative component to developing an effective, responsible approach to managing end-of-life electronics.

Since its founding in 2003 by Electro-Federation Canada (EFC) the Information Technology Association of Canada (ITAC) and leading consumer electronics and information technology manufacturers, EPSC has an established reputation for working to design, promote and implement sustainable solutions for Canada's electronic waste. EPSC is proud to see four industry-led environmental stewardship programs now operating in Canada. With Ontario set to join the programs already operational in British Columbia, Saskatchewan and Nova Scotia, the successful partnership approach that EPSC has used since its inception is clearly an effective one. We have demonstrated that industry can work with all levels of government to create and operate programs that ensure safe end-of-life programs for electronics.

In addition to EPSC's concern for products at the end of their lives, this report also visibly indicates that our member companies are investing significantly in the environmental performance of their products throughout their lifecycle. Their commitment to the investment required in the initial research and development, which may take several years to bring to full implementation, is remarkable. From the design stage, through manufacturing, marketing and delivery, our companies are working to create products that leave a much smaller environmental footprint. As a result, our customers have a wider range of electronic products that can be used more efficiently and can be recycled in a more environmentally responsible manner.

This document provides a summary of the findings from the research EPSC commissioned the Green Electronics Council to conduct. The complete report is available at www.epsc.ca. This is just one more example of EPSC's dedication and commitment to working together on behalf of all of its member companies, and to provide accurate and timely information to the Canadian public.

Lloyd Bryant
Acting Chair
Electronics Product Stewardship Canada (EPSC)

Foreword

Electronics Product Stewardship Canada (EPSC) hired Green Electronics Council (GEC) in September 2008 to research and report on Design for Environment (DfE) of electronics goods that are sold in the Canadian market.

The purpose of this report is to identify key trends and advances in environmental design. These DfE initiatives study well-known areas such as energy use and reduced use of environmentally sensitive materials. Other important areas seeing positive improvements include design for expandability, design for better management at end-of-life and use of recycled materials.

Based on GEC's research in the electronics industry, this report is divided into five key areas:

1. Environmentally Sensitive Materials
2. Environmentally Preferable Materials Selection
3. Energy
4. Design for End-of-Life
5. Product Expandability

The information presented in this report is based on secondary research conducted over several months by a team of environmental professionals assembled by GEC.

Founded in 2005, GEC is a non-profit organization established to work with all stakeholders in the electronics eco-system with the intention of "re-designing society's relationship with electronics" by:

- Developing market-based incentives for improved practices
- Building the capacity of individuals and organizations to reduce the life-cycle impacts of electronic products
- Conducting research

GEC assembles virtual teams for research of this type, comprising key industry professionals with germane and specialized knowledge. The following team prepared this EPSC report:

- *Mark Schaffer*, President, Schaffer Environmental, was the project manager in addition to leading the research in the Energy and Product Expandability Sections
- *Pamela Brody-Heine*, Principal, Eco Stewardship Strategies, led the research on Environmentally Sensitive Materials and Materials Selection
- *Anne Peters*, President, Gracestone Inc., led the research on Design for End-of-Life
- *Maria Kelleher*, Principal, and *Janet Robins*, Senior Researcher and Consultant, Kelleher Environmental, provided input on regulatory and procurement drivers in the Canadian marketplace
- *Wayne Rifer*, Manager of EPEATTM Operations, Green Electronics Council, was the project's technical advisor

Executive Summary

Design for the environment (DfE) trends yielding positive environmental benefits are occurring throughout the electronics industry in a number of ways:

1. Participation by the industry in global voluntary initiatives such as environmental labels and programs, and cooperative industry standards, such as EPEAT™, ENERGY STAR, EcoLogo™ and Bluetooth
2. Leadership in environmental standard setting by industry organizations, such as Institute of Electrical and Electronics Engineers, Inc. (IEEE), International Electrotechnical Commission (IEC), ECMA International and International Electronics Manufacturing Initiative (iNEMI)
3. Design shifts and creative inventions, such as the use of new and converging technologies that yield both performance and environmental benefits, such as the move to LEDs and multifunction devices
4. Product changes due to consumer demand and requirements, such as smaller, thinner, less-material-intensive products
5. Meeting and, in some cases, exceeding, regional regulatory requirements and applying those requirements to products worldwide, such as Restriction of Hazardous Substances (RoHS) and provincial take-back schemes

It is encouraging that these trends integrate environmental benefits – along with product performance improvements in standard product design and business practices – while meeting marketplace demands.

Product design has changed significantly and quickly in recent years due to the mounting availability and economic viability of new materials, processes and technologies that offer environmental advantages. Additionally, environmental programs and ecolabels are more widely developed and used than ever, especially in Canada. These voluntary tools identify best practices to minimize adverse environmental impact during material selection, product and component design, product use and the end-of-life (EOL) phase. Purchasers' access to products through these programs and ecolabels is very strong in Canada, further amplifying a market-driven incentive for manufacturers to “go green.” Industry's ability to provide products that meet both marketplace and green imperatives depends upon its flexibility to take rapid advantage of these new developments, and being recognized by purchasers for being able to do so. The purchaser is providing positive feedback to the environmental design and functionality requirements, which in turn promotes more innovative environmental product design in a timely fashion.

During the past three years, Canadian consumer electronics and information technology manufacturers have worked co-operatively to develop and implement industry-led recycling programs. Since its inception in 2003, Electronics Product Stewardship Canada (EPSC) has used a successful partnership approach, demonstrating that competing industry players can work together effectively, and with other stakeholders, to create and operate programs that ensure that e-waste is collected and recycled safely.

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While continuing on its substantial progress in developing the capability to deliver end-of-life (EOL) programs, the electronics industry has also turned its attention to DfE programs. DfE-related trends and advancements can be grouped into five major areas:

1. Environmentally Sensitive Materials
2. Environmentally Preferable Materials Selection
3. Energy
4. Design for End-of-Life
5. Product Expandability

Within each of these areas, which were the focus of this research, voluntary industry-wide initiatives are improving the design of electronics and information technology products well beyond what is required by regulation.

Perhaps the most successful example of developments in the DfE area for some consumer electronics is the widespread adoption of EPEAT, which encompasses the five key DfE areas. A multi-stakeholder group that included industry, government, purchasers and activist organizations developed this voluntary program between 2003 and 2006. The industry's active support was one of the key factors that led to EPEAT's success. EPEAT is part of the *Canadian National Master Standing Offer for IT equipment*. EPEAT recently partnered with the leading Canadian voluntary environmental procurement program, EcoLogo™, to make it easier to certify and promote green electronics. In Canada, over 3 million notebooks, desktops and monitors that meet EPEAT's criteria were sold in 2007.

Within each of the key DfE areas outlined above, the research found trends that indicated improving product environmental design. Together, these trends contribute significantly to positive environmental outcomes.

Environmentally Sensitive Materials: The electronic industry has made significant strides in moving away from the use of Cathode Ray Tubes (CRTs) over the past two decades. The availability and viability of new materials and technologies has facilitated the reduced use of environmentally sensitive materials, especially lead in CRTs as flat panel displays are replacing CRTs, and mercury in mercury-bulb backlit liquid crystal displays (LCD) as light-emitting diode (LED) technologies that are mercury-free are becoming more common.

However, there is a distinction between the leading companies and the many small- to medium-sized manufacturers and suppliers. Work still needs to be done to improve practices in smaller companies with little-known brands, who have less capacity for innovation, less ability to influence their supply chain, and often less transparency with the public or regulators.

Environmentally Preferable Materials Selection: Industry efforts focus primarily on two areas – dematerialization and “alternative” materials. The dematerialization (using less material overall) of products occurs due to multiple trends. The availability of newer, smaller products or subassemblies such as flat-panel technologies replacing CRTs is an example of how new technology can change what and how much material is needed to meet users' needs. Consumers far prefer flat-panel display technology, because it takes up much less space, uses fewer

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materials, generally consumes less power, and generates less heat during use. As a result, the enclosure (for a laptop or a television, for example) can be smaller and lighter. An example of this trend is well illustrated by the evolving design of televisions. Twenty years ago, a 32” TV might weigh over 45 kg (100 pounds) due to its CRT; today, that 32” TV is only 9-14 kg (20 - 30 pounds) (or less) thanks to LCD technology. Besides less production of primary materials, this dematerialization also yields dividends in reduced transport impacts throughout the product lifecycle and reduced product packaging.

While dematerialization is a common practice in the industry, the use of post-consumer recycled content and bio-based/renewable materials remains more of a challenge. Looking to the future, materials engineered from recovered and renewable/bio-based materials, as well as the development of nanomaterials and nanotechnologies, will impact the type, size and number of materials potentially utilized in new industry designs. While these state-of-the-art technologies can always produce more environmental challenges, the investigation and mitigation of these challenges are playing a growing role in the technology development process.

Energy: Industry has been, and continues to be, a partner in the development of ENERGY STAR and other voluntary energy-management programs such as the 80 Plus Program and the Climate Savers Computer Initiative (CSCI). These engagements will only increase over the next few years as EPEAT and ENERGY STAR expand into more products and more restrictive management levels for off, standby and use phase energy.

The next challenge for the electronics industry will be to identify more than off or standby mode power limits. The evolution will be identifying true product efficiency and the tools to measure this are already being investigated for computers. By developing them, other benchmark tools may become available to define product efficiency for additional consumer devices such as televisions, displays, and printers.

Design for End-of-Life: Due to EPEAT, EcoLogo™ and other voluntary environmental ecolabel programs, the design of electronics products has become more streamlined than in the past. Fewer screws, more snap-fit parts, as well as fewer different types of materials are found in these products. These design changes make them easier to recycle at end-of-life. Additionally, manufacturers are providing more transparent information on how products can be disassembled either for recycling or for upgrading and life extension by end-users.

