

BC Major Appliance Stewardship Plan

Submitted to the BC Ministry of Environment
by:

Association of Home Appliance Manufacturers Canada
(AHAM Canada)
&
Retail Council of Canada
(RCC)

December 22, 2011

Revised: June 29, 2012

Table of Contents

1. Introduction	3
2. Program Plan Sponsors	4
3. Products Included in the Plan	5
4. Key Marketplace Statistics	6
4.1. Annual Sales of Major Appliances in BC	6
4.2. Estimates of Units Entering End-of-Life	7
4.3. Material Composition of Major Appliances	9
5. The Existing Market Driven Recycling System	12
5.1. Overview	12
5.2. Collection Process	14
5.2.1. Collectors	14
5.2.2. Scrap Metal Brokers/Consolidators	19
5.2.3. Processors	20
5.2.4. End Markets	21
5.3. End-of-Life Major Appliances Recycling Practices	21
5.3.1. Overview	21
5.3.2. Pre-Processing Practices	22
5.3.3. Processing Practices	25
5.4. Market Driven System Flow Diagram	27
5.5. System Performance	27
6. Program Plan – Supplement the Existing Market-Driven System	28
6.1. Introduction – Supplement versus Replacement	28
6.2. Program Plan Framework	29
6.3. Enhanced Producer Oversight and Accountability	30
6.4. The Major Appliances Processing Standard	31
6.4.1. Support for the Processing Standard	32
6.4.2. Ensuring Proper Refrigerant Extraction	33
6.5. System Best Practices & Recycling Research Program	34
6.6. System Monitoring & Performance Reporting	35
6.7. Pollution Prevention Hierarchy & Design for the Environment	35
6.8. Promotion & Education	38
6.9. Program Administration & Funding	39
6.10. Ensuring Compliance	40
6.11. Dispute Resolution	41
7. Measurement of Program Performance	41
7.1. Recovery & Diversion Rates	41
7.2. Annual Report	43
8. Stakeholder Consultations	43

1. Introduction

The BC Recycling Regulation (B.C. Reg. 449/2004 – the “Regulation”) under the *Environmental Management Act* requires that as of July 2012 every “Producer¹” (as that term is defined in the regulation) of major household appliances that wishes to sell, offer for sale or distribute their products in British Columbia must operate, or be a member of, an approved plan concerning the end-of-life management of their products. The Regulation further stipulates that Producers wishing to receive BC Ministry of Environment approval for such a plan must submit their plan to the Ministry on or before October 1, 2011.

This proposed stewardship plan (the “Proposed Plan”) for major household appliances in BC has been developed by the Association of Home Appliance Manufacturers Canada (AHAM Canada) and the Retail Council of Canada (RCC) in consultation with retailers and manufacturers in the major appliances sector. AHAM Canada and RCC have developed the Proposed Plan pursuant to the requirements of the Regulation and following plan approval intend to establish a Stewardship Agency (as that term is defined in the Regulation) to carry out the duties under the Regulation of those Producers who elect to appoint it as their agent. The Proposed Plan has been structured so as to enable a July 1, 2012 program commencement as required by the Regulation.

As required by the Regulation the Proposed Plan will be submitted for public and stakeholder consultation during November 2011.

The Proposed Plan is unique in that it deals with a product category that is much different than virtually all other product categories included under the Regulation to date. The major household appliances category is unique in that a long-standing and highly effective market-driven recycling system already exists for end-of-life (EoL) product. This market-driven system exists largely because EoL major household appliances, unlike most other EoL electronic or electrical equipment, actually have a positive financial value at end-of-life. More simply put, EoL major appliances can actually be recycled at a profit without the need for subsidies or incentives.

This positive financial value characteristic, which is primarily driven by the metals value in the products, has given rise to a diverse market-driven collection and recycling system comprised of appliance retailers and their contracted service providers, scrap metal dealers, municipalities, metal recyclers and steel mills. This system has operated for decades and has proven itself to be flexible and adaptable to changing market conditions as well as highly effective in terms of its collection and diversion performance.

¹ The BC Recycling Regulation Guide defines Producers as:

“... the product producer is principally the first-seller of the product in the province. In practice the producer is typically the product manufacturer, distributor or brand-owner. The producer could also be an importer, broker or retailer who sells the product directly to a consumer.”

The major appliance stewardship plan outlined in this document proposes to build on and support this market-driven system rather than supplant and replace it with a traditional stewardship program model wherein all aspects of EoL product collection, transportation and processing are controlled and managed by a single stewardship agency. The imposition of a traditional stewardship model on the pre-existing market-driven system has the potential to cause economic dislocation for businesses operating in that system, confusion for consumers, and reduced environmental performance. In the view of AHAM Canada, RCC and their member companies, building upon the market-driven system and the existing economic players within that system is the most responsible, economically efficient and environmentally prudent approach to maintaining and enhancing the already impressive performance of major appliances recycling in BC.

2. The Program Plan Sponsors

As noted earlier, this Proposed Plan has been developed by AHAM Canada, RCC and their member companies in the major appliances sector.

AHAM Canada is an industry association representing appliance manufacturers in major, portable and floor care appliance categories. AHAM Canada serves as the industry voice in Canada on all legislative, regulatory and public policy matters affecting its member companies. AHAM Canada's members include the manufacturers of all the well-known brands of major, portable and floor care appliances.

RCC is a national not-for-profit industry association representing more than 43,000 store fronts of all retail formats across Canada including department, specialty, discount, independent stores, and on-line merchants. RCC serves as an advocate of retailing in Canada and works with all levels of government and other stakeholders to support employment growth and career opportunities in retail, to promote and sustain retail investments in communities from coast to coast, and to enhance consumer choice and competitiveness. RCC also provides its members with a full range of services and programs including education and training, benchmarking and best practices, networking, advocacy, and industry information.

While AHAM Canada and RCC have been the lead proponents in the development of this plan, that work has been informed by consultation with other stakeholders in the existing market-driven recycling system including municipalities and recyclers.

Following plan approval, AHAM Canada and RCC will either establish a new stewardship agency or secure the agreement of an existing stewardship agency to assume responsibility for implementing and operating the approved plan on behalf of Producers of major household appliances who elect to appoint the stewardship agency as their agent.

Governance and oversight of the approved plan will be conducted by a Board of Directors tentatively known as the Major Appliances Recycling Program Roundtable (the “Roundtable”). The Roundtable will be comprised of manufacturers, distributors/importers or retailers in the BC major household appliances category who meet the definition of Producer under the Regulation. As municipal governments play an important role in the collection, and in some cases the pre-processing of major appliances, this plan proposes to include municipal representation within the Roundtable structure through a municipal advisory committee.

3. Products Included in the Plan

The Proposed Plan is intended to cover, as specified, *major household appliances* powered either by 120 volt or 240 volt input power or gas (i.e., natural gas or propane) that have been *designed for use in residential homes* and related products as described in greater detail below. More specifically, albeit recognizing this list may need to be adjusted before program launch, the Proposed Plan is intended to cover the following:

Refrigeration Appliances: Includes standard household refrigerators without a freezer unit, standard refrigerators with a freezer unit (top mount, bottom mount or side by side), chest freezers, upright freezers and under cabinet refrigerators, wine coolers, beverage centres, electric water dispensers, and ice makers;

Laundry Appliances: Includes both front load and top load clothes washers, clothes dryers whether powered by electricity or gas, and combination clothes washers and dryers;

Cooking Appliances: Includes gas or electric ovens (stand alone and built in), ranges with gas or electric cook tops, warming drawers, built in cook tops, over-the-range microwave ovens with or without hood vent combinations, microwaves and combination microwave-convection units built into kitchen cabinetry, and ventilating range hoods;

Dishwashers: Includes free standing or built in electric powered dishwashers;

Room/Portable Air Conditioners: Includes self contained air conditioners where in the evaporator, condenser, fan and temperature controls are contained in a single unit that can be plugged into a residential electrical outlet;

Dehumidifiers: Includes free-standing dehumidifiers that are not mounted on or installed in the heating and ventilation system of household and that use refrigeration to extract moisture from the air;

Food Waste Disposers: Includes electrically powered devices attached to a drain that mechanically crush food waste and discharge it into a household drain;

Trash Compactors: Include electrically powered devices that compress household waste for subsequent disposal.

Hot water heaters and appliances designed for industrial or commercial purposes are manufactured by a different set of manufacturers than those represented by AHAM Canada, are distributed through different distribution channels than the retailers represented by RCC, and are recycled/disposed of in a different end of life system. As a result, this Proposed Plan has not been designed to address those products and they are outside its scope. However, major household appliances sold to industrial and commercial customers that have the same essential design as household appliances will be included in the Proposed Plan.

The Proposed Plan covers both products clearly attributable to an existing Producer as well as orphaned products (i.e., those products that are no longer in production and where the Producer is no longer in business).

4. Key Marketplace Statistics²

4.1 Annual Sales of Major Appliances in BC

From 2000 to the onset of the economic recession in 2008 growth rates for major appliance shipments had been consistent averaging 5% per year across all categories. Since 2008, however, there has been a flattening of shipment growth due to the softening of the economy, slowing population growth and reduced housing starts. These factors are offset somewhat by a consistent growth in the number of residential households in Canada which is the byproduct of a declining number of individuals per household. Due to the high saturation level of most core major appliances in Canadian households, it is likely that current shipment growth is due to a growing replacement of previously sold units. This growth tracks the steady national shipment growth occurring throughout the late 1990's and into the 2000s.³

Table #1 below provides historical shipment statistics by major appliance type for the BC market for the period 2005 through 2010 (based on ElectroFederation of Canada appliance shipment data) and forecasted shipments for the years 2011 through 2020 (based on a forecasting methodology developed by SBR International for their study on the major appliances recycling system in Ontario). As the SBR study did not examine niche products such as room/portable air conditioners, dehumidifiers, trash compactors or food waste disposers, forecasts for these items have not been included in this table. Further data gathering on these categories will be conducted between plan approval and plan implementation in July 2012.

² Statistics on major appliances entering end-of-life in BC and the material composition of those appliances provided in this section have been estimated from models and data developed by SBR International Inc. in the study of the Ontario market: "White Goods Assessment – Ontario", March 2009.

³ SBR International Inc report "White goods Assessment – Ontario, March 2009.