Although there are many drivers aiding in designing for end-of-life, there are still challenges. As such, industry groups, key trade associations, national-level agencies and authorities in North America and Europe, and various non-governmental organizations (NGOs), are all looking for solutions to break down the barriers to designing products that can be more efficiently managed at end-of-life. Strategies for breaking down these barriers are many, and include changes in governmental policies, purchasing mechanisms, voluntary collaborative industry work groups, and continued research into all aspects of increasing EOL design.

Product Expandability: Industry has worked together to establish common specifications for key aspects of electronics product design and functionality, by establishing non-competitive means to communicate with one another to establish cross-industry standards. The standards

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resulting from pan-industry work were prompted through market demand for increased interoperability of electronic devices, and have given rise to a number of universally adopted standards. Additionally, industry has formed agreements such as the Digital Living Network Alliance (DLNA), where manufacturers are designing an array of electronic products that communicate and function efficiently with one another, giving rise to a more streamlined digital lifestyle for consumers. Though much work remains to be done to expand these efforts in cross-generational and cross-brand functionality of components and systems, they have already effectively lengthened the life of products through upgradability and refurbishment, and by decreasing production and EOL disposal of proprietary connectors and cables.

As well, the convergence of functionality in devices has given rise to further opportunities in dematerialization. Customer demand and market pressures for smaller, lighter multi-functional devices have resulted in new classes of products. Netbooks, smartphones and multi-function printer devices are examples of converging multiple features into a single device – typically smaller than any one of the previous “single function” devices. The demand for more of these devices, with even more functionality, smaller form factors, lower energy use per function and lessened material use, will continue into the future.

1. Introduction

1.1 Background to the Study

Consumer electronics in general, and information technology in particular, play a major role relative to global efforts to create a sustainable relationship with the environment. IT makes a significant positive contribution to human sustainability by empowering people worldwide with enhanced communication, increasing the efficiency of the economy in meeting human needs, and providing the foundational tools for planning, controlling, optimizing and monitoring environmental impacts.

While Canada has a small market share of the global consumer electronics market, representing only 1% of world sales, it plays a key role as a leader advocating environmental sustainability. Canada is noteworthy in that its electronics industry, through Electronics Product Stewardship Canada (EPSC), works closely with governments at the federal, provincial, and even municipal level to promote sustainable management of consumer electronics throughout production, use and EOL stages. Industry joins regulators and policy-makers regularly in both informal and formal idea-generating and decision-making settings to ensure communications are clear, stakeholders understand one another's agendas, and that industry continues to exceed public expectations for enhanced environmental performance.

EPSC was created in 2003 as a not-for-profit organization working to design, promote, and implement sustainable solutions for appropriate management of Canada's electronic waste. Led by industry, EPSC works with many key stakeholders, including provincial regulators, academia, electronics recyclers and others, to design, promote and implement sustainable solutions for appropriate management of Canada's electronic waste. EPSC is the environmental voice for the electronics industry in Canada. As product stewardship programs grow across Canada, EPSC seeks to stay in the forefront of initiatives from regulators and program managers. EPSC has been instrumental in establishing industry-led EOL electronics management programs in Saskatchewan, Ontario, BC and Nova Scotia. DfE is of key concern to EPSC as one of the ways in which electronics stewards can improve long-term performance, and reduce the long-term environmental footprint of electronics products in Canada.

EPSC issued a Design for Environment report in 2006. In 2008, EPSC hired Green Electronics Council (GEC) to prepare a more detailed and updated Design for Environment report (DfE). This report is intended to serve as a resource for authorities to reference regarding the Canadian electronics industry's efforts in the DfE arena, and as a reference for those considering potential legislation focused on DfE improvements. This report builds on and enhances the work done in a similar 2006 EPSC report, "Designing for the Environment¹."

For specific examples of companies that are working towards making a significant difference in the five key environmental areas, see Appendix A.

¹ www.epsc.ca/dfe/

2. Green Procurement Initiatives in Canada

2.1 The Context

Research into green procurement initiatives in Canada highlights some promising trends. Increasingly, government purchasing agencies and consumers are recognizing the influence of their purchasing power. The Canadian federal government alone buys about \$20 billion in all goods and services, more than the total operating budgets of many smaller countries. It is estimated that the federal government purchases between 32,000 and 37,000 notebooks and 70,000 to 80,000 desktop computers annually. Purchasing agencies can exert strong influence on the environmental integrity of products by incorporating environmental preferences in their tendering specifications.

The Canadian government, as well as provincial and local governments, recognizes the importance of harmonizing environmental attributes requested of electronic manufacturers with other jurisdictions, especially the United States. For this reason, the federal government's purchasing agency, Public Works and Government Services Canada (PWGSC) has adopted EPEAT and ENERGY STAR standards in its notebook, desktop and server tender specifications. These environmental criteria play a major role in the evaluation process

EPEAT is now specified in the *Canadian National Master Standing Offer for IT Equipment*, and many Canadian agencies and jurisdictions, including PWGSC, are incorporating green specifications and/or EPEAT into their IT tender documents. Some jurisdictions specify EPEAT Silver standards for all desktop and notebook purchases, at a minimum, and have done so since 2007.

2.2 EPEAT in Canada

EPEAT is an environmental purchasing program that explicitly covers the US and Canada, though it is now being expanded internationally. Table 1 shows the unit sales of EPEAT-registered products in 2007.

Table 1: 2007 Unit Sales of EPEAT Registered Products²

Region	Desktops	Notebooks	Monitors	Integrated Systems	Total
Canada	983,029	561,096	1,606,612	0	3,150,737
USA	12,403,405	10,375,874	18,883,816	1,196,621	42,859,716
Rest of World	22,478,991	13,219,158	28,218,926	59	63,917,134
Total	35,865,425	24,156,128	48,709,354	1,196,680	109,927,587

Sales of EPEAT-registered desktop computers in Canada were 172,000 in 2006; as shown in Table 1 above, this increased over fivefold to sales of 983,000 in 2007.

² Environmental Benefits report 2007, www.EPEAT.net.

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EPEAT was designed and created by a multi-stakeholder process. Industry’s initial and ongoing support of EPEAT has been strong, and is based chiefly on two benefits that it offers to the industry:

1. EPEAT establishes a common framework for measuring the effectiveness of industry’s DfE efforts. Industry promotes EPEAT because it can help to harmonize DfE requirements and standards so that all of industry, as well as standard setters and users, can share a common language and set of goals.
2. EPEAT provides a clear measure of environmental performance for industry competition. That is, it is a shared incentive that rewards industry efforts for continuous improvement. Industry participated in the setting of tough standards, especially in the optional criteria that are now the market-place distinguishers.

Table 2 provides a summary of the environmental benefits from purchasing of EPEAT-registered products in Canada in 2007.

Table 2: Environmental/Cost Benefits of 2007 Canada Purchasing³

Benefit Category	Savings
Energy	1.34 billion kWh
Primary Materials	2.4 million metric tons
Air Emissions	5.54 billion kg
GHG Emissions	105 million kg
Water Emissions	11.6 million kg
Toxic Materials	91,400 kg
Hazardous Waste	3.56 million kg
Cost Savings	\$116 million

2.3 EcoLogo™ and Other Green Procurement Standards

The other ecolabel that covers electronics in North America is EcoLogo™. It encompasses a broad list of electronic products and peripheral electronic devices, such as printers (laser and ink jet), photocopiers and facsimile machines. EPEAT and EcoLogo™ have signed a cooperative agreement that establishes EcoLogo™ as a certifier of EPEAT products. This agreement will allow IT products to be registered with either environmental program based on the common, harmonized standard – IEEE 1680.

Other initiatives underway include the ENERGY STAR program, which has been modeled on the United State’s ENERGY STAR program, ensuring that all technical specifications are the same for Canada and the United States. The Energy, Air and GHG Emissions environmental benefits in Table 2 are mostly from the inclusion of ENERGY STAR as part of EPEAT. Canada has been pursuing an action plan for standby power that would target consumer electronic products, and has encouraged its NAFTA trading partners to pursue similar standards.

³ Environmental Benefits report 2007, www.EPEAT.net.

2.4 Clean Production and Toxics Related Legislation in Canada

Canada has also implemented numerous programs promoting clean production and responsible management of electronics products. In 2006, Canada launched the Chemical Management Plan with a mandate to categorize 23,000 toxic chemical substances⁴ in order to identify substances to which the human population is most likely to be exposed, as well as those which are persistent, bio-accumulative, and/or inherently toxic to humans or the environment. Currently, 4,300 chemical substances have been identified as needing a more thorough examination. Five hundred of these were considered to have the greatest potential for causing harm, and are receiving highest priority for study.

Under the *Canadian Environmental Protection Act* (CEPA), the federal government has authority to set limits and restrictions on new or additional uses of chemicals, including the establishment of regulations, guidelines, codes of practice, or other mechanisms to reduce the environmental and/or human health impacts of the substance. Recently, two materials contained in consumer electronics – mercury and brominated flame retardants – have been targeted as high-risk toxic materials requiring special attention and restrictions. The province of Ontario announced a Toxics Reduction Strategy in late November 2008 that will initially target a defined list of chemicals including Bisphenol A and lead-related compounds.

2.5 Canadian End-of-Life Electronics Programs and Design For Environment Requirements

Canadian provinces and territories are predominantly responsible for waste management policy setting, with the federal role in waste management limited to toxics, transboundary and international issues. Canadian provinces and territories have embraced the concept of Extended Producer Responsibility (EPR) for managing a variety of materials, with new programs being considered and implemented each year. EPR programs targeting a selected list of EOL electronics have been implemented in British Columbia, Saskatchewan and Nova Scotia to date. A program will be implemented in Ontario, in April 2009.

Many of the provincial EPR regulations or program plans for electronic waste include DfE elements and/or mandate product reuse and refurbish targets. The government of British Columbia requires that the electronic Producer Responsibility Organization (PRO) showcase industry design for environment initiatives as part of its reporting requirements. The Ontario Waste Electrical and Electronic Equipment (WEEE) Program Plan sets reuse targets, and requires the PRO to provide examples and analysis of reduction activities undertaken by industry, including DfE initiatives. Nova Scotia's electronic stewardship program requires brand owners to incorporate DfE in their planning process and requires Atlantic Canada Electronics Stewardship (ACES, the provincial electronic product stewardship program) to report on DfE improvements across the industry.

⁴ Requires every new chemical substance made in Canada or imported from other countries since 1994 to be assessed against specific criteria.

3. Environmentally Sensitive Materials

3.1 Context

Computers, televisions, monitors, notebooks, printers and other types of electronic equipment used at home, in the workplace and in schools have traditionally contained materials or substances that raise concern due to their hazardous constituents. These materials include lead found in CRT monitors and printed circuit boards, chlorinated plastics in cable wiring, brominated flame retardants (BFRs) in circuit boards and plastic enclosures, mercury in the lighting in some flat panel displays and other heavy metals. This is of concern because these substances and others found in electronics have been linked to adverse human health effects and environmental impacts. These products, when managed improperly at end-of-life (particularly in overseas informal recycling sectors found in some developing nations), can pose risks to human health and the environment.

In response to policy mandates, regulations and other market drivers – as well as growing public concern over the environmental impacts of electronics, and advancements in research and development of less harmful alternatives – the electronics industry has made significant strides in moving away from the use of these substances over the past two decades. This section discusses the positive movement made in reducing adverse impacts of materials of concern in electronic products manufacturing.

3.2 Mercury

In electronic products, mercury is primarily used in CCFLs, in the backlighting flat-panel displays of monitors, laptops and televisions.

During use, mercury is well sealed within an electronic product; however mercury-containing components require special EOL handling. Mercury is a neurotoxin that affects the brain and nervous system, particularly in the early years of life as a child's brain is developing. Mercury is one of the six substances regulated through Restriction of Hazardous Substances Directive (RoHS), although mercury lamps are exempt (see Section 3.6 for a discussion of RoHS and other regulations).

The Canadian federal government has responded to the need for mercury management by developing diverse policies and program initiatives. Mercury is identified in Schedule 1 of CEPA 1999 (List of Toxic Substances). It has been targeted for reduction and has been designated a Track 2 substance requiring life cycle management⁵ to bring levels back to naturally occurring levels of mercury.

A separate process under CEPA is assessing options to address mercury in products. A Discussion Paper containing various approaches was released in December, 2007.

Under the Canadian Council of Ministers of the Environment (CCME), three Canada-wide Standards (CWS) for mercury have been signed. These standards target waste dental amalgam, fluorescent lamps and emissions from incinerators. The CWS for mercury-containing lamps calls for a reduction in the average mercury content of lamps sold in Canada. From a 1990 baseline,

⁵ Because mercury is considered a naturally occurring substance, element or radionuclide, it is excluded from the Track 1 substance list requiring virtual elimination.

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the numeric target was a 70% reduction by 2005 and a total reduction of 80% by 2010. This CWS also includes a commitment for jurisdictions to assess the feasibility of recycling/recovery of lamps, and to implement initiatives to encourage these types of activities, when appropriate. As well, mercury was targeted in the recently announced Ontario Toxics Reduction Strategy in November 2008.

EPEAT includes three criteria addressing declaration, reduction and/or elimination of mercury. GEC estimates that for 2007, EPEAT purchases resulted in a reduction of almost 295 kg of mercury, equivalent to the amount of mercury needed to fill over 482,000 household fever thermometers.

A few leaders in the electronics industry have recently made commitments to phase-out mercury use in LCD displays, primarily by switching to LED backlighting. LED backlights are known to be mercury-free and very recyclable. Compared to CCFL technology, which most LCD displays use today, LED displays are much more energy-efficient. Several manufacturers have already begun selling mercury-free, LED backlit televisions, monitors and notebook products.

3.3 Other Heavy Metals

The electronics industry has been working diligently to meet the RoHS requirements for restricted substances, including the three other heavy metals, in addition to mercury; lead, cadmium, and hexavalent chromium. Lead and hexavalent chromium have been designated "toxic substances" and placed on the List of Toxic Substances in Schedule 1 of CEPA 1999. Under this listing, the government of Canada has the authority to regulate and authorize other instruments to prevent or control the use and/or release of these substances.

For substances that are designated "toxic" under CEPA 1999 and added to the *List of Toxic Substances*, Environment Canada and Health Canada must propose prevention or control instruments for managing the substance, which will reduce or eliminate risks to human health and the environment posed by its use and/or release.

Lead: CRTs can contain up to 2 to 3 kilograms of lead, and circuit boards can contain some of this metal. Exposure to lead can cause brain damage, nervous damage, blood disorders, kidney damage, and developmental damage to a foetus.

Most major manufacturers are transitioning to flat-panel displays (FPDs), which do not require the use of lead. FPDs are thin (generally less than 4 inches), lightweight video displays used in a variety of applications, including laptop computers, desktop computer monitors, televisions, and microdisplays. FPDs are predicted to replace CRTs in almost every application in North America, particularly in desktop computer monitors and television sets. By 2008, devices that contain FPDs were projected to account for nearly 85 percent of the total U.S. demand for display products; by 2013, the percentage is predicted to reach 94 percent.⁶ Worldwide, the move from CRTs to FPDs in monitors and televisions continues, with many manufacturers making commitments to no longer produce CRT televisions in many of the world's markets.⁷

⁶ King County, 2007. Literature Review Flat Panel Displays: End of Life Management Report. Prepared By: King County Solid Waste Division, Updated Report, April 24, 2008

⁷http://economictimes.indiatimes.com/News_by_Industry/Sony_to_exit_CRT_TV_business_in_India/articleshow/3843040.cms

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Lead solder was widely used by industry, prior to the RoHS directive and other regional restrictions on lead. Lead was used due to its temperature range and reliability, as well as cost, primarily in the manufacture of printed circuit board assemblies. The switch to lead-free solder has not been simple and still faces many challenges. Not only do lead solder replacements generally require higher reflow temperatures in manufacturing, thereby using more energy; there are also concerns over the reliability of solder joints and the thermal stability of electrical laminates. Other unforeseen technological challenges have also occurred, most notably with “tin whiskers” (unintended growths of tin on the surface of circuit boards that cause short circuiting). These issues are requiring changes to manufacturing processes, are introducing other exotic or potentially hazardous materials (such as silver), are using more energy, and are causing higher defect and scrap rates – all of which impact negatively on the environment. It should be noted that the environmental and technological impacts of banning one material and its potential replacements should be better understood and evaluated before being regulated. Industry continues to test “lead-free” solder alternatives.

Cadmium: This heavy metal is found in some batteries, electronic contacts and switches; persists in the environment; and accumulates in living organisms. One common usage has been in plastics, as a stabilizer or colouring agent. Over three-quarters of EPEAT-registered products meet an optional criterion indicating that these products have concentrations of cadmium less than half the threshold level defined in RoHS (note that there is an exception for cadmium attributable to recycled content).

Hexavalent chromium: This heavy metal can sometimes be found in screws, metal railings, and metal casings/frames of chassis, hard drives, optical drives and power supplies. Given RoHS restrictions, and voluntary standards such as EPEAT, much of the industry is working to eliminate hexavalent chromium from their products.

Arsenic: This heavy metal is added during the manufacturing of the high performance glass used in LCDs, to prevent the formation of defects. Several manufacturers have announced plans to eliminate the use of arsenic in their displays.

3.4 Flame Retardants

Brominated flame retardants (BFRs), which are one family of chlorinated flame retardants, are frequently used in various types of products for the purpose of fire safety. They are commonly found in enclosure casings and circuit boards in the electronics industry. Although they are quite effective as flame retardants, BFRs’ ability to persist in the environment has raised concern over their use and effect on human health. Many major manufacturers have risen to the challenge of eliminating BFRs in their products and are working to expand the availability of safe and suitable alternatives.

In addition to the two primary drivers for DfE with respect to environmentally sensitive materials, regulatory and legal requirements, customer requirements such as ecolabels and green procurement specifications, and advocacy organizations have all substantially influenced manufacturers’ moving towards eliminating halogenated materials, primarily BFRs and Polyvinyl Chloride (PVC). One notable effort is that of Greenpeace and its *Guide to Greener Electronics*⁸. The guide ranks the 18 top manufacturers of personal computers, mobile phones,

⁸ www.greenpeace.org/international/campaigns/toxics/electronics/how-the-companies-line-up

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televisions and games consoles according to their policies on toxic, recycling and climate change.

Some manufacturers have developed timelines to eliminate all use of BFRs; however, not all of these companies have publicly released roadmaps on how they plan to get there.⁹

EPEAT, EcoLogo™ and other prominent global ecolabels have incorporated criteria that specify and promote the removal of brominated flame retardants.

3.5 Polyvinyl Chloride and Chlorinated Plastics

Polyvinyl chloride (PVC) is a chlorinated plastic that it is widely used by the electronics industry, mainly as an insulator and coating for electrical cables, as well as in packaging. However, throughout its lifecycle, from the use of hazardous raw materials during the manufacturing stage through the addition of various chemical additives, such as plasticizers to make it flexible and soft, to its EOL disposal, PVC presents environmental problems and human health concerns.

Viable alternatives to PVC exist for most applications, and a number of companies have already voluntarily phased it out of a wide range of their products, with stated goals of total phase-out by 2009. Many of the voluntary ecolabels to which the electronics industry registers products require that large plastic parts are free of PVC.

3.6 The Market Context

The electronics industry's efforts to reduce the use of materials of concern come from three major forces:

1. Many of the leaders in the electronics industry have made voluntary and public commitments to restrict use of certain environmentally sensitive materials, often at the encouragement of Environmental Non Government Organizations (ENGOS).
2. Regulatory and legal requirements are directing industry's use of these substances of concern.
3. The marketplace has tools of its own emerging that enable customers to efficiently purchase greener products through use of ecolabels and green procurement specifications such as EPEAT, Blue Angel, TCO, and organization-specific schemes like Wal-Mart's Green Supply Chain and Electronics Scorecard.