Table #1
BC Provincial Units Shipments (Estimated) by Major Appliance Category
Historical & Forecasted Shipments (000's units)

Year	Clothes Washer	Clothes Dryer	Freezer	Dish Washers	Electric Range	Gas Range	Refrigerator	Total
2020F	129.2	117.9	42.0	106.9	105.1	16.7	133.2	651.1
2019F	120.1	117.5	42.2	107.4	103.9	16.3	134.0	641.5
2018F	129.6	118.6	41.7	105.6	102.1	16.1	135.7	649.5
2017F	128.9	115.8	41.2	106.4	100.8	15.8	137.4	646.3
2016F	126.0	112.9	41.8	103.2	102.1	15.5	138.0	639.6
2015F	123.6	113.0	42.4	101.2	103.3	14.4	136.6	634.6
2014F	121.0	108.7	42.7	100.6	102.0	13.5	136.5	625.1
2013F	115.3	104.2	43.5	97.5	100.9	12.7	139.0	613.2
2012F	114.7	100.3	44.0	95.7	101.8	11.9	138.5	606.8
2011F	122.7	107.3	47.0	102.3	108.9	12.7	148.1	649.0
2010	131.4	116.6	49.3	103.9	119.6	13.4	159.6	693.8
2009	126.9	112.5	49.4	95.3	108.0	12.0	140.2	644.4
2008	129.5	116.3	51.8	102.5	116.2	12.6	166.7	695.6
2007	141.0	126.2	50.9	106.9	118.5	15.4	167.3	726.4
2006	124.3	108.9	51.2	95.6	113.2	10.3	175.5	678.9
2005	115.1	102.6	50.9	91.3	106.1	10.1	157.0	633.2

4.2 Estimates of Units Entering End-of-Life

Estimates of the number of EoL major appliances entering the recycling stream were derived using the following:

- Historical and forecasted industry shipment data for the BC market;
- The average lifespan data developed under the 2005 Beck and Weston study for AHAM on the major appliances recycling system in the United States and Canada; and,
- Incorporating the above two data sets into a Weibull lifespan probability distribution model as per the 2009 SBR International Study.

In developing its lifespan estimates for each category of major appliances Beck and Weston collected data from over 2,000 retired major appliances in the United States and Canada in order to determine date of manufacture. Manufacturers were able to provide the date of manufacture for 1,350 of these appliances. The average age of retired appliances sampled in the United States and Canada was 17.6 years. Refrigerators had the highest average age of 20.1 years. The oldest appliance sampled was 56 years old while the youngest was less than one year old. Table #2 below provides a summary of the average age of major appliances by category.

Table #2⁴

Average Age of North American Appliances Retired in 2005	
Category	Average Age (years)
Freezer	19.39
Clothes Washer	14.68
Clothes Dryer	16.11
Dishwasher	12.72
Refrigerator	20.07
Electric Range	15.89
Gas Range	12.90
OTR Microwave	13.99
Air Conditioner	18.12
Compactor	6.00
Dehumidifier	12.37
Disposer	13.00

Based on this analysis, it is estimated that the following number of units of major appliances have or will be entering the EoL recycling system in BC between 2008 and 2020 (see Table #3 below). As noted earlier, as the SBR study did not examine products such as room air conditioners, dehumidifiers, trash compactors or food waste disposers, forecasted units entering end-of-life are not provided for these product categories. That said, the number of units of these products sold is extremely small so their overall contribution to the waste stream in the major appliances category is thought to be low relative to core white goods.

Table #3

Number of Major Appliances Entering End-of-Life 2008 – 2020 (000's units)							
Year	Clothes Washer	Clothes Dryer	Freezer	Dish washer	Electric Range	Gas Range	Refrigerator
2008F	77.7	60.4	43.7	52.2	67.9	5.0	85.7
2009F	75.2	57.3	41.5	48.9	62.1	4.4	71.4
2010F	77.2	58.4	41.6	54.8	69.2	4.6	80.5
2011F	70.1	53.0	39.9	54.2	63.5	4.2	76.6
2012F	65.3	50.1	37.9	51.3	61.6	3.9	73.9
2013F	66.5	52.0	38.0	54.2	63.4	4.2	75.9
2014F	69.0	54.1	38.0	57.2	65.3	4.5	78.1
2015F	71.7	56.4	38.1	60.5	67.9	4.9	80.4
2016F	73.9	58.9	38.3	63.7	69.8	5.2	82.7
2017F	77.0	61.2	38.4	67.5	72.3	5.5	85.6
2018F	80.3	64.9	38.6	71.2	74.6	6.2	88.5
2019F	77.4	67.4	39.2	74.2	77.6	6.4	90.6
2020F	86.4	70.2	39.2	76.4	79.8	6.8	94.1

⁴ *Recycling, Waste Stream Management, and Material Composition of Major Home Appliances*, R.W. Beck and Weston Solutions for the Association of Home Appliance Manufacturers, October 2005

4.3 Material Composition of Major Appliances

When it comes to recycling and end-of-life management, major appliances are unique in that the high metal content (ferrous and non-ferrous metals) and the general absence of hard to manage substances found in many consumer electronics products, mean the products actually have a positive financial value at end-of-life. By “positive financial value” we mean that the products can be collected and processed to extract various component materials and the value of the extracted materials exceeds the cost of collection and processing. The recycling of these products can actually be a profitable business venture.

While metal prices fluctuate over time, the value of the metals in major appliances has consistently proven itself to be sufficient to support an on-going and stable market-driven recycling system. Businesses in the scrap metal recycling sector have become adaptable and flexible in the face of changing scrap metal values and have learned how to manage their businesses through both high and low metal prices. This has meant that fluctuating metal prices have not had a material impact on the collection and recycling rates of major appliances over time.

Table #4 below illustrates the material composition of major appliances in 2005. These data were compiled through a product tear down analysis completed by Scientific Recycling Inc., a major appliance and electronic product recycler headquartered in Holmen, Wisconsin as part of 2005 Beck and Weston study on the major appliances recycling system completed for AHAM. A total of 39 new and 42 retired major home appliances were dismantled to determine their material composition.

Table #4⁵
Composition of Major Appliances Manufactured in 2005

Appliance Type	Ferrous	Non-Ferrous	Plastic	Other
Side-by Side Refrigerator	55.9%	5.8%	33.1%	5.2%
Top/Bottom Refrigerator	45.9%	7.1%	38.7%	8.3%
Freezers	81.4%	1.8%	15.2%	1.5%
Electric Range	83.9%	3.9%	1.4%	10.9%
Gas Range	86.7%	2.0%	2.2%	9.1%
Dishwasher	65.0%	4.4%	28.0%	2.5%
Gas Clothes Dryer	93.3%	3.9%	4.5%	0.1%
Electric Clothes Dryer	80.7%	3.9%	4.5%	10.9%
Clothes Washer	63.1%	5.7%	19.5%	11.7%
Microwave Oven	68.1%	7.1%	12.8%	12.0%
Room Air Conditioner	62.6%	18.0%	15.2%	4.1%

⁵ *Recycling, Waste Stream Management, and Material Composition of Major Home Appliances*, R.W. Beck and Weston Solutions for the Association of Home Appliance Manufacturers, October 2005

Table #5 below shows the results of a study performed by the U.K. Industry Council for Electronic Equipment Recycling in 2000 which illustrates the material composition of major appliances compared to other consumer electronic products. This data further reinforces the unique nature of major appliances in terms of their significant high value metal content.

Table #5⁶
Composition of Different Types of Electrical and Electronic Equipment

Product Class	Ferrous	Non-Ferrous	Glass	Plastic	Other
Large Household Appliances	61%	7%	3%	9%	21%
Small Household Appliances	19%	1%	0%	48%	32%
IT Equipment	43%	0%	4%	30%	20%
Telecommunications	13%	7%	0%	74%	6%
TV, Radio	11%	2%	35%	31%	22%

The 2005 Beck & Weston study material composition data were also compared to data from a similar study conducted in 1997 when both new and retired appliances were dismantled and analyzed for material content. As such, the two material composition studies provided four time periods with which to analyze material composition trends:

- Appliances that were retired in 1997 (the average age of these appliances was 19 years meaning that on average they were manufactured in 1978);
- Appliances that were retired in 2005 (the average age of these appliances was found to be 17.6 years meaning that on average these appliances were manufactured in 1987);
- Appliances that were new in 1997; and,
- Appliances that were new in 2005.

Comparing data from these different years Beck and Weston were able to identify a number of relevant trends in the material composition of major appliances over time. Those trends included:

- The average weight of appliances has declined over time. On average, appliances manufactured in 2005 were 17 percent lighter than those that were retired in 1997 (manufactured, on average, 27 years earlier);
- This light-weighting trend was accompanied by a reduction in the amount of ferrous metals contained in appliances and an increase in the amount of plastic used;
- However, the trend in weight and ferrous metal reduction reversed itself between 1997 and 2005. It was found that many of the new appliances dismantled in 2005 contained more ferrous by weight than the new appliances dismantled in 1997. This new trend was attributed to shifts in the market as consumers moved to

⁶ UK Status Report on Waste from Electrical and Electronic Equipment, Industry Council for Electronic Recycling, 2000.

larger models of certain appliance types, like refrigerators, or higher end models made with heavier materials (e.g. front load washers). The significant increase in stainless steel appliances also played a significant role.

- Looking at the trends in the last eight years, by comparing the new appliances dismantled in 1997 to the new appliances dismantled in 2005, there was a decline in the total amount of plastic in freezers, electric ranges, dishwashers and electric clothes dryers. In all other appliance categories, the weight of plastic continued to increase.

Building off of this Beck and Weston work, SBR International, in their 2009 study of the major appliances recycling system in Ontario, constructed a model to forecast the material composition of all major appliances entering the end-of-life recycling system through to the year 2020. Table #6 below provides an estimate of what this model would predict for the BC market from 2008 through 2020.

Table #6
Mass of Component Materials Entering End-of-Life by Year – All Products⁷

Mass of Material Entering EoL(Kt)									
Year	Total	Ferrous	Non-Ferrous	Plastic	Glass	Other	Circuit Boards	Polyur Foam	Refrig.
2008F	30.77	22.85	1.98	4.82	1.20	0.82	0.03	0.69	0.03
2009F	27.72	20.46	1.80	4.48	1.10	0.76	0.03	0.66	0.02
2010F	29.28	21.48	1.88	4.90	1.18	0.80	0.03	0.74	0.03
2011F	26.95	19.67	1.73	4.65	1.10	0.75	0.03	0.71	0.02
2012F	25.27	18.30	1.62	4.50	1.04	0.69	0.05	0.70	0.02
2013F	25.75	18.54	1.65	4.73	1.06	0.72	0.05	0.75	0.02
2014F	26.15	18.72	1.67	4.97	1.08	0.74	0.05	0.80	0.02
2015F	26.79	19.08	1.72	5.23	1.13	0.77	0.05	0.85	0.02
2016F	27.40	19.39	1.76	5.48	1.16	0.79	0.05	0.91	0.02
2017F	28.18	19.84	1.79	5.76	1.21	0.82	0.05	0.97	0.02
2018F	28.95	20.29	1.84	6.08	1.26	0.84	0.08	1.02	0.02
2019F	29.28	20.44	1.87	6.27	1.27	0.86	0.08	1.06	0.02
2020F	30.58	21.25	1.95	6.65	1.34	0.89	0.08	1.13	0.02

While the above data illustrate that the amount of ferrous and non-ferrous metals in major appliances is forecasted to decrease from 79.4% of all major appliances entering end-of-life in 2011 to 75.8% in 2020, and plastic is forecast to grow from 17.3% in 2011 to 21.8% in 2020, these changes are not expected to result in any significant disruption to the current market-driven recycling system for major appliances. Metals will continue to comprise the vast majority of major appliances mass at least through 2020 and the increasing preference for and prevalence of stainless steel fascias and unit interiors will provide processors with an additional valuable revenue source in the future. While the recent increased use of stainless steel may have a smaller impact on the current end-of-life stream it will become increasingly regular as we approach 2020 and beyond.

⁷ Data has been extrapolated from SBR study on Ontario pro-rating for BC's population.

Regarding the increased use of plastics, high quality/purity recyclable plastic has a significant market both domestically and overseas, valued at \$1,000-\$1,500/tonne (September 2008). Unfortunately, the purity of plastics derived from EoL major appliances can only currently be used for low-quality applications and there are limited economically accessible technologies to extract and recycle it. However, as technologies for the separation of recovered plastic mature, recovered plastic could become a valuable source of additional revenue for businesses involved in EoL major appliances recycling.

5. The Existing Market Driven Recycling System

5.1 Overview

As noted in the introduction, the application of Extended Producer Responsibility program principles to the recycling of major appliances poses unique challenges and in the opinion of AHAM Canada and RCC, warrants the implementation of a unique solution in light of the existing market driven system for major appliance recycling. That system, as noted previously, is driven by the fact that major appliances, unlike virtually all other EoL products, have a positive financial value at end-of-life and therefore can and are being profitably recycled.

The positive economic value of major appliances has led a variety of economic players to engage in the business of major appliance collection, brokering and recycling. As a result, across North America today there is a diverse and highly adaptable and flexible system comprised of an array of minor and key stakeholders who essentially funnel the appliances into a pyramidal processing hierarchy.

EoL major appliances are generally processed with automotive and industrial metals and delivered from small pre-processors to mid/large-scale processors and finally to end-markets for conversion into new products. Through fundamental supply/demand economics, this reverse logistics system achieves internationally leading efficacy in the absence of regulatory imposition or industry intervention.

Knowledge and understanding of this system has been gained through three in depth research studies into the major appliances recycling system in the last 7 years:

- ***Generation and Diversion of White Goods from Residential Sources in Canada.***

This study was completed for Canadian Appliance Manufacturers Association (CAMA) by Hansen Research and Communications and Hilken International Policy for the Government of Canada Action Plan 2000 on Climate Change – Enhanced Recycling Program. The study was conducted during 2004 and published in 2005. It was a national study covering all provinces in Canada.

- ***Recycling, Waste Stream Management and Material Composition of Major Home Appliances.***

This study was completed for AHAM by RW Beck and Weston Solutions. The study was conducted during the first half of 2005 and published in October 2005. It was a North American study and examined the major appliances recycling systems in both Canada and the U.S.

- ***White Goods Assessment – Ontario.***

This study was completed for CAMA by SBR International Inc. The study was conducted throughout 2008 and the final report was concluded in March of 2009. This study was a detailed examination of the Ontario major appliances recycling system.

These studies have determined that EoL major appliance stakeholders across Canada and North America can be separated into four main groups, based on their function within the handling chain. In some cases, a stakeholder may fill more than one role. General stakeholder groups by function include:

- ***Collectors*** – provide a collection service either to promote their core business (e.g. retailers) or to sell the collected units into the recycling stream based on their material worth;
- ***Consolidators/Pre-Processors*** – amass quantity in order to access mid or large-scale processors. Their geographic spread allows for province-wide capture from collectors;
- ***Mid/Large-Processors*** – isolate scrap material to suit the demands of end-markets. This may involve shredding, baling or combining EoL major appliances with other scrap metal to target purity levels;
- ***End-Markets*** – incentivize the system by valuating the feedstock based on provincial, national and international demand. International demand has a significant impact on the global scrap metal industry.

While most stakeholders in the system consider themselves to be “recyclers” most are actually “collectors/consolidators” including – municipalities, contracted agents, large and small retailers, refurbishers/re-sellers, utility bounty programs, peddlers, scavengers and scrap metal dealers. It is really only the processors (shredders/balers) and the end-markets (steel mills) that are actual material recyclers as that term would traditionally be defined. Nonetheless, each of these stakeholders is involved in the collection of EoL major appliances and all are intertwined within the overall handling and recycling system. Through all these channels, an estimated 27 kilotons⁸ (Kt) of disposed EoL major appliances will be collected in BC in 2011.

⁸ See table #6.

5.2 Collection Process

5.2.1 Collectors

Collectors within the major appliances recycling system include the following entities:

- Retailers
- Municipalities;
- Contracted agents;
- Multi-Unit Residential Managers;
- Peddlers;
- Refurbishers;
- Utility Bounty Programs; and,
- Scavengers.

Through this collection network consumers have access to a wide variety of recycling options for their end-of-life major appliances. While some collectors such as retailers or municipalities may charge a fee to collect an appliance from a residence, some will also provide at home or curbside collection services for free.

Retailers

In total, retailers are the largest collection channel in the market-driven system accounting for approximately 60% of the total mass of EoL major appliances retired each year.

EoL major appliances management practices vary somewhat between large and small retailers of new major appliances. Small retailers are defined as those with annual sales of less than \$5M while large retailers are defined as those with annual sales of \$5M or more. Within the retail sector collection channel, large retailers account for approximately 1/3 of retailer collections while small retailers account for approximately 2/3 of retailer collections.

It is estimated that about 60% of major appliances are sold through large retailers and 40% through small retailers. While both large and small retailers offer EoL major appliances collection services the discrepancy between units sold versus units returned through the two channels indicates that large retailers tend to take back fewer EoL units per new units sold than do small retailers.

Surveys have shown that many retailers currently offer to remove old appliances free of charge when a consumer purchases a new appliance. While free appliance removal is offered by some retailers, some retailers will also charge a fee for new appliance delivery and this fee often includes the removal of the old appliance. The practice of offering “free delivery” and/or “free take-back”, while present in both the large and small retailer channels tends to be more pronounced in the small retailer channel where small retailers will use the free take-back service as a means to differentiate themselves from their larger

competitors on customer service grounds. Where these fees are applied they are considered a fee for service, and a choice exercised by the consumer.

While some large retailers have their own delivery infrastructure, the majority elect to employ contractors to perform both their new unit deliveries and their EoL unit collections. In many cases these delivery contracts will often require the contractor to provide EoL unit removal services but will not compensate them for it as it is assumed that the sale of the EoL unit into the recycling stream will compensate the contractor. As a result, most collected units are funneled into the scrap metal recycling stream through contracted agents or scrap metal consolidators/pre-processors to generate revenue from the value in the EoL units. While some EoL units collected by large retailers have been found to find their way into the refurbisher or municipal channels these quantities are small, typically amounting to less than 10% of units collected. In contrast to the large retailers the vast majority of small retailers (approx. 85%) have been found to handle both their new unit deliveries and EoL unit collections through internally operated programs. The majority of small retailer sales of new units will involve a delivery by the retailer and typically about 60% of the time an EoL unit will be removed. While the incidence of small retailers injecting collected EoL units into the refurbishment channel is greater than for large retailers, the quantities are typically 10% or less. The cost of managing product take backs is generally included in a delivery fee associated with the new unit.

As is the case with large retailers, small retailers generally feed EoL units into the scrap metal market via small consolidators or pre-processors, which then feed the large and mid-sized processors. In most cases, small retailers exchange the material value of their collected units in exchange for disposal/removal and decommissioning services.

Municipalities:

Municipalities are the second largest collection channel accounting for about 20% of all major appliances collected within the current market-driven system. As such, they are about 1/3 the size of the retail collection channel.

Municipalities generally use 1 of 3 strategies for the collection of major appliances:

- Offer municipal drop-off facilities and curbside collection;
- Offer municipal drop-off facilities only; or,
- Offer no municipal services.

Services may be delivered by the municipality itself, a private contractor, or a combination of both. Generally speaking it was found that in the majority of municipalities major appliances collections are contracted to a private company while depots/transfer stations are owned and managed by the municipality. In many larger municipalities, major appliances are collected by the municipality and delivered to municipal transfer stations. In small municipalities, sections of municipally owned landfills are often designated as transfer stations for temporary storage and/or decommissioning of major appliances until quantities are sufficient for processing.

Generally speaking, for municipalities that collect EoL major appliances about 50% offer some form of curbside collection for residents while the other 50% offer some form of drop off location. Of those that offer curbside collection about half use an appointment system while the other half use regularly scheduled pickups. Typically about half of municipalities offering a pick-up service charged a fee for pick-up and half offered the service for free.

Municipalities were found to be the only entities operating in the major appliances collection and recycling system that sometimes stated that they didn't make a "profit" collecting and selling major appliances. In all three studies, however, it was found that many municipal governments could not specifically identify the net costs or revenues associated with handling end-of-life appliances as the costs and revenues were often bundled with recycling costs for scrap metal or with recycling or solid waste management cost generally. Of municipalities that claimed they could identify the net financial impact of managing EoL major appliances, approximately half claimed their programs resulted in a net cost while the other half claimed their programs resulted in a net revenue.

Contracted agents

Contracted agents are defined as third party waste management companies that acquire, and possibly pre-process major appliances on behalf of another entity. They often collect major appliances on behalf of municipalities and/or industrial clients.

Contracted agents perform a variety of services for municipalities, including collections, staffing transfer stations and managing all aspects of the EoL major appliances pre-processing chain. The services provided are a function of the contract undertaken with each municipality and the municipal infrastructure present.