There are a myriad of global regulations and legislation targeting the use of certain substances in electronics products such as:

- European Union's Restriction of Hazardous Substances (RoHS)
- European Union's Registration, Evaluation, Authorization and Restriction of Chemical Substances (REACH)
- China's Management Methods on the Prevention and Control of Pollution Caused by Electronic information Products (Chinese RoHS)
- Japan's Green Procurement Survey Standardization Initiative
- Korea's RoHS

⁹ www.cleanproduction.org/library/electronicManufacturers.pdf

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- Norway's Hazardous Substances in Consumer Products (as of December 2008, under review by Ministry of Environment)
- Canadian Chemical Management Plan
- Various U.S. state-level legislation incorporating restricted substance requirements

Although there are some commonalities between some regulations, each is unique, with varying requirements. The lack of harmonization of global regulations on restricted substances is a key concern of the industry.

The Government of Canada has chosen to take immediate action on five substance categories confirmed to be harmful to the environment and to human health in the long run, moving toward prohibiting most uses, including polybrominated diphenyl ethers (PDBEs). It will also be establishing the Virtual Elimination List under CEPA 1999, and adding the first substances to that list, which will include tetraBDE, pentaBDE and hexaBDE congeners.

Most procurement programs and tools include some kind of chemical or materials specifications or restrictions. Many reference either EPEAT, which requires RoHS compliance, or RoHS itself. In addition, ecolabels such as TCO, Blue Angel, IT Eco Declaration, Japan PC Green Label, Korean Eco-Label, and Taiwan Green Mark typically include restricted substances requirements.

3.7 Conclusions

The efforts of industry leaders to reduce and eliminate materials of concern are notable and to be commended. The electronics industry has made significant strides in moving away from use of these substances over the past two decades. This has been achieved through advancements in research and development of less toxic alternatives, as well as in response to policy mandates, and public interest in the environmental impact of electronics.

There is, however, a distinction between the leading companies and the many small- to medium-sized manufacturers and suppliers. Work still needs to be done to improve practices in smaller companies that produce little-known brands, since they have less capacity for innovation, less ability to influence their supply chain, and often less transparency with the public or regulators. Additionally, there are still many opportunities for all manufacturers to eliminate hazardous substances from electronics.

4. Environmentally Preferable Materials Selection

4.1 Context

With technical advances taking place on an ever-escalating basis, it is critical for the electronics industry to address the environmental impact throughout the entire life cycle of their products. More companies are recognizing the importance of materials selection. The goal is to design and manufacture electronics products so the resources needed to manufacture those products are minimized, the use of recycled and/or renewable materials is maximized, and new material blends and types are thoroughly evaluated for health and environmental safety prior to use.

4.2 Dematerialization

Dematerialization is key to reducing the environmental impact of the electronics industry. Simply put, dematerialization means making smaller products that provide the same or more functions as their larger ancestors. It's a way of having products deliver more functions with less material. Section 7 discusses in more detail the move to convergence of more functionality within electronic devices.

There are five main drivers for dematerialization: purchaser requirements; the increasing costs of raw materials; the increasing costs of transportation costs along the entire supply chain; the need for manufacturers to have greater control of their supply chains to ensure materials meet voluntary and regulatory requirements; and the general trend of consumer demand for miniaturization of certain products.

Manufacturers have introduced new technologies, as they become available, that allow for dematerialization of products. For example, the manufacture and sale of products in recent years has shifted from desktops to notebooks and from CRTs to FPDs. This has resulted in the dramatic decrease in material use per unit. A typical FPD uses little more than half the weight of materials in a conventional CRT screen, and requires approximately 60% less energy in use. The weight difference between desktops and notebooks is even more remarkable – typically an 80% reduction. Combined, a notebook with an additional flat screen display represents only one-third of the weight of a desktop with a CRT.

4.3 Packaging Optimization in Canada

Consumer packaging is subject to extended producer responsibility legislation in Ontario and Quebec, and stewardship and funding programs are in place in other provinces through a variety of mechanisms. Several provinces are in the process of developing EPR legislation targeting consumer packaging. Most ecolabels also address concerns with packaging, including appropriate marking, recyclability and reusable systems.

In recent years, industry has tended to use less packaging, while balancing the need to deliver the product without damage to the purchaser. Packaging engineering throughout the industry has worked to achieve the same goal along different paths. The use of moulded pulp, reduction in foams, and the move to more completely paper-based packaging solutions are some of the common trends being seen today.

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4.4 Post-Consumer Recycled Content

Post-consumer recycled content means a product is using recycled material that has been recovered from the post-consumer waste stream (as distinguished from a post-industrial or “in plant” waste stream, which has historically been recycled).

Manufacturers’ use of post-consumer materials such as plastics and papers in making new products and packaging is an example of “closing the loop.” Closing the loop ensures that demand for post-consumer content materials continues from manufacturers, to keep the collection infrastructure for post-consumer materials thriving. This in turn reduces the extraction of virgin resources, resulting in significant environmental benefits through reduced logging and drilling for oil and gas, transportation energy use – and dramatic reductions in the negative greenhouse gas impacts associated with virgin resource extraction.

Similar to the German ecolabel, Blue Angel, which includes criteria for recycled plastic content for electronic products, EPEAT contains three criteria that specifically reward use of post-consumer recycled plastic content. Plastics recyclers reported in 2008 that, due to EPEAT, the demand for their material has increased significantly. However, ensuring a high-grade, consistent, and sufficient supply of post-consumer material is challenging. In October 2008, less than 5% of EPEAT-registered products declared conformance with the optional criterion, specifying that the product contained an average post-consumer recycled plastic content of 10% or greater. And only 3% declared to another criterion specifying a minimum post-consumer recycled plastic content of 25%.

Another challenge associated with “closing the loop” for plastics in electronics products is the BFR content used in plastics for fire safety. As described in Section 3.4, BFRs are commonly found in electronics products’ enclosure casings and circuit boards. Although quite effective as flame retardants, BFRs’ ability to persist in the environment has raised concern over their use and effect on human health. Some electronics manufacturers are voluntarily phasing out use of some or all BFRs. TCO, EPEAT and other ecolabels also contain criteria rewarding restricted use of BFRs. Due to a historic and widespread use of BFRs, it can be very difficult to find a reliable source of post-consumer plastic that is free of BFRs. Consequently, there is tension between assuring products are free of BFRs and maximizing use of post-consumer recycled plastic. It is important to note, however, that the plastics recycling industry is actively working to bring to market technology that would separate BFRs from recovered, post-consumer plastic.

A final challenge associated with “closing the loop” for plastics is that the majority of plastic parts in electronics are produced in Asia, while post-consumer plastic is recovered where the consumers are – primarily in the developed world. This presents an added step of transporting the recyclate back to the point of product manufacture. Some types of plastics are re-used in the market countries in different applications, thus “closing the loop” through a different industry or product. However, as observed above, most flame retardants used in electronics are quite specific to electronics, and present health risks that complicate this common approach.

4.4 Renewable/Bio-based Materials

With the price volatility and supply of oil continuing to be of concern, along with a growing awareness of greenhouse (GHG) emissions associated with petroleum-based plastics, some manufacturers are exploring the use of renewable resources to reduce the net environmental burden in product materials use. Bio-based plastics (typically made from corn-derived

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polylactide acids or PLA) hold the promise of creating materials with the versatility of petroleum-based plastics but a lessened environmental footprint.

To date, however, bio-based plastics are not performing as well as conventional plastics in such areas as flame retardance, impact resistance, heat resistance, and mouldability. As a result, their use in products has been limited to a very small number of parts. In October 2008, there was only one product in the EPEAT Registry, out of more than 950, which declared to an optional criterion specifying that the product contains greater than 5% renewable/biobased plastic materials. In addition, most bio-based plastics are not compatible with the recycling processes used for petro plastics, which means they can actually contaminate and inhibit plastics recycling.

Finally, the optimal EOL treatment of many bio-based plastics is biodegradation in an industrial composting facility. This is not a common EOL treatment for many materials used in electronics, and requires careful identification, removal, and segregation of bio-based plastics from other materials – thus complicating an already complicated EOL treatment process.

The trend in industry at this time has been more on investigation of these technologies rather than implementation. However, some companies have implemented bio-based materials in packaging.

4.5 Nanomaterials

Nanomaterials are gaining a lot of attention for many applications. This section explains what nanomaterials are, and their potential use and impact in the electronics sector.

What it is: Nanotechnology is the process of engineering and using materials between 1 and 100 nanometers in size. It is attracting increasing attention in the electronics industry because nanomaterials perform with interesting new properties, due to their extremely small size. One nanometer is one-billionth of a meter. To get a sense of this scale, note that a human hair is 100,000 nanometers wide, while a smoke particle is 10,000 times greater than a nano-molecule.

Most electronics equipment made with nanomaterials uses carbon nanotubes, which are generally considered the basic building block of nanotechnology. Carbon nanotubes are over a nanometer in diameter but many times that size in length, and have conductivity properties like a wire or a semiconductor. As well, they are bendable, 100 times stronger than steel and 1/6th the weight, have low resistance when transporting current or heat, can emit light, and can be made from renewable sources such as corn stover or cellulose. Nanoelectromechanical systems (NEMS) are now used in electronics product manufacture to support the drive to miniaturize chips – one of the many frontiers that electronics design continues to explore to meet the Moore's Law imperative.¹⁰

The bright side: Nanotechnology has the potential to dramatically improve the performance and environmental impact of electronics equipment. Enhancing conductivity can reduce power usage; products may become stronger, lighter, and much more durable; and safer nanomaterials can be substituted for toxic materials with the same performance characteristics. As well, materials can be engineered to incredible tolerances and very detailed specifications, making EOL management easier because materials will be very well known.

¹⁰ Moore's Law: processor capacity doubles in speed about every two years. www.intel.com/technology/mooreslaw

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Issues and Concerns: Because nanotechnology is a newly emerging option in material design and specification, the environmental risks and benefits are not yet well known. Research on the impacts on human health and the environment of nanomaterials is at a very early stage. One concern is that the human health and environmental regulatory framework that has evolved in North America and Europe is based on traditional toxicity characteristics of materials. Because chemicals behave differently at the nano level, it is possible that legislations, regulations and processes such as CEPA, NPRI, ARET and CMP¹¹ in Canada (or the TRI in the EPCRA, RCRA, and CERCLA in the US¹²) will not encompass the performance of these materials throughout their life cycle. Consequently nanowastes from manufacturing or products containing nanomaterials reaching EOL will pose a human health and environmental risk in their EOL management. With hundreds of products on the market containing nanomaterials, research is needed to determine if existing EOL strategies for recycling, or even disposal, are appropriate for nanoscale wastes from electronics equipment. For example, the Toxicity Characteristic Leaching Procedure (TCLP) is widely used to determine the toxicity of materials, such as those in shredded circuit boards (which contain toxic substances such as lead, cadmium, etc.). However, it is not known if a TCLP test will accurately predict the toxicity of nanomaterials in those same shredded circuit boards.¹³

Canadian Status: In September 2007, Environment Canada issued an Advisory Note concerning notification obligations for manufacturers and importers of nanomaterials. The Advisory Note confirms that nanomaterials are subject to the same regulatory requirements as chemicals and polymers, and accordingly, manufacturers and importers of nanomaterials are required to submit a New Substances Notification package to Environment Canada prior to the manufacture in or import into Canada of new nanomaterials.

Nanomaterials manufactured in or imported into Canada that are not listed on the Domestic Substances List (DSL) are considered new substances. The nanoscale form of a substance is considered a "new" substance if it has a unique structure or molecular arrangement. Accordingly, new nanomaterials are subject to notification under the regulations.

However, nanomaterials present challenges to the current regulatory framework under CEPA 1999 due to their novel properties. The existing risk assessments used as part of current regulations governing traditional chemicals and polymers may not appropriately address these challenges.

Applications: In the electronics industry, much of the research and development of nano-level applications is occurring at the component level, with integrated circuit (IC) makers pushing for ever-smaller chips that are then purchased by brand owners for incorporation into their products.

¹¹ *Canadian Environmental Protection Act* (CEPA) provides the authority for the development of regulations and programs such as the National Pollutant Release Inventory (NPRI), the Accelerated Reduction/Elimination of Toxics (ARET), and the Chemical Management Plan (CMP)

¹² Toxics Release Inventory in the Emergency Planning and Community Right-to-Know Act, 42 USC § 116 (2005); Resource Conservation and Recovery Act; Comprehensive Environmental Response, Compensation and Liability Act (Superfund).

¹³ "Where Does the Nano Go? End-of-Life Regulation of Nanotechnologies," Linda K. Breggin and John Pendergrass, Project on Emerging Nanotechnologies, Woodrow Wilson International Center for Scholars, July 2007.

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4.6 Emerging Materials

One notable electronics industry trend is the emergence of fashion-conscious “designer electronics” targeted for the mass market. Often these products are slim and sleek, and many companies are seeing the competitive edge by making these designer items greener. These products use innovative designs and/or materials such as:

- Single external casing made of a single material such as aluminium
- User-replaceable external casings
- Ultra-compact designs
- Use of novel materials such as leather or bamboo

4.7 Conclusions

More companies are working towards designing and manufacturing electronics products to minimize resources needed for manufacturing, and to increase the use of recycled and/or renewable materials. Drivers for material selection consideration are primarily market-driven and include: voluntary procurement through tools such as EcoLogo™, TCO, Blue Angel and EPEAT; market differentiators; and economic factors. Dematerialization is a common practice in the industry, while the use of post-consumer recycled content and biobased/renewable materials remains more of a challenge.

5. Energy

5.1 The Energy Context

Energy generation, demand, use, and management are now a routine topic in design departments, boardrooms, and legislatures globally – as energy prices fluctuate (inexorably trending upwards) and access to energy sources comes into question through depletion or for geopolitical, environmental impact, or other reasons. The energy consumption of electronics products during their use continues to be an area of focus for consumers, regulators, and the industry.

There are noteworthy efforts in voluntary standards development:

- ENERGY STAR is the leading voluntary energy standard used worldwide, and is widely cited in purchasing requirements across a broad range of product categories.
- Some efforts at voluntary energy efficiency standards development are multi-year progressive standards like the Climate Savers Computing Initiative (CSCI), while others are multi-purpose efforts that include sustainability requirements as well as energy efficiency, such as EPEAT.

Utilities in energy-constrained jurisdictions are providing incentives to consumers and businesses when they purchase targeted and specific “high efficiency products” (ENERGY STAR appliances and windows). These incentives are beginning to be offered to consumers on devices such as flat panel monitors and computers.

Canada and the US work very closely on energy-related issues, as they are considered effectively the same market. For this reason, both countries typically adopt common standards such as ENERGY STAR. The Information Technology Industry Council¹⁴ (ITIC), American Electronics Association¹⁵ (AeA), American Council for an Energy Efficiency Economy¹⁶ (ACEEE) and Technology CEO Council¹⁷ (TCC) have worked together over the last two years to deliver reports identifying opportunities to drive efficiency. In 2007, the Climate Group¹⁸ released the SMART 2020 report¹⁹ on behalf of the Global e-Sustainability Initiative (GeSI)²⁰. This focused on Information and Communication Technology products’ (ICT) ability to substantially reduce overall energy consumption, far more than the use-phase energy consumption of ICT products themselves.

Reports from the Technology CEO Council²¹ and AeA (Europe Report²²) are included in most industry communications concerning energy strategy and opportunities for improvement.

¹⁴ www.itic.org/

¹⁵ www.aeanet.org/

¹⁶ www.aceee.org/

¹⁷ www.cspp.org/

¹⁸ www.theclimategroup.org/

¹⁹ www.smart2020.org/

²⁰ www.gesi.org/

²¹ “A Smarter Shade of Green,” February 6, 2008, www.techceocouncil.org/

²² “Advanced Electronics and Information Technologies: The Innovation-Led Climate Change Solution”, September 17, 2007, www.aeanet.org/AeACouncils/Energy_Efficiency_Report_Launch_17September2007.asp

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Voluntary standards are leading the way in energy management, although there has been a recent flurry in energy regulation regarding design and standby power usage.

5.2 Voluntary Standards

Many voluntary energy or energy-related standards exist in the market today. Table 3 summarizes the EPSC member companies that have adopted several of the most influential standards today. These standards are described briefly below.

Table 3: EPSC Member Companies Participation in Energy “Efficiency” Standards

EPSC Member Companies	EPEAT Member ²³	ENERGY STAR Partner ²⁴	Climate Savers Member ²⁵	80 Plus Qualified Computers ²⁶
Apple Canada Inc.	BofA*	Yes	No	No
Agilent Technologies	n/a	n/a	n/a	n/a
Brother International Canada	n/a	Yes	n/a	n/a
Canon Canada Inc.	n/a	Yes	n/a	n/a
CIARATECH	Yes	Yes	No	Yes
Dell Canada	BofA	Yes	BofD	Yes
Seiko-Epson	n/a	Yes	n/a	n/a
Hewlett-Packard (Canada) Co.	Yes	Yes	BofD	Yes
Hitachi Canada Ltd.	No	No	No	No
IBM Canada Ltd.	n/a	Yes	No	No
Lenovo Canada Inc.	Yes	Yes	BofD	No
LG Electronics Canada	Yes	Yes	No	n/a
Lexmark	n/a	Yes	n/a	n/a
Logitech	n/a	No	n/a	n/a
MDG Computers Canada Inc.	Yes	Yes	No	No
Microsoft Canada	n/a	Yes	BofD	n/a
Northern Micro Inc.	Yes	Yes	No	Yes
Panasonic Canada Inc.	Yes	Yes	No	n/a
Philips Electronics	Yes	Yes	No	n/a
Samsung Canada	Yes	Yes	No	n/a
Sharp Electronics of Canada Ltd.	n/a	Yes	n/a	n/a
Sony of Canada Ltd.	BofA	Yes	No	n/a
Sun Microsystems	No	Yes	Yes	No
Toshiba of Canada Ltd.	Yes	Yes	No	n/a

**Note: BofA means the member company sits on the Board of Advisors for EPEAT. BofD means the member company sits of the Board of Directors for Climate Savers.*

²³ <http://www.epeat.net/Companies.aspx>

²⁴ http://www.energystar.gov/index.cfm?fuseaction=estar_partner_list.showPartnerSearch

²⁵ <http://www.climatesaverscomputing.org/about/member-directory/>

²⁶ <http://www.80plus.org/manu/buy.htm>

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ENERGY STAR and Ecolabels: ENERGY STAR is a program sponsored by the United States Environmental Protection Agency (EPA) and referenced worldwide. Natural Resources Canada had been developing similar standards on energy efficiency at the same time that ENERGY STAR was being developed in the US. Canada agreed to adopt the ENERGY STAR standards to promote harmonization, and to treat the Canada and US as one large market. ENERGY STAR products feature reduced energy consumption and improved efficiency performance. It is a voluntary standard, but is generally acknowledged as the leading standard for efficiency worldwide, and is generally considered a premier brand. The ENERGY STAR label is a requirement for many worldwide ecolabels such as TCO, Blue Angel, EcoLogo™, EPEAT and CSCI.

The ENERGY STAR program recently started reviewing and updating many of its criteria for electronics equipment such as televisions, computers, external power supplies, displays, imaging (printers) and computer servers. Manufacturers assure conformity through self-declaration and occasional spot-checks by ENERGY STAR.