Contracted agents acquire EoL major appliances in a variety of ways. Units may be dropped off at their facilities, or collected through a regular or appointment-based curbside collection system. In some instances agents receive significant quantities of their flow from retailer take-back programs.

Contracted agents generate revenues from some combination of flat fees paid by the municipality, per-visit collection revenue, and the sale of collected material. In this last case, the transfer of possession of collected scrap metal may be part of the payment mechanism built into the service contract. Similarly, some municipalities may also derive revenue generated from the contracted agent's sale of collected materials as a "royalty payment".

In providing EoL major appliances collections services, many contracted agents use specialized vehicles to facilitate safe handling of refrigerant containing units. Others decommission units at a transfer station.

Contracted agents, as their name suggests, operate as agents for other collection entities. The quantity of major appliances units collected by these entities is therefore accounted for in the percentage collection values association with other collectors (e.g. municipalities and retailers).

Multi-Unit Residential

The majority of property management companies (approx. 80%) handle major appliances centrally. It is their responsibility to replace or repair EoL major appliances generated by their tenants, and determine the channels through which their EoL units flow. Almost all rental dwellings in multi-unit complexes contain a refrigerator and range provided by property management. In a smaller portion of units, usually those in row houses of higher end rentals, a dishwasher, clothes washer, and clothes dryer may also be included.

Property managers typically comment that major appliances in a rental setting have a significantly shorter lifespan than would be expected in a non-rental setting. The lifespan in a rental setting is typically described as being no longer than 10 years. Regardless of life span, virtually all EoL units are exchanged for new units.

Approximately $\frac{3}{4}$ of EoL major appliances generated from multi-unit complexes are generally removed through retailer take-back programs while about $\frac{1}{4}$ are diverted directly into the scrap metal stream through a collector/consolidator. Insignificant quantities have been found to be diverted through municipalities or scavengers.

In owned units (i.e., condos), the replacement and disposal of EoL major appliances is the responsibility of the individual property owners. That said, in the studies on the EoL major appliances system most property managers in resident-owned buildings surveyed have commented that EoL units are either collected through retailer take-back programs or the municipal channel. As such, EoL units from resident owned multi-unit dwellings are assumed accounted for in other channel flow estimates.

Multi-unit residential sources have been found to typically generate 20 – 25% of the total number of EoL units retired and as much as 35% of the total mass of retired units. This discrepancy between % of units and % of mass retired is due to the disproportionate prevalence of ranges and refrigerators, which tend to be heavier in weight compared to other major appliances, in the multi-unit stream.

Scavengers

Scavengers are individuals who acquire EoL major appliances opportunistically by intercepting them from some other regular collection mechanism. The main source of EoL units for scavengers is curb-side collection programs as the units are easily accessible and visible.

Because most scavengers do not have registered businesses or keep records of their EoL major appliances collection activities it is difficult to determine their precise impact on

the overall diversion of EoL white goods. That said, it is assumed that the value of materials contained in the products is what motivates scavengers to engage in EoL major appliance collection. As such, as metal prices rise, the incentive for scavengers to engage in the scavenging process increases. Since the material value of EoL major appliances cannot be realized without injecting collected units into the market-driven recycling system, it is assumed that all scavenged units are diverted from landfill through other stakeholders in the system (either through the recycling or refurbishing channels).

Scavengers are estimated to account for 11% of EoL major appliances collection, a number that can vary significantly depending on ferrous and non-ferrous metal scrap prices.

Refurbishers

Refurbishers are defined as businesses that acquire used major appliances for the purpose of reconditioning or repairing them for subsequent re-sale. Consistent with the overlapping nature of many stakeholder roles in the system there is some overlap between pure refurbishers (i.e., those that only sell used units) and many small retailers who often sell a mixture of new, used and “scratch & dent” appliances.

Pure refurbishing operations are typically proprietorships, partnerships, or small limited companies. Many operate as family businesses, while others have a small number of employees, typically fewer than ten. Refurbishers may only recondition and resell used appliances, or they may combine this activity with other related pursuits such as repairs, new/used part sales or sales of scratch & dents acquired from manufacturers.

Refurbishers source their EoL units from a variety of channels from residential drop offs, the multi-unit residential channel, trade-ins and retailer take backs. Approximately 50% of units collected by refurbishers are stripped of parts and then channeled into the scrap metal recycling stream. The remaining 50% are refurbished for re-sale.

Generally speaking, the refurbishing business has been in decline in urban areas in recent years and somewhat more stable in rural areas. The decline in urban areas is attributed to the declining price points of new entry level appliances and special financing offers from large big-box retailers.

Peddlers

Peddlers are defined as 3rd party contractors hired to collect materials from a residential or multi-family location on a one-time basis (e.g. 1-800-Got-Junk and similar businesses). Peddlers generally offer a range of disposal services. The material they collect is only in their possession transiently, and is generally sent to either private or municipal transfer stations/landfills for a fee. Peddlers earn revenue from a fee charged for collection and transportation services, while incurring the cost of disposal. If a collected load contains scrap metal, peddlers will attempt to generate additional revenue by selling it into the scrap metal stream, rather than using private or municipal transfer stations.

Peddlers have a general focus on “junk” removal rather than recycling and the handling of major appliances typically represents a very small percentage (less than 5%) of their total volume. However, due to the high return on major appliances, peddlers do occasionally handle these items. A favoured disposal source for peddlers is refurbishers as they will pay between \$30 and \$75 for a desirable item. That said, primary research suggests that peddlers handle only a fraction of EoL major appliances (less than 1%). Despite their minimal role, peddlers fill a niche within the overall major appliances collection system and provide residents with an additional in-home recycling option for their EoL units.

Bounty Programs

Bounty programs, wherein a financial or other incentive is offered to consumers to retire an old appliance, are generally operated by utility companies or provincial government energy departments or agencies. These programs are generally operated for the purpose of reducing demand on a province’s electricity generating and distribution infrastructure. They do, however, have the additional effect of channeling EoL major appliances into the EoL recycling system.

BC Hydro’s PowerSmart offers such a bounty program. Under this program BC Hydro will arrange for the free pick-up of a refrigerator that measures between 10-24 cubic feet that is still in working condition. In addition to free pick-up BC Hydro also provides the resident with a \$30 incentive per refrigerator (maximum two per customer). BC Hydro also offered to pick-up for free spare freezers as a limited time service during the month of October 2011 which has been designated as Power Smart Month.

5.2.2 Scrap Metal Brokers/Consolidators

A scrap metal broker/consolidator is a company that acquires EoL major appliances by various means but has no processing facilities (processing practices are defined in greater detail in section 5.3). The goal of these businesses is to acquire and accumulate large quantities of scrap metal including EoL major appliances in order to re-sell in volume to processors.

Scrap metal brokers/consolidators typically acquire most of their EoL major appliances from collectors who generate small volumes such as refurbishers, small retailers, multi-unit residential managers, peddlers, and scavengers. They accumulate EoL major appliances as well as all manner of scrap metal with a particular focus on those items carrying the highest concentration of metals, both ferrous and non-ferrous.

The type of material handled by these companies varies significantly, however, the bulk of material is typically derived from automotive or industrial sources. EoL major appliances typically make up a smaller percentage of their total throughput. All items received are combined as general scrap before being rapidly shipped to a processor.

Savvy scrap metal brokers/consolidators may perform some coarse materials separation of ferrous and non-ferrous metals derived from EoL major appliances. This practice is particularly focused on copper, brass, and aluminum as all these metals have higher value than the HMS-2 grade of ferrous scrap that EoL major appliances are made from. Both refrigeration coils and motor windings contained within EoL major appliances are easily accessible sources of non-ferrous metals.

Scrap metal brokers/consolidators provide a consolidation point for many small-volume sources, allowing material to be channeled into mid-sized and large-scale processors. In this sense, these companies serve as a crucial integration point within the overall EoL major appliances handling chain. Besides offering free or revenue-positive disposal options for business and residents, scrap metal brokers/consolidators provide the final point at which EoL major appliances can be tracked separately from the general scrap metal recycling stream.

5.2.3 Processors

Processors can be roughly categorized by size. Large processors typically operate shredding or shredding and baling operations and may be vertically integrated with smelting facilities. Mid-sized processors generally only bale and do not have shredding capability. They may however operate multiple balers or loggers for different types of material. Small processors typically operate only one baler and handle only scrap steel. They are essentially consolidators who have the infrastructure to compact their collected material for facilitated transportation.

Processing begins with the decommissioning of any units requiring this service (e.g. refrigeration units). Following this step, EoL units are baled or shredded depending on the nature of the processor and the facility (section 5.3 provides a more detailed explanation of the baling and shredding process). Baled units are then generally transported to a higher-level processor/end-market for direct smelting. For those units that are shredded, both the ferrous and non-ferrous metal “shred” are also sent to steel mills for smelting.

Non-metallic components contained within bales are desired ingredients for the production of certain types of steel alloys. These components are incinerated during the smelting process at the end-market. Non-metallic components contained within shredded units are generally outputted as “shredder fluff” and often used as primary day-cover for landfill sites.

Processors of all scales provide a crucial function within the EoL major appliances value chain in that they convert recovered EoL units into a commodity desirable by end-markets. In addition, they provide additional system access locations for the public as they diversify their material sourcing streams.

While EoL major appliances “piggy back” on larger-volume scrap streams (primarily automobiles and industrial scrap), this input diversity establishes stability near the top of the value chain.

5.2.4 End-Markets

The majority of EoL major appliances are recycled into reinforcement bar for construction purposes. “Re-bar” is used to reinforce concrete for bridges, roads, building foundations and even prefabricated building component pieces.

Processed EoL major appliances arrive for smelting as either shred or bales of mixed scrap steel.

For shred, the majority of non-metallic elements have been removed during the shredding process, leaving only 10-15% non-ferrous content. Non-ferrous content is separated and shipped to appropriate non-ferrous smelters.

Bales on the other hand are generally of mixed composition and ferrous content. As such, they are evaluated visually and combined in the smelting process to homogenize purity over large lots. The inherent inability to precisely control composition when smelting bales is reflected in their lower value as compared to shred.

All said, steel continues to be one of the most recycled materials in the world. In 2006, Canada produced 14.7M tonnes of steel using 8.1M tonnes of scrap for a 55% recycled content⁹.

5.3 EoL Major Appliance Processing/Recycling Practices

5.3.1 Overview

The nature of EoL major appliances processing/recycling practices vary based on the commodity price of metals, legislative requirements associated with the handling of component materials, the material composition of the unit being processed, and the ease with which component materials can be separated. The degree to which major appliances are processed depends on the nature of the processor, end-market requirements, and the associated economics. **Pre-processing** involves the decommissioning, dismantling and disassembly EoL major appliances whereas **Processing** refers to the shredding or smelting of pre-processed materials. Pre-processing and processing include the following broad sub-categories of activities:

Pre-processing includes the following activities:

Decommissioning – defined as the process of rendering an EoL major appliance non-functional – i.e., evacuating refrigerant from a refrigerator compressor and removing any legislated hazardous materials to allow for further processing;

⁹ SBR International Page 3-51

Dismantling – defined as the process by which component materials are separated based on type;

Disassembly – defined as the process by which components of EoL major appliances are removed for reconditioning, resale or repair.

Processing includes the following activities:

Baling – defined as the compaction of EoL major appliances to facilitate transport or to accommodate end-market demand. Different bale densities are produced for different purposes. High-density bales cannot be shredded and are sent direct to steel smelters. Low-density bales and occasionally whole EoL major appliances are sent for shredding and subsequent material separation;

Shredding – defined as the use of a hammer mill to break materials into small pieces of mixed material that can be sorted using a number of downstream techniques. For example, ferrous metal can be separated using magnets while other materials can be separated using eddy-current or mass-based techniques.

5.3.2 Pre-Processing Practices

Decommissioning:

The nature of decommissioning performed on EoL major appliances depends on a number of factors including the following:

- The age of the EoL unit;
- The type of appliance (refrigerating appliances tend to require more decommissioning than other types of major appliances);
- The unit manufacturer;
- The unit feature set;
- The handling stakeholder.

Due to the rapid consolidation of EoL major appliances into the general scrap metal stream, decommissioning is primarily performed by collectors or at the first entry point into the processing stream. This is usually at the consolidator, scrap metal broker, or small-scale processor level. That said, some higher level processors may also perform some decommissioning in an attempt to further vertically integrate their operations.

Decommissioning practices typically involve the following steps:

- The evacuation of refrigerants;
- The removal of mercury containing switches (where present); and,
- In some cases, the removal of motors/compressors.

The practice of decommissioning is generally restricted to refrigerating appliances as non-refrigerating appliances do not generally contain any environmentally sensitive substances requiring special treatment.

With the exception of refrigerant extraction which requires specialized certification, decommissioning is relatively simple to perform. In fact, the removal of some parts such as motors is optional.

Mercury Switches:

The incidence of mercury switches in older freezers and clothes washers and in gas pilot light ranges is low and decreasing with time. Manual switches have completely replaced mercury-based switches in freezers manufactured after 2000 and were relatively uncommon in the years prior. In the case of gas ranges mercury-based flame safety sensors were contained only in constant-burning pilot light gas ranges without electrical igniters. Due to lack of applicable substitute technology, these sensors had no functional replacement until 2007 when manufacturers ceased any remaining use of these safety switches and replaced them with an alternative safety device. In addition, the incidence of gas ranges is relatively low, and the number of units sold without electrical ignition had been decreasing prior to 2007. It has been estimated that less than 18% of all gas ranges manufactured in 2000 would have contained this type of sensor and that percentage would have fallen to less than 5% by 2005.

That said, the removal of these switches requires minimal effort and there is widely available public information providing clear and concise instructions on the identification and safe and efficient removal of mercury containing switches from major appliances.

PCB Capacitor Removal:

While major appliances sold today do not contain any PCB containing capacitors, some refrigerators and freezers manufactured prior to 1978 may have contained control boards containing PCB capacitors. However, their use was not uniform across all manufacturers, model years or categories making it difficult for those decommissioning these products to determine associated screening requirements. Further complicating this issue is that capacitors containing PCBs were not marked as such by capacitor manufacturers.

Given that fewer than 7% of refrigerators and freezers are forecasted to be of pre-1978 manufacture years¹⁰, and that previous teardown studies in 1990 failed to find any PCB-containing capacitors in either of these product categories¹¹, it is

¹⁰ SBR International Report – White Goods Assessment – Ontario, 2009, Page 5-3

¹¹ Appliance Recycling Information Centre (ARIC), “Technical Bulletin #5, Major Appliances and Small PCB Capacitors”, 2005

highly probable that all such control boards have already passed through the processing stream prior to 2010.

Refrigerant Extraction:

The extraction of refrigerants (CFC 12, HCFC 22, or HFC 134a) from EoL major appliances is regulated under BC Regulation 387/99 known as the “Ozone Depleting Substances and other Halocarbons Regulation.” In addition to requiring that extraction of refrigerants be performed in accordance with Environment Canada’s Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems, this regulation also prohibits the release of refrigerants into the atmosphere. The regulation further requires that refrigerants can only be extracted by an approved technician, that equipment used to extract refrigerants must meet specified performance standards and that all units that have had the refrigerant extracted must be properly tagged and labeled.

The extraction process which takes 10-25 minutes per unit generally works as follows:

- A needle valve is attached to one of the refrigerant lines, without puncturing it and in a manner designed to secure a seal to prevent leakage;
- A drain hose is attached to the needle valve with the drain valve in the closed position;
- The needle valve is then tightened to puncture the refrigerant line;
- A extraction pump is turned on and the drain valve lever is opened, draining the refrigerant from the refrigerator or freezer;
- The refrigerant is drained into either a marked reclamation container wherein like refrigerants are contained to avoid contamination;
- Depending on the refrigerant type it can either be destroyed or reclaimed and reused;
- Once the refrigerant is extracted, the hose and needle valve are removed and the technician affixes a “refrigerant” extraction label to the appliance to signify that it has been evacuated.

Dismantling:

Extensive manual dismantling of EoL major appliances occurs infrequently within the market-driven recycling system due to the higher labour costs involved. That said, the dismantling of easily accessible components, comprised of non-ferrous metals is performed by some smaller-scale processors who attempt to access specialized markets for these valuable materials. Non-ferrous components have value well in excess of equivalent masses of HMS-2 scrap metal. Since the average EoL major appliance contains about 3.6kg of non-ferrous material (aluminum, copper and brass), separating these materials can prove lucrative depending on market prices for these metals.

Disassembly:

The disassembly of EoL major appliances is primarily performed by businesses involved in the refurbishing and repair industries.

All EoL major appliances with the exception of dishwashers and clothes dryers are commonly dismantled for their component parts. Typically ranges provide the greatest quantity of reusable parts due to the limited number of wear items (e.g., motors). Refrigerators offer a number of potentially reusable parts. However, due to their common replacement and specific application, those that are available are often offered at a premium. Refurbishers are careful to recover functioning evaporator fans, switches, solenoids, control units, shelves, drawers and even refrigerant where possible.

Clothes washers are particularly complex among major appliances as they have a number of moving parts and must remain watertight throughout operation. Therefore, minor part failures necessitate immediate replacement. This makes their salvaged parts particularly desirable for future resale/use. Knobs, motors, transmissions, pumps, inlet valves, actuators, and tubs are all of value to the refurbishers and repair businesses.

5.3.3 Processing Practices***Baling:***

The “baling” of EoL major appliances occurs for the primary purpose of facilitating transportation and handling efficiency through to final processing. EoL major appliances and other scrap metals are baled or logged as HMS-2 scrap metal. Baled scrap is generally used directly in the smelting process.

Baling typically outputs a 16”X16” or 24”X24” compacted cube that may weigh anywhere from 650 – 1,400 pounds. Higher density scrap steel feedstock results in a cube of higher density and mass. Large specialized balers are used to handle automobile hulks and produce oblong bales weighing up to 5,400 pounds.

EoL major appliances range in their concentration of non-metallic components, between 10 and 45% depending on category. As a result, bales comprised of these items are typically of lower overall density than those produced from industrial scrap. However, EoL major appliances are rarely baled alone and are usually mixed with other scrap metal from a number of sources. EoL major appliances generally represent less than 5% of the total scrap steel processed by balers with automotive shells representing 80-85% and industrial scrap making up the remaining 10-15%.

An alternative format for compacting scrap steel is into loose oblong bales called “logs”. Logs are used as feedstock for shredding as the high density of a typical bale can damage shredding equipment. Logs are often produced in situations where the impurity content is high which allows for efficient mechanical separation of ferrous and non-ferrous component materials after shredding.

Shredding:

Shredders are huge automated multi-stage separating and processing stations designed for the separation of component materials from their feedstock.

Most shredding of EoL major appliances takes either logs or un-compacted units as feedstock. In addition, some large-scale shredders are also capable of handling higher density logs/bales, but this ability is the exception.

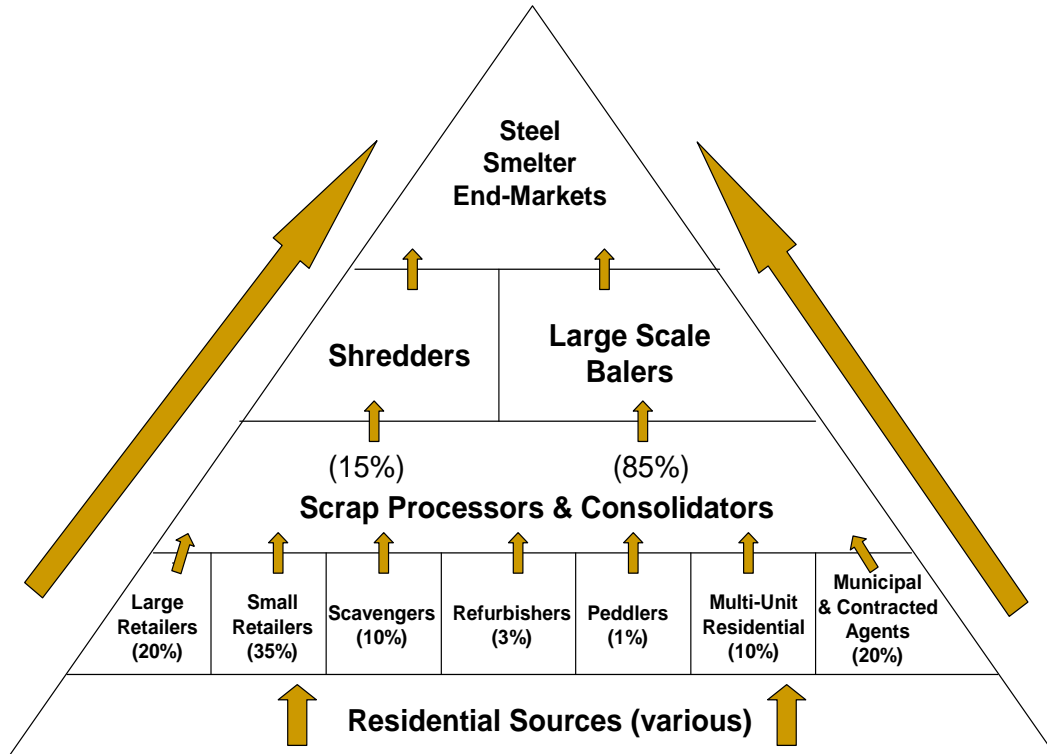
In the shredding process a large crane collects EoL major appliances using either a large magnet or multi-toothed jaws. This crane then loads the unit(s) into the shredder's hopper or loading conveyor. The units then enter the first stage of the shredder called the hammer mill. At this station, the material flowing through the shredder is struck by a series of heavy hammers which pound the material into pieces. On larger scale shredders a sub-stage may exist where the semi-pulverized scrap steel may be subsequently fed through an additional set of rotating chopping blades to further decrease the output size.