Climate Savers Computing Initiative: CSCI²⁷ identified power supply efficiency requirements for computer and server applications. These efficiency points were identified in multi-year progressive phases, starting with compliance with ENERGY STAR. In addition, CSCI realized that just setting the bar was insufficient. Further requirements exist within the member's framework of CSCI that require the deployment of these high efficiency power supplies, in an increasing percentage of purchases over a multi-year basis. The combination of these factors has attracted the interest of many North American utilities, such as PG&E and Hydro Quebec. CSCI maintains a list of products whose manufacturers declare that they meet the standards, but there is no program for verifying the manufacturers' claims.

80Plus: 80Plus²⁸ is a collaborative effort with the Electric Power Research Institute²⁹ and operated by ECOS Consulting, which delivers third-party validation for power supply testing. The 80Plus organizations, in partnership with CSCI, have agreed and aligned test procedures and efficiency requirements to deliver these results. Power supply test results may be viewed on the 80Plus.org web site that provides manufacturer and model number of the power supply, along with pertinent efficiency and power factor information. Many consumer and computer manufacturers are utilizing this service to access utilities and rebate programs offered to offset the cost burden of high efficiency power supplies.

The Green Grid: The Green Grid³⁰ is an example of voluntary, “best in industry” collaboration and is designed to drive improved environmental performance of the data centre environment. The focus is at the data centre-level as opposed to efficiency for servers, other components of the data centre, or individual computers. The Green Grid collaboration encompasses and networks with globally significant efforts such as:

1. European Union Data Centre Code of Conduct
2. EPA's and Data Centre and Server Energy Star Standards

²⁷ www.climatesaverscomputing.org/

²⁸ www.80plus.org/

²⁹ my.epri.com/portal/server.pt?

³⁰ www.thegreengrid.org/home

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3. DOE's Save Energy Now
4. Climate Savers Computing Initiative

Green Grid's member groups and committees exist within North America, Europe and Asia. This activity places the Green Grid at the centre of data centre efficiency and metrics, establishing it as a significant force for energy efficiency and conservation.

5.3 Regulatory Standards

Energy-using Products Directive (EuP)

The Energy Using Products Directive, or the Ecodesign Requirements for Energy Using Product 2005/32/EC (EuP), is a European Union Directive aimed at integrating environmental aspects, specifically energy efficiency, into product design. The first of many implementing measures within the EuP, it establishes requirements for standby and/or off mode electric power consumption.

This directive specifically impacts electronics consumer and business equipment, including computers, displays, projectors, printers, and products with external power supplies (such as cell phones, PDA and MP3 players). Targets established for implementation are July 2010 at 1 Watt, and July 2013 at 0.5 watts. EMC Class A (servers and storage equipment) equipment is excluded from this directive. Compliance is through self-declaration, with conformity assured through issuance of the CE mark. Although based in Europe, the EuP Directive will have an impact on products designed, manufactured, imported and sold in Canada.

Standby Regulations

Canadian: Natural Resources Canada's (NRCan's) Office of Energy Efficiency (OEE) is proposing to amend Canada's *Energy Efficiency Regulations* to prescribe certain products that use Standby Power as energy-using products, and to establish minimum energy performance standards for them. In particular the amendment will affect the following products:

- Compact Audio Products;
- Televisions;
- Video Playing/Recording Products;
- Computer Printers and
- Multi-Function Devices.

The regulations apply to products imported or shipped inter-provincially for sale or lease in Canada. NRCan are holding consultations on the proposed amendment in January, 2009 prior to publishing the proposed amendment wording in the *Canada Gazette*, Part 1.

Standby power is defined in the consultation document as the lowest level of electricity consumed by appliances which cannot be switched off (influenced) by the user and may persist for an indefinite time when an appliance is connected to the main electricity supply.

The State of California currently has an Appliance Efficiency Regulation which includes standby power limits for three consumer audio and video equipment categories (compact audio products, televisions and DVD players and recorders) and several other states plan to follow the California

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regulations. Canada is proposing an initial standard, effective in 2009, that will meet the current California limits for these products. The standards will be strengthened to a 1watt target in 2011.

A two-staged implementation is proposed for computer printers and multifunction devices with an eventual standard that is equivalent to the current ENERGY STAR criteria for these products by 2011.

Table 4: Proposed Tier 1 and Tier 2 Stand-by Power Limits

Product Type	Tier 1 (2009) Stand By Power Standard	Tier 2 (2011) Stand By Power Standard
Compact Audio Products	2W	1W
Televisions	4W	1W
Video Products	3W	1W
Printers (Small and Standard Size Format)	2W	1W
Multi-Function Devices	4W	2W

NRCAn is proposing that the Tier 1 and Tier 2 energy efficiency performance standards for standby power apply to products manufactured after June 1st, 2009 and 1st June, 2011 respectively.

The regulations are expected to take effect in late 2009, after publishing in the Canada Gazette, Part 2. NRCAn is not proposing mandatory EnerGuide labelling requirements. Dealers/importers would be required to report to NRCAn verifying that the standby power requirements have been met prior to importing a product to Canada, or trading a product inter-provincially.

Worldwide: The definition of “Standby” in the International Standards IEC 62301 is now under consideration, and the committee draft proposed in November 2007 defines “standby mode” separately from “network-connected standby mode(s).” A significant shift is in process – countries that had voluntary standby limits are moving to mandatory requirements in legislation or regulation. Table 4 shows countries that have or will have standby regulations in force. Additionally, standby regulations are proposed for China, Brazil, Switzerland and Argentina.

Table 5: Standby Regulations in Force by Country Today

Country	Year Enacted/In Force	Product Categories
Australia/New Zealand	2002/2010	Consumer Electronics, External Power Supply EPS
California	2004/2007	Consumer Electronics, EPS
Europe	2005/2010	Consumer Electronics, EPS
Japan	1998/1998	TV & Consumer Electronics
Korea	2005/2009	Consumer Electronics, EPS

United States	2007/2008	EPS
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5.4 Embodied Energy

There appears to be growing interest in evaluating the amount of energy – often referred to as “embodied energy” – and other resources used in the manufacture of electronics products. Preliminary research suggests that perhaps 80% of the environmental impact (including energy consumption) of many electronics products occurs during their manufacture, rather than during their use. This is in stark contrast to earlier estimates, which were closer to 20%.

This perspective on energy associated with ICT seems to have escaped the notice of analysts focusing on energy use, probably for two main reasons. First, it is very difficult to quantify, and second, it appears on analyses of energy consumption as the consumption of “industry”, and is not associated with electronics products per se. It seems likely that this perspective will gain traction in the near future because it implies very different priorities when trying to reduce the environmental impacts of electronics. Although there is little hard research available at this point, embodied energy is likely to be a topic of increasing interest in 2009 and beyond.

5.5 Conclusions

Industry has been and continues to be a partner in the development of ENERGY STAR and other voluntary energy-management programs. These engagements will only increase over the next few years as EPEAT and ENERGY STAR expand into more product sets and more restrictive management levels for off, standby and use-phase energy.

The next challenge for the electronics industry will be to identify more than off or standby mode power limits. The evolution will be identifying true product efficiency, which could be represented as “Useful Work Performed divided by Energy Consumed.” The tools required for developing this important metric are already in development as part of the benchmarks for computers. ENERGY STAR, along with the industry, is reviewing the EEcoMark and SPECpower tools for defining computer and computer server efficiency. Once these tools are available, defining computer efficiency will be possible. By developing them, other benchmark tools may become available to define product efficiency for consumer devices such as televisions, displays and printers.

Finally, the embodied energy of electronics will likely become a topic of research and conversation in 2009.

6. Designing for End-of-Life (DfEOL)

6.1 Context

In a world of rapidly changing consumer and industrial information technology and communications products, the concept of designing products to be “better for the environment” is a relatively new one. While what it means for a product to be environmentally friendly is a broad and complex discussion, this section focuses on making products that will not have adverse effects on the environment as they reach the end of their useful life. “End of life” (EOL) of an electronics device is generally defined as the point when the original user can no longer use it. It does not mean the product is broken.

At an electronics product’s EOL, several things can happen. In decreasing order of environmental preferability, the product can be:

- Reused by a second user
- Refurbished and upgraded (and then donated or resold)
- Dismantled for selective component re-use
- Recycled for recovery of materials
- Disposed in a landfill or incinerator (legally or illegally)

Environment Canada estimated the amount of e-waste disposed in Canada in 2005 to be 67,324 tonnes³¹. Since that time, a number of provincial EPR programs have diverted substantial amounts of e-waste from disposal to recycling. A description of these EPR programs is provided in Appendix B, Electronic Stewardship Programs in Canada.

Most EPSC member companies include some level of DfE principles in their design criteria. These principles include the items discussed in earlier sections (reduced use of environmentally sensitive chemicals, selecting materials for positive EOL management and environmental impacts, and design for energy efficiency), as well as principles centred on maximizing EOL environmental outcomes of electronics products.

EcoLogo™ has begun to address DfEOL in its certification program for electronics products. In 2007, the EcoLogo™ program released a final draft certification criteria document pertaining to notebooks and desktop computers. The document featured environmental and performance criteria that explicitly addressed design for recycling:

- Modular construction for components
- Inclusion of replacement/disassembly instructions
- Easy disassembly
- Identification of items with special handling needs
- Labelling of plastic parts; plastic parts greater than 25 g are one type of polymer
- Stipulations on manufacturer takeback programs, to ensure responsible reuse and recycling.³²

³¹ Source Environment Canada website at www.ec.gc.ca/nopp/docs/rpt/itwaste/EN/summary.cfm

³² www.greenercomputing.com/resources/resource/canadian-environmental-choice-program-computers-ecologo-certification and www.ecologo.org/en/certifiedgreenproducts/

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The final draft document was circulated for comments to different stakeholder groups in August 2007. However, it was never finalized – largely because of the then-recent success of EPEAT addressing the same product types and the industry’s desire for harmonized standards. Currently, the EcoLogo™ program has criteria for printers (laser and ink jet), facsimile machines and photocopiers.