The second processing stage subjects the debris exiting the hammer mill to magnetic separation of ferrous metal followed by a cyclonic air current. This process separates the high-density metallic materials from the automatic shredder residue (ASR). ASR may include glass, plastics, rubber, and insulation in the case of some EoL major appliances. The third processing step involves magnetic separation to identify any remaining ferrous metal in the ASR. The final processing step uses electrostatic eddy current separation to separate remaining non-ferrous metals from the ASR. At this point, the remaining material is referred to as "shredder fluff".

Typically, for each tonne of ferrous metal that is recovered from mixed automotive and EoL major appliances feedstock, about 300 kg or 30% of shredder fluff remains, which is in line with the mean non-metallic composition of EoL major appliances.

5.4 Market-Driven System Flow Diagram

The following diagram provides a visual depiction of the hierarchical or pyramidal flow of EoL major appliances from point of collection through to end markets.



5.5 System Performance – Market-Driven System

As noted in the introduction to this section, the major appliance industry has undertaken three studies over the past 6 years to assess the performance and effectiveness of the existing market driven major appliances recycling system. Each of these studies has confirmed that the collection and diversion performance of the existing major appliances recycling system in Canada and the United States places these systems among the most successful in the world. These studies have found the overall collection rate to lie between 95% and 99% of all EoL major appliances entering the waste stream.

The rate of material diversion from landfill has been found to lie between 83% and 89%. This range was determined based on the SBR International study of Ontario wherein it was concluded that a determination of the rate of diversion depended on the nature of processing. As noted earlier, EoL major appliances are either smelted in the form of a bale or shredded. Those that are smelted whole as bales are considered to be fully diverted as no residual material (i.e., shredder fluff) is sent to landfill. In the case of shredded units, only the metallic components are diverted. Non-metallic material, or fluff,

is generally sent to landfills as day cover. This non-metallic diversion of material in the scrap metal recycling system represents a future diversion performance opportunity and is an area in which considerable international research is presently focused.

In light of these facts, SBR calculated its estimates of the mass diversion rate by taking the non-metallic proportion of the average EoL major appliance to determine the total amount of non-metallic material entering the processing stream under collection scenarios ranging between 95%-99%. These values were then scaled by a research informed estimate of the percentage of units that are shredded versus baled. This methodology produced an overall diversion estimate for the entire EoL major appliances category of between 83% and 89%.

These figures illustrate the fact that Canada's and BC's diversion rates for EoL major appliances are significantly higher than either the EU (approx. 40%¹²) or Japan (approx. 50%¹³) where traditional EPR based systems for major appliances currently operate.

Thus, the current market-driven system should be considered to be operating at near-peak effectiveness given available technologies and unresolved processing issues.

6. Program Plan – Supplement the Existing Market-Driven System

6.1 Introduction -- Supplement versus Replacement

The principal objective of the BC Recycling Regulation, and similar EPR legislation around the world, is to divert end-of-life products from landfill to recycling while at the same time shifting the responsibility and cost of managing end-of-life products from local governments to those who produce and consume the product. By shifting these costs and responsibilities to producers and consumers and requiring the establishment of programs to collect and recycle end-of-life products, it is envisioned that EPR regulations will achieve the following principal outcomes:

- The amount of waste going to landfill will be reduced;
- EoL products will be re-directed to recycling or reuse which will reduce the demand for energy and finite natural resources; and
- Producers will receive economic signals (the cost of collecting and recycling their products) that will encourage them to design their products for more efficient recycling including the use of more recyclable materials.

In seeking to achieve these outcomes, most EPR regulations are structured so as to require product producers, either individually or collectively through a stewardship agency or industry funding organization, to create, finance and operate integrated programs that are effectively reverse logistics systems to collect and recycle their

¹² European Commission, “2008 Review of Directive 2002/96 on Waste Electronic and Electrical Equipment (WEEE)”, 2007

¹³ Tsutomu et. Al., “proceeding Plastic Recycling Technology. Level Recycling of White Goods Plastics”, Plant and Process, 2005, 47:10, 87-93

products. This approach may make sense for products that have negative residual value at end-of-life (i.e., EoL products where the cost to collect and recycle the product exceeds the value of the recyclable materials that can be extracted). However, it is unlikely to be the most environmentally or economically effective approach for dealing with products that have positive residual value at end-of-life (i.e., products where the value of the recyclable materials that can be obtained exceeds the cost of recycling) and which have a fully developed recycling market.

In the case of negative value products, few if any existing businesses can create an opportunity to profitably engage in the recycling of the product and hence limited, if any, market-driven recycling activity occurs. In these situations, where the market is failing to achieve the objectives of EPR, traditional EPR approaches, such as producer or stewardship agency managed and operated programs, have sometimes been used. However, in the case of products with positive EoL value (e.g., products like EoL major appliances) businesses do see an economic opportunity to engage in their collection and recycling and hence many of the underlying objectives of EPR regulation are already being achieved through basic economic market forces – i.e., recycling the product is a profitable business venture.

As the Organisation for Economic Co-operation and Development (OECD) in its 2001 publication “Extended Producer Responsibility: A Guidance Manual for Governments” noted, the nature of EPR programs can vary significantly across product types and across jurisdictions and depends largely on the post-consumer value of the product and its potential for environmental impact. The OECD report notes that in cases where existing systems are in place, functioning with high efficiency, and the potential for environmental impact is low, the imposition of traditional EPR instruments must be carefully considered so as to limit systemic distortion. In these situations, the OECD report recommends the continued use of market-driven systems¹⁴.

In light of the existence of the market-driven recycling system for major appliances, and its existing high level of diversion performance, AHAM Canada and RCC believe that the most environmentally and economically prudent approach to improving the EoL management of major appliances is to build on and support this existing system. It is AHAM Canada’s and RCC’s view that to adopt the traditional EPR approach of having a Stewardship Agency manage and control all aspects of EoL major appliance collection, transportation and recycling (activities already being performed in the market) would place that agency in disruptive competitive conflict with existing market players. Such conflict would not only result in the systemic distortion noted in the 2001 OECD report, but would run the very real risk of generating poorer rather than the better environmental outcomes.

6.2 Program Plan Framework

¹⁴ OECD, “Extended Producer Responsibility: A Guidance Manual for Governments”, 2001

As such, AHAM Canada and RCC’s proposed approach to achieving compliance with the BC Recycling Regulation for major appliances is to support and enhance the existing market-driven system in the following areas:

- Enhanced and formalized producer oversight and accountability for the successful on-going operation of the system;
- The adoption of processing standards and a processor certification and audit program to address the proper decommissioning of substances of concern;
- Work with collectors and recyclers to research and promote the adoption of best practices to ensure on-going system performance and improvement over time including the provision of guidance and information on how to cost effectively comply with the proposed processing standard;
- The creation of a branding and communications program to encourage market players to participate in the program plan and to inform consumers of the program and its benefits;
- Development of a systematic approach to monitor and evaluate the performance of the market-driven system including the establishment of collection/diversion tracking and reporting systems to assess system performance over time.

6.3 Enhanced Oversight and Accountability

In order to provide more formalized accountability and oversight for the market-driven recycling system AHAM Canada and RCC will establish a new body tentatively to be known as “The Major Appliance Recycling Roundtable.” This body will be comprised of member companies in the major appliances category including major appliance manufacturers and retailers. In addition to manufacturers and retailers, and in order for this plan to be implemented effectively, the Roundtable will seek to include representatives from BC’s municipal sector in a Municipal Advisory Committee given their significant role in the major appliances collection process. As noted earlier, the Roundtable will either be established as a stand-alone Stewardship Agency or may be incorporated into an existing Stewardship Agency. The final decision on the approach to be taken will be made following plan approval.

The Roundtable’s activities will be funded by its various members in the manufacturing and retailing sectors who meet the definition of Producer under the Recycling Regulation and whom appoint the Roundtable to act as their agent for purposes of achieving compliance with the Recycling Regulation. While municipalities play a key collection role in the market-driven system, they are not considered Producers under the Recycling Regulation and therefore will not be financial contributors to the operation of the plan.

The Roundtable’s role will be to oversee and manage the major program plan initiatives outlined in greater detail below, namely:

- Development of a major appliances processing standard and processor certification process to address substances of concern;
- Development and execution of a program branding and communication program;

- Best practices programs to improve collection and diversion performance;
- The setting of program targets and the implementation of a systematic approach to monitor and report on overall system performance and performance against targets; and
- The development of response strategies and plans to address issues that arise and affect the effective functioning of the system.

6.4 The Major Appliances Processing Standard

Based on studies into the operation of the market-driven system, it has been demonstrated that the processing of the metals portion of the recycling stream is working extremely well. Where the system would benefit from assurance of proper performance, and where AHAM Canada and RCC feel improved diligence and oversight is warranted, is in the area of EoL product decommissioning standards especially in relation to substances of concern such as mercury switches and refrigerants.

In order to ensure proper system performance in this area, the Roundtable plans to adopt a major appliances processing standard that will, among other things, require that major appliances be processed in a manner that ensures all mercury switches are properly removed and recycled, that all refrigerants are properly evacuated in accordance with BC Regulation 387/99 (Ozone Depleting Substances and other Halocarbons Regulation), and that collected refrigerant is either sold for acceptable uses or properly reclaimed or destroyed. The standard will also require the maintenance of specified records and the provision of data necessary to enable the Roundtable to measure and report on system performance.