The electronics industry has made progress in recent years in several aspects of designing products to be more easily managed at end-of-life. These include use of single-piece external cases that are easily removable, and compliance with a number of voluntary ecolabels (detailed below) that mandate, among other things, fewer different plastic types, avoidance of adhesives or welds, and the use of snap-fit fasteners.

A number of procurement tools, policies, and manufacture initiatives globally are driving better DfEOL of electronics. These include:

- Voluntary Procurement tools
 - The EcoLogo™ ecolabel originated by Environment Canada, features environmental criteria for printers (laser and ink jet), facsimile machines and photocopiers that include design for recycling and reuse.
 - EPEAT requires a number of specific criteria for which brand owners can get credit for designing products that are more easily recyclable and easy to disassemble. EPEAT’s DfEOL criteria are the largest of its eight performance categories. 26% of the required and 19% of the optional criteria relate to DfEOL
 - Wal-Mart’s recent announcement that, starting January 2009, it would require manufacturers supplying its goods to follow stricter environmental standards.³³
- Policy initiatives
 - Provincial producer responsibility legislation requires reporting on DfE progress. It has been built into the regulations and program plans of three provinces involved in electronic stewardship: Ontario, British Columbia and Nova Scotia. Details of the requirements are provided in Appendix C, Design for the Environment Requirements in Canadian Electronic Stewardship Programs.
 - The EU was drafting updates to its 2006 Battery Directive in 2008, requiring that electrical equipment be designed to allow batteries to be “readily removed” for replacement or removal at EOL. In addition, it will require producers to provide details on safe battery removal.³⁴ This is likely to reduce the disposal of small electronics devices with hard-to-remove batteries.

³³ “Wal-Mart announces new ethical and environmental principles,” Stephanie Rosenbloom, International Herald Tribune, October 22, 2008. www.iht.com

³⁴ “New EU directive pushes toward replaceable iPhone batteries,” Prince McLean, October 7, 2008. www.appleinsider.com/articles/08/10/06/new_eu_directive_pushes_toward_replaceable_iphone_batteries.html

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- Indirect drivers
 - Local landfill bans by jurisdictions throughout Canada (such as the province of Nova Scotia and Metro Vancouver) and worldwide, necessitates a flow of scrap electronics into reuse and recycling markets³⁵.
 - In Europe, the enactment of the Waste Electrical and Electronic Equipment (WEEE) Directive³⁶ in 2003 mandated brand owners and manufacturers to recycle electronics in EU countries. This forced the development of recycling strategies by brand owners who may have never previously considered recycling their products.
 - Through early Fall 2008, a thriving global industrial growth created strong market demand for secondary metals that can be extracted more easily from a ton of scrap circuit boards than from a ton of dirt or rock. Similarly, worldwide demand for scrap plastics created a strong market for this material. The recent economic downturn in late 2008 will result in a softening of all these markets for an unknown period of time.

Laws protecting private information in the health care, banking, education, and other sectors mean this data must be destroyed on the storage media when electronics reach end-of-life. This will drive the growth of both refurbishment, with data wiping, and increased recycling of destroyed data storage media such as hard drives.

At the September 2008 Sustainability Summit of the International Electronics Manufacturing Initiative (iNEMI), a prominent global industry group, electronics manufacturers' representatives identified four key needs in the areas of reuse and recycling of components: ease of disassembly, identification, cross-compatibility, and a lifetime indicator. For better materials reclamation from the e-waste stream that design could influence, iNEMI saw needs for cross-industry collaboration and for self-regulation on a common group of plastics, noting that only a few are dominant (such as ABS, PC and epoxy). This group is convening a number of industry-led symposia on all aspects of sustainability.³⁷

6.2 Conclusions

Although there are many drivers aiding in DfEOL, there are still challenges. Industry groups, national-level agencies and authorities in North America and Europe, along with key trade associations and various NGOs, are all working to create solutions that will break down the barriers to designing products with more efficient EOL management. Strategies for breaking down these barriers are many, and include changes in governmental policies, purchasing mechanisms, voluntary collaborative industry work groups, and continued research into all aspects of increasing EOL design.

³⁵ Many Canadian jurisdictions have placed bans on electronic equipment at the landfill or from being picked up at the curb including: Metro Vancouver, the Province of Nova Scotia and the Region of Waterloo, Ontario which, among others, has banned electronic waste including personal computers, printers and televisions from landfill; and the City of Toronto, which refuses to pick up waste electronics at the curb as part of its garbage collection service.

³⁶ Directive 2002/96/C of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment.

³⁷ www.nemi.org/cms; personal communication with iNEMI participants, Fall 2008.

7. Product Design – Convergence, Expandability, New Devices

7.1 Market Context

Due to rapid changes in technology and the ever-growing demand by consumers for devices that offer ease of use and portability for today's lifestyles, devices' ability to communicate with each other has become an important feature. Additionally, devices that perform more than one function or allow users to perform activities that were once impossible are becoming more and more desirable.

The idea of expandability and connectivity is not new. For example, expandability for electronics products has been around many years, through the use of wired connections for external devices. What is new are a series of standards for both wired and wireless connectivity that the industry is adopting. These include Universal Serial Bus (USB) and Bluetooth. Voluntary standards and efforts such as Blue Angel, EPEAT and the Digital Living Network Alliance (DLNA) all promote the use of connectivity and expandability technologies.

Device convergence has also been around for several years, most notably in the imaging sector where multifunctional imaging equipment is common, combining printing, scanning, faxing and copying as well as the ability to create photographic quality "photo prints." Now, however, there are a wide variety of new, "essential" devices that provide multiple functionality. For example, smart phones provide email, web surfing, cameras, texting and phone capabilities. Some portable music players and gaming players, in addition to their main functionality, can play movies and connect to the Internet.

To date, the main driver for connectivity, expandability and the convergence of devices has been consumer demand. In addition, changes in technology have made new types of products more feasible and cost effective to produce, and therefore for customers to purchase. Environmentally, the desired impact is for better-connected devices with fewer wires and more compatibility, resulting in less obsolescence. The convergence of functions reduces both the resources and energy for production, transportation, energy consumption during use, and the EOL impacts – as a single device may now do the tasks that once took multiple devices.

7.2 Expanding Connectivity Options and Standards

Several industry-created standards already exist that directly or indirectly promote connectivity and product expandability. Additionally, there are opportunities for industry to be involved in the development of these standards. Table 5 shows four standards along with EPSC companies and their participation levels. Though these standards may not apply to each member company, due to the product sets of the standard, 100% of EPSC member companies are still involved in some way, either meeting the standard for their products via EPEAT or engaging in or using other standards, such as Bluetooth.

Table 6: EPSC Member Companies Participation in “Expandability and Connectivity” Standards

EPSC Member Companies	EPEAT Registered ³⁸	Bluetooth SIG level ³⁹	USB IF member ⁴⁰	DLNA Member Level ⁴¹
Apple Canada Inc.	Yes	Associate	Yes	No
Agilent Technologies	n/a	Associate	Yes	n/a
Brother International Canada	n/a	Adopter	Yes	Contributor
Canon Canada Inc.	n/a	Associate	Yes	Contributor
CIARATECH	Yes	None	No	No
Dell Canada	Yes	Adopter	Yes	Contributor
Seiko-Epson	n/a	Associate	Yes	Contributor
Hewlett-Packard (Canada) Co.	Yes	Associate	Yes	Promoter
Hitachi Canada Ltd.	No	Adopter	Yes	Contributor
IBM Canada Ltd.	n/a	Associate	No	Promoter
Lenovo Canada Inc.	Yes	Promoter	Yes	Promoter
LG Electronics Canada	Yes	Associate	Yes	Promoter
Lexmark	n/a	Adopter	Yes	No
Logitech	n/a	Associate	Yes	No
MDG Computers Canada Inc.	Yes	None	No	No
Microsoft Canada	n/a	Promoter	Yes	Promoter
Northern Micro Inc.	Yes	None	No	No
Panasonic Canada Inc.	Yes	Associate	Yes	Promoter
Philips Electronics	Yes	Adopter	Yes	Promoter
Samsung Canada	Yes	Associate	Yes	Promoter
Sharp Electronics of Canada Ltd.	n/a	Associate	Yes	Promoter
Sony of Canada Ltd.	Yes	Associate	Yes	Promoter
Sun Microsystems	No	Adopter	Yes	n/a
Toshiba of Canada Ltd.	Yes	Promoter	Yes	Promoter

Expandability and its effect on DfE comes from voluntary efforts like EPEAT and the DLNA, which promote design characteristics to extend the life of products, or make them more compatible for consumers. For example, EPEAT has a mandatory requirement that registered products must be upgradeable, and specifically identifies USB as one way to meet this requirement. The DLNA promotes the interconnectivity of digital devices on a home network to make the sharing of digital media easier for consumers. It allows for the use of Bluetooth technologies, as part of the whole system, to provide this functionality. As both EPEAT and the DLNA have garnered much support from industry, the requirements of these voluntary efforts

³⁸ <http://www.epeat.net>

³⁹ <http://www.bluetooth.com/Bluetooth/SIG/Membership/>

⁴⁰ https://www.usb.org/members_landing/directory?complex_search_companies=1

⁴¹ http://www.dlna.org/about_us/roster/

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are changing how products are designed and their impact on the environment. For additional details, see Appendix D, Product Expandability Standards – Bluetooth, USB and DLNA.