The standard will be developed by the Roundtable in consultation with system stakeholders including collectors (retailers and municipalities) and processors. As processors may be required to adjust current processing practices in order to achieve compliance with this new standard, the Roundtable envisions focused and detailed consultation with this segment of the market.

Fortunately, there are existing processing standards that can be reviewed as exemplars so the creation of a completely new and customized standard can be avoided. Care will be taken to ensure the standard is designed in a manner to achieve its environmental objectives while not burdening either collectors or processors with unnecessary or costly process or data tracking changes. The phasing in of certain standards requirements may be necessary in order to give processors time to adjust to new processing requirements.

The Standard will be “enforced” by having major appliance retailers and municipalities (who represent the majority of products collected) join the Roundtable (in the case of municipalities through the Municipal Advisory Committee) and agree as a condition of membership that they will either:

- i.) Decommission the appliances they collect in accordance with the processing standard in circumstances where they perform the decommissioning function; or
- ii.) Require the processors to whom they sell or provide the major appliances they have collected, be certified by a Roundtable certification program against the major appliances processing standard.

In either of the above cases, the entity performing the decommissioning will be required to agree that it will adhere to that standard on an on-going basis. Where retailers or municipalities utilize an external processor to perform decommissioning, they will be asked to impose this requirement on those external processors either as a condition of sale or a condition of transferring title should the units be provided to the processor at zero cost. In this regard, it is important to note that the practice of retailers offering to collect EoL major appliances from customer residences when delivering new major appliances is currently a voluntary market-driven decision of individual retailers. Under this plan this practice would remain a voluntary decision of individual retailers. Participation in the plan by any Producer (retailer or manufacturer) is not intended to obligate them to provide EoL product collection services from residences.

The Roundtable will work to conduct periodic spot audits of collectors who are decommissioning appliances and processors accepting appliances from collectors (e.g., retailers and municipalities) who are Roundtable members in order to confirm that they are processing the appliances provided to them in accordance with the standard.

While it is known from research that approximately 80% of EoL major appliances are collected through retailers and municipalities, another 20% moves through alternate channels such as multi-unit residential property managers, scavengers and private residential waste haulers (e.g. 1-800-Got Junk). The Roundtable will work to solicit the participation of these entities in the Roundtable's program and will also seek to partner with end markets (e.g., scrap metal processors) to encourage them to agree to only accept EoL major appliances from entities that have agreed to operate in accordance with the Roundtable's processing standard.

The assistance of the BC Ministry of Environment in encouraging processors to work with the Roundtable will be important to achieving the underlying objectives of the program.

6.4.1 Support for the Processing Standard

In order to support compliance with the processing standard, the Roundtable will undertake an outreach campaign to provide information and educational resources to all companies and municipalities that are engaged in the processing of major appliances. The information and materials used in this outreach campaign will include:

- A brochure and letter explaining the need for mercury switch collection, including information about the environmental and health impacts of mercury if it is not properly managed;
- A list of brands and key characteristics about the appliances that historically contained mercury switches to assist the processors in determining which appliances are most likely to contain switches;
- A step-by-step guide with information about where to find the switches, how to remove them and photos of the switches for easy identification;
- Information recycling options for mercury switches including available and cost effective transportation options.

In addition to the outreach and educational materials, the Roundtable will consult with the following agencies to determine opportunities to further incent or enforce participation in the Roundtable's major appliances processing standard:

- The BC Ministry of the Environment about options to include information regarding appliances recycling and mercury switch removal in the training/certification for contractors that remove refrigerants;
- The Canadian Association of Recycling Industries about educating their members and securing participation in the Roundtable's major appliances processing standard certification program as part of their membership obligations;
- The Coast Waste Management Association and other similar organizations about educating their members and encouraging participation in the Roundtable's standards program;
- The Canadian Steel Producers Association (CSPA) about their ability to enforce a policy among their members to purchase mercury-free scrap from appliances (a similar policy has already been enacted for mercury-free scrap from automobiles) and potentially to purchase scrap steel only from processors who agree to be certified under the Roundtable's major appliances processing standard.

6.4.2 Ensuring Proper Refrigerant Extraction

As noted earlier, the extraction of refrigerants from refrigerating major appliances is regulated under B.C. Regulation 387/99 under the *Environmental Management Act*. The major provisions of this regulation are as follows:

- It is an offence to release an ozone depleting substance or other halocarbon from refrigeration equipment unless expressly permitted to do so;
- An ozone depleting substance cannot be added to equipment that is leaking;
- An ozone depleting substance may not be stored, disposed of or destroyed in a manner that would allow it to enter the environment;
- Refrigerants may only be added to or evacuated from a refrigerating major appliance by an "approved person" as that term is defined in the Regulation;
- Only an "approved person" may service refrigerating major appliances unless the refrigerant has been evacuated;

- Any business that services refrigerating major appliances must ensure that any person who services refrigerating major appliances is an “approved person”;
- Any person who evacuates or re-charges a refrigerating major appliance with an ozone depleting substance must affix a label or tag to the appliance detailing the service performed and, in the case of refrigerant evacuation, a statement that the equipment does not contain an ozone depleting substance, the date it was evacuated and the name and registration of the person and business who performed the service. This information must also be retained in a service log and be made available for inspection;
- Equipment used to evacuate an ozone depleting substance from a refrigerating major appliance must meet the performance standards specified in the regulation;
- **No refrigerating major appliance may be disposed of unless any ozone depleting substances contained in it have been recovered in accordance with the terms of the regulation.**

The Regulation further stipulates that any person who contravenes the regulation is subject to fines of up to \$50,000 for violations of certain provisions of the Regulation and up to \$200,000 for violations of all other provisions of the Regulation.

While the above noted regulation already sets rigorous standards for the extracting of ozone depleting or other halocarbon refrigerants and makes it illegal to dispose of major appliances that have not had an ozone depleting or other halocarbon substance properly extracted and recycled, AHAM Canada and RCC believe there are three additional ways, along with increased government enforcement of the law, in which this program plan can support this existing law and improve on the proper extraction of refrigerants:

- 1.) By implementing an education and outreach program to major appliance collectors and processors to inform them of requirements of Regulation;
- 2.) To conduct research on best practices in refrigerant extraction, storage and recycling and communicate that information to those engaged in the extraction of refrigerants;
- 3.) By including the requirement to extract refrigerants from major appliances in accordance with BC Regulation 387/99 in the Roundtable’s major appliances processing standard and encouraging major appliances collectors (retailers & municipalities, etc.) make certification against, and compliance with, the standard a condition of selling or providing major appliances to a processor.

In this regard, the Roundtable’s standard certification process will require a processor to confirm that they have “approved persons” on staff to remove refrigerants with equipment that meets the standards set out in the Regulation, or that they have a relationship with a 3rd party contractor who meets this requirement. The Roundtable will conduct periodic audits of the processors, and consider developing a reporting regime on transgressions of the Regulation to the BC Ministry of Environment.

6.5 System Best Practices & Recycling Research Program

The Major Appliances Recycling Roundtable will establish the Major Appliance Recycling Research and Information Initiative (MARRII) to conduct research into the environmentally and economically efficient recycling of major appliances and to disseminate findings of that research to stakeholders in the major appliances recycling system.

The overarching mission of MARRII's research and educational outreach work will be to improve the overall recycling rate of major household appliances. MARRII will develop and make available the most accurate technical data about appliance recycling, including advances in appliance recycling technology. The MARRII program will be used as an avenue to work with municipalities and other stewardship agencies to research the issue of illegal dumping and to explore potential initiatives to help mitigate this problem. It will also be used to support research into major appliances recycling in rural and remote areas where the availability of metals processors and long transportation distances to material markets can pose unique challenges. Lastly, MARRII will be used to fund research on recycling opportunities for component materials that today have limited or no economically accessible recycling alternatives.

6.6 System Monitoring & Performance Reporting

Monitoring of the overall performance of the market-driven major appliances collection and recycling system will be accomplished through the following two major activities:

- The major appliances processing standard certification and audit program; and
- Periodic system studies to determine the sales of major appliances into the BC market, the collection and diversion performance of the system including an assessment of appliances collected by collection channel, and the final disposition of materials through processing.

The program will report annually on its activities under the standard certification and audit program including the number of processors certified and the results of its spot audit program of certified processors.

The first periodic study to validate the performance of the BC market driven system for major appliances will be concluded prior to the end of the first year of program operation. A second study into the system's performance will be concluded a minimum of 6 months prior to the program plan's five year expiry date so as to provide the necessary insight to inform the development of a new 5 year plan.

6.7 Pollution Prevention Hierarchy & Design for the Environment

Reduce:

The environmental impact of major appliances can be reduced in three principal ways:

- Reducing toxic components;
- Reducing the materials used in manufacture and use of the products; and
- Increased energy efficiency which is by far the most significant environmental impact of these products when considering their long life cycles.

All of these areas of environmental impact reduction have and will continue to receive significant attention from major appliances manufacturers.

Most importantly, in the area of energy efficiency significant gains have been made over the past 20 years. As the Table #7 below shows the average energy consumption of the typical set of major household appliances has declined by 50.2% since 1990. These gains are the result of a combination of factors including lower minimum energy efficiency standards, major research and development investments by manufacturers, and through promotion and resulting increased market penetration of Energy Star[®] rated and utility rebate and promoted appliances.

Table #7
Improvements in Average Energy Efficiency of Major Appliances 1990 - 2009

	1990 (kWh/Year)	2009 (kWh/year)	% Change
Refrigerator	956	430	55%
Freezer	714	357	50%
Dishwasher	1026	325	68.4%
Range	772	518	33%
Clothes Dryer	1218	234	80.8%
Clothes Washer	1103	921	16.5%
Total:	5788	2785	51.9%

In terms of the reduction in toxic components manufacturers have, as noted earlier in this report, eliminated the use of mercury switches and PCB containing capacitors. Significant changes have and will continue to be made in the types of refrigerants used in refrigerators and freezers as manufacturers seek out refrigerants with lower GHG having already eliminated ozone depleting potential (ODP) refrigerants from their products. Likewise, in terms of refrigerator insulation foam, the development of foam blowing agents which have significantly lower GHG potential and no ODP are being researched and used. Major appliances manufacturers have also been working to discontinue the use of brominated flame retardants in plastics.

In terms of material reduction, manufacturers have been working to reduce the amount of material used in the manufacture of many major appliances and in the packaging used to transport them. These efforts must, however, be balanced against ensuring consumer safety and the overall protection and lifespan of the product.