7.3 Functional Convergence of Devices

A key trend in electronics product design over the past ten years has been the convergence of multiple functions or new function into a single product. This functional convergence has been made possible by many factors, not the least of which is the overall environmental improvements gained through energy use and resource reductions. Examples of new classes of products that now exist due to functional convergence include, but are not limited to:

- Multifunction imaging devices that print, copy, scan and fax documents
- Media or Entertainment PCs that combine the functions of a computer, DVR, and an HDTV
- Smart phones that combine phone functionality with Internet access - some also offer the functions of cameras, game players, portable video and/or music players
- Gaming systems that combine gaming with optical drives to play movies, have hard drives and Internet access that allows them to have some of the functionality of traditional computers

7.4 Future Trends

Electronic Paper/Digital Books: One of the more interesting technologies that is beginning to come to the market is a replacement for traditional digital displays. Sometimes called Digital Paper or Electronic Paper, the early generation of these displays is currently sold in book reader products from several different manufacturers.

This display technology replaces traditional LCD displays. It is more lightweight than the standard digital display, with a much higher resolution and viewing angle so that it more closely emulates the act of reading from paper.

Environmentally, it requires both less energy to manufacture and to run. It also has the potential to reduce both paper use and waste paper, as it is possible to print many images to an electronic paper display.

Current digital book readers are also providing a convergence of functionality for the user. Besides displaying books or even magazine and newspaper subscriptions, which obviates the need for printed material, these devices may also have the ability to play MP3 files or view PDF documents, and some provide limited connectivity to the Internet. As the design of future generations of these devices evolves, it is likely the line between a digital book reader and a notebook computer will disappear.

Ultraportable Notebooks and Netbooks: With increasing consumer demand for more mobile electronics device functionality, two very similar “new” classes of notebook computers have grown in popularity over the past two years. Ultraportable notebooks and their even smaller kin, netbooks, provide mobile computing in smaller forms, although with some limitations in functionality versus traditionally notebooks. Screen size is limited (generally under 10 inches for a netbook, slightly larger for the ultraportable), both devices are designed for power conservation and longer battery life, and the component parts (CPU, hard drive, memory) are chosen to optimize energy use rather than computing power. As technology progresses, however, it is likely energy optimization will still be possible, while providing more and more computing

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power. Designed for the highly mobile user, these PCs may not have optical drives and likely contain solid-state hard drives that allow for more durability.

Virtualization/Cloud Computing/Web Computing: Virtualization is the ability for one server to run multiple applications that previously needed dedicated servers. Thus, each application program has its own “virtual” server, but not its own physical server. Web and Cloud Computing refer to the increasing trend for applications and data to reside in a central location (a data centre) and to run from any computer over the web.

The technology industry is in the early stages of a big shift – one that will transform how we access information, share content and communicate. A new model of computing will drive this next wave. Instead of installing packaged software applications on their computers, people and businesses will use their web browsers to access a wide range of 'cloud services' available on-demand over the Internet.

The ability to distribute computing across data centres should facilitate more efficient use of existing data centres and reduce the need for more data centres to be built by organizations that embrace virtualization.

Ultraportable notebooks, smart phones, the greater adoption of thin-client systems that have the primary function of connecting to the web, and Cloud Computing centres will all be a growth area for the industry. The move to this type of interface, through a central computing location, will provide additional environmental benefits in dematerialization and energy use.

7.5 Conclusions

In the area of product expandability, there are several drivers today. Technology standards for connectivity such as Wi-Fi, WiMax, wireless WAN standards like 3G, USB and Bluetooth have been developed, widely adopted and supported by the electronics industry. Consumer demands for ease and connectivity is promoted and adopted by industry through the DLNA and similar organizations.

There has been an accelerating move over the past ten years to create products that are easier to use, with multiple functionalities. Printers, televisions, PCs and cell phones now have abilities far beyond the original vision when they were first introduced to the market. And industry continues to improve these devices, making them smaller, faster, more energy efficient and with a longer life, in addition to incorporating more features.

New technologies and ways to provide more functionality choices to consumers and business are always under consideration by the electronics industry. Current research on new technologies encompasses all aspects of environmental improvement, for both the end-user and the manufacturer.

The combination of technological improvements and developments, coupled with the consumer desire for more portable, smaller, faster and more interconnected devices, is having a net positive effect on DfE. Fewer resources are consumed in the manufacture of these devices, they use less energy and – because they are designed to industry-accepted standards (such as EPEAT and DLNA) – these devices work together and are upgradeable, promoting a longer useful product life.

Appendix 10: Ontario-Specific Compliance Requirements



In addition to meeting the applicable OES Standards established for each participating organization, OES requires verification of organizational compliance with, but not limited to, the applicable Ontario-specific requirements in the following laws:*

- Environmental Protection Act, 1990 (including R.R.O. 1990, Regulation 347, General – Waste Management)
- Employment Standards Act, 2000
- Occupational Health and Safety Act, 1990
- Workplace Safety and Insurance Act, 1997
- Municipal zoning by-laws or other by-laws such as parking or hours of operations.

If Applicable

- Provincial Dangerous Goods Transportation Act (R.S.O. 1990, c. D.1)
- Hazardous Waste Information Network (HWIN): Current registration and compliance status.

*Participating facilities located outside of Ontario must document and demonstrate that they have operational practices and policies which are comparable in scope and intent to the OES reuse and recycling standards set out in Appendices 9a and 10a, as well as any other Ontario-specific compliance requirements which apply to Ontario-based facilities. Acceptable documentation and demonstration of comparable compliance requirements must be confirmed through an assessment performed by a qualified auditor familiar with Ontario-specific requirements.

Appendix 11: WEEE Discard Model Assumptions

Table A-1 details the seven assumptions that were used in the WEEE Discard Model, as described below:

- Weight (kg/unit)
- Age at first life of product
- Percentage of products that have are reused in a second life
- Percentage of products that have are stored in a second life
- Percentage of products that are discarded
- Age at end of life
- Years in storage

Table A-1: WEEE Discard Model Assumptions

	kg/ unit	Age at First Life	% to Second Life Reuse	% to Second Life Storage	% to Discard	Age at End of Life	Years in Storage
Monitors	7.7	5.0	0.40	0.10	0.50	8.0	3
TV < 18"	6.0	7.5	0.70	0.15	0.15	10.5	3
TV ≥18"-29"	21.0	7.5	0.70	0.15	0.15	10.5	3
TV >29"-45"	35.0	7.5	0.70	0.15	0.15	10.5	3
TV >45"	45.0	7.5	0.70	0.15	0.15	10.5	3
Desktop Computers	7.4	6.5	0.40	0.10	0.50	9.5	3
Portable Computers	2.9	2.0	0.40	0.10	0.50	5.0	3
Computer peripherals	1.1	5.2	0.40	0.10	0.50	8.2	3
Modem and networking devices	0.5	1.5	0.40	0.50	0.10	3.0	3
Hard drive – DAS	0.5	1.5	0.40	0.50	0.10	3.0	3
Desktop Printers	9.4	3.5	0.40	0.50	0.10	6.5	3
Electric typewriter	5.0	4.0	0.40	0.50	0.10	5.5	3
Laser printers	6.2	4.0	0.40	0.50	0.10	5.5	3
Ink-Jet/Dot Matrix	6.2	4.0	0.40	0.50	0.10	5.5	3
Handheld printers	2.5	4.0	0.40	0.50	0.10	5.5	3
Fax Machine	7.0	4.0	0.40	0.50	0.10	5.5	3
Floor-standing printers	50.0	4.0	0.40	0.50	0.10	5.5	3
Desktop or portable scanner	5.1	4.0	0.40	0.50	0.10	5.5	3
Desktop Multifunction Device	10.2	4.0	0.40	0.50	0.10	5.5	3
Floor-standing photocopiers	100.0	4.0	0.40	0.50	0.10	5.5	3
Telephones (Wire line)	1.0	7.0	0.40	0.50	0.10	8.5	3
Telephones (Cordless)	1.1	3.0	0.40	0.50	0.10	4.5	3
Telephone Answering Machines	1.5	6.0	0.40	0.50	0.10	7.5	3
Personal Digital Assistant, Pagers	0.2	1.5	0.40	0.50	0.10	3.0	3
Cellular Phones	0.2	1.5	0.40	0.50	0.10	3.0	3
Converged Mobile Devices	0.2	1.5	0.40	0.50	0.10	3.0	3
Digital Cameras	0.3	3.0	0.40	0.50	0.10	4.5	3
MP3 Players	0.2	1.5	0.40	0.50	0.10	3.0	3

	kg/ unit	Age at First Life	% to Second Life Reuse	% to Second Life Storage	% to Discard	Age at End of Life	Years in Storage
Solid state voice recorders	0.1	1.5	0.40	0.50	0.10	3.0	3
Video Cameras/ Camcorders	2.5	6.0	0.40	0.50	0.10	7.5	3
Speakers - Docking Speakers	2.3	1.5	0.40	0.50	0.10	3.0	3
Audio Player (tape) Portable Stereo	3.1	4.0	0.40	0.50	0.10	5.5	3
Audio Player - Personal CD Player	0.4	4.0	0.40	0.50	0.10	5.5	3
Audio Player - CD Player single/multi	4.8	7.0	0.40	0.50	0.10	8.5	3
Audio recorder/ Portable Tape/ Radio players	0.5	4.0	0.40	0.50	0.10	5.5	3
Speakers - Home Theater	22.9	7.0	0.40	0.50	0.10	8.5	3
Speakers - Home Speakers	22.9	7.0	0.40	0.50	0.10	8.5	3
Data Projectors	14.4	7.0	0.40	0.50	0.10	8.5	3
Speakers - Multimedia	2.4	7.0	0.40	0.50	0.10	8.5	3
Clock Radios	6.0	4.0	0.40	0.50	0.10	5.5	3
Amplifiers/Receivers	2.3	4.0	0.40	0.50	0.10	5.5	3
VCRs, DVD and HD-DVD Players	2.3	7.0	0.40	0.50	0.10	8.5	3
Aftermarket Vehicle	2.3	7.0	0.40	0.50	0.10	8.5	3
Home Theatre Systems	22.9	7.0	0.40	0.50	0.10	8.5	3