On the issue of water consumption, manufacturers have been able to reduce water consumption through design changes to dishwashers and innovations such as front-load and high efficiency top-load washers. For example water consumption in dishwashers has been reduced by 37.3% (litres/cycle) between 1990 and 2009. Water usage in washers has also been reduced by 43.4% between 2005 and 2010. These reductions in water consumption also significantly reduce energy demand as there is less water to heat to perform the same cleaning task.

In addition to the above activities AHAM is currently engaged in the development of a North American Sustainability Standard for major appliances. This standard will address the comprehensive “cradle to cradle” impact of major household appliances in a systematic and documented way.

The Roundtable will report on progress in each of these areas annually in their annual report on the program.

Reuse:

As previously noted, the market-driven system for major appliances is characterized by a small but generally healthy reuse market. Given the relative high value and long life spans of major appliances they naturally lend themselves to reuse, either through the resale of second hand units or in the removal and resale of parts. That said, this segment of the market has not been growing in part due to the declining real dollar price points of entry level major appliances, special financial deals offered by retailers on new units, and because the higher energy consumption rates of older units that typically find their way into the reuse market. On this latter point of energy consumption, the promotion of reuse of older major appliances is unlikely to have positive environmental benefit given that older units can consume up to 50% more energy than new units. And, given the long life-span of major appliances, encouraging the retention of these more energy inefficient units is unlikely to make environmental sense.

Recycle:

As noted in Section 6, the current market-driven system for major appliances achieves world leading collection and recycling rates. From the three market studies completed by CAMA and AHAM in the last 6 years it has been determined that the collection rate for major appliances ranges between 95% and 99%, and the overall diversion rate ranges between 83% and 89%. AHAM Canada and RCC are committed through this plan to maintain and enhance this performance. Activities will include work on the recovery rate and proper processing of toxic substances such as mercury switches and refrigerants and exploring through MARRII activities and opportunities for recycling of other non-metal components.

6.8 Promotion and Education

Consumer Awareness:

The long-standing nature of the market-driven recycling system for major appliances and its high rates of collection and recycling, indicate that consumers already have a high degree of knowledge about disposal options for their EoL major appliances. Unlike other programs designed for negative value products where recycling systems didn't exist prior to program start-up, the major appliance program is not faced with having to educate consumers about a completely new system. The system has existed for decades and consumers have developed a sound knowledge of it and have been successfully accessing its various collection channels for long periods of time.

That said, the Roundtable intends to engage in a variety of communication activities to build consumer awareness of its activities and programs and to provide information about available collection alternatives and the environmental merits of proper major appliance decommissioning and recycling. These activities will include:

- Point of sale materials for retailers to use with major appliances purchasers informing them of the Roundtable's activities and programs and encouraging them to only provide their EoL major appliances to a collector who has agreed to participate in the major appliance processing standard certification program;
- Communication tools for collectors to use with consumers that will enable them to identify themselves as a member of the Major Appliances Recycling Roundtable so as to position themselves as responsible recyclers;
- A website that will inform consumers about recycling options for their EoL-major appliance and assist them in locating the services of a collector who has agreed to only utilize the processing services of a certified processor. This website will also provide information in a downloadable form on the Roundtable's programs and research and educational outreach activities;
- The program will participate in the RCBC's recycling hotline and Recyclepedia;
- The program will develop a media relations strategy and plan to support its launch and to generate awareness through earned media;
- The program will have a PR/earned media program designed to generate on-going media coverage of the program and major appliance recycling initiatives and issues;
- The program will issue annual media releases following the approval of its annual reports by the Ministry of Environment and will post the annual report on its website for interested parties to read. The report will include information on the program's activities and initiatives, its collection and diversion performance, information on the environmental and economic benefits of major appliances recycling and information on other environmental performance dimensions of major appliances including energy and water consumption;

System Stakeholder Awareness:

To maximize participation in the major appliances processing standards program, the Roundtable will undertake the following promotional and educational elements:

- Develop and implement a promotional/media strategy to let potential participants know about the Roundtable and its activities including the establishment of a major appliance processing standard certification and audit program. This effort will utilize a variety of industry communications (newsletters/publications, conference speaking engagements, etc.) to inform the affected sectors (i.e., retail, municipal, scrap processors) about the Roundtable major appliance program and the benefits of membership and in the case of processors the benefits of certification;
- Develop and distribute educational resources to processors/dismantlers and municipalities that process appliances to:
 - inform them of the requirements of Regulation 387/99 pertaining to refrigerant extraction and to advise them on proper procedures and disposal options;
 - help them to easily identify which appliances contain mercury switches. These resources will include:
 - A list of appliances by make and/or model (when possible) that contain mercury switches;
 - Laminated posters with visual examples of what the switches look like;
 - A step-by-step guide with instructions for how to easily remove mercury-containing switches from appliances.
 - Develop a labeling system for end-of-life appliances to clearly mark that a switch has been removed and that it is mercury-free.

6.9 Program Administration & Funding

The program plan will be governed by the Producer members (i.e., manufacturers and retailers) of the Major Appliance Recycling Roundtable which will either be established as a stand-alone Stewardship Agency or incorporated into an existing Stewardship Agency. The final decision on the approach to be taken will be made following plan approval.

Funding for the activities of the Roundtable will be accomplished through fees levied on the sale of new major appliances into the BC market by members of the Roundtable who meet the definition of Producer under the Recycling Regulation. The precise cost allocation formula and fee schedule will be determined by the initial members of the Roundtable following plan approval.

It is known from the three major studies on the current market-driven recycling system cited in Section 5 of this plan that some collection facilities for major appliances may charge the public a fee to remove refrigerants from major appliances. Additionally, some

retailers charge a fee for new appliance delivery and this fee often includes the removal of the old appliance. Neither the refrigerant removal nor retail delivery/pick-up fees are requirements or a component of this stewardship plan.

Recognizing that challenges exist with a program built on a highly successful, already existing market driven collection and recycling system where it is known that both free collection and collection for a fee services are offered, the program commits to conduct a more detailed study, in collaboration with stakeholders, to assess the extent to which the public has access to free versus fee for service appliance collection services. This study of accessibility and fees in the current system will be undertaken during the first year of the plan. Based on the findings of this study the stewardship agency will, where necessary, identify options to ensure consumers have reasonable access to free disposal options for the management of end-of-life major appliances. The Program will provide a report to the Ministry by May 2013 outlining the findings of the study and will work towards resolving identified issues by October 30, 2013.

6.10 Ensuring Compliance

In order to ensure that all obligated Producers of the program products are in compliance with the Recycling Regulation, the Roundtable will conduct a continuous market surveillance and producer recruitment effort. The Roundtable will actively research, identify and recruit Producers of program products.

Techniques to identify potential Producers will include internet searches, store visits, and information received from existing members. Once a potential producer is identified, the following is the compliance process protocol to be followed by the Program in recruiting producers of such products:

1. Notification by telephone, letter or email advising of the regulatory obligation and inviting the producer to join the Program within a 30 day period.
2. Two formal letters to the producer noting the prior contact, referring to the regulatory obligation and advising the producer of the Program's intention to notify the Ministry for enforcement purposes if compliance is not demonstrated within a second 30 day period (which may be accomplished by joining the Program or by participating as a producer regulated under Part 3 of the regulation).
3. The Program will issue a letter to the Ministry of Environment advising of the circumstances including the name of the producer, the product and location of place of sale, with the request to the Ministry of Environment to investigate and if appropriate conduct enforcement proceedings.

6.11 Dispute Resolution

The program will develop a dispute resolution procedure for fee paying Producer members of the Major Appliances Recycling Roundtable that will be incorporated into the terms of the membership agreement.

The program will also establish a dispute resolution system for processors to resolve disputes that may arise in the administration of the major appliances processing standard certification and audit program. This procedure will be transparently spelled out in the terms of the processing standard.

7. Measurement of Program Performance

7.1 Recovery & Diversion Rates

The Aggregate Collection Rate:

The BC Recycling Regulation requires that programs such as the major appliances stewardship plan achieve, within a reasonable time, a recovery rate of 75% or another recovery rate established by the director. The Recycling regulation further states that a program plan must also achieve any other performance requirements or targets established by the director, and any performance requirements or targets contained in the plan.

On the matter of the overall system diversion rate, the Roundtable, will as noted earlier, undertake a detailed study into the BC major appliances recycling system within the first 18 months of Program operation in order to develop a more complete picture of how the market-driven system functions in BC including its overall diversion rates. This work will enable the Roundtable to ascertain with greater precision how the performance of the BC major appliances recycling system compares to the Canadian, U.S. and North American systems as a whole.

The interim target recovery rate for the first two years of operation of the program will be the 75% target required by the Recycling Regulation. The data gathered during the study will be used to establish final recovery rate targets for years 3-5 of the program. These targets will be submitted to the BC MoE by April 1, 2014, and prior to that will undergo public consultation.

The Roundtable will use this first system study and subsequent studies to measure the ongoing recovery performance of the system relative to these performance targets. Where such research demonstrates that the recovery rate has fallen below these targets, the Roundtable will undertake to develop and where feasible, implement initiatives to return the system's performance to the required recovery rate level. Similar to the SBR International study referenced earlier, it is envisioned that these studies will utilize an end-of-life retirement model to produce theoretical estimates of the quantity of major appliances entering end-of-life annually. These estimates of the quantity of major

appliances available for collection will serve as the generation total or the denominator in the return rate calculation. The numerator, or the measure of the quantity of retired major appliances that actually enter the market driven recycling system for processing, will be determined through surveys of collectors and processors extrapolated to the overall system. As major appliances aren't typically tracked by processors by individual appliance type (i.e. # of refrigerators or # of ranges collected), it is anticipated that the return rate calculation will be computed on a total weight basis using average weight estimates for the different appliance types entering the end-of-life processing system.

Processing Standard Compliance:

The Roundtable will also report annually on the number of collectors (i.e., retailers and municipalities) who agree to make processing of major appliances in accordance with the Roundtable's processing standard a condition of selling or providing the units they have collected to a processor. In addition, the Roundtable will report on the number of major appliance processors (i.e., scrap metal dealers or shredders) who agree to be certified against the major appliances processing standard and agree to submit themselves to periodic audits against that standard.

It is the intent of the program to support and engage an increasing percentage of retailers, municipalities and processors each year and to encourage them to make certification against the Roundtable's processing standard a mandatory component of their appliance recycling/processing contracts. However, it is also recognized that there are external circumstances (i.e., pre-existing multi-year contracts) that may prohibit some retailers and municipalities from immediately switching to a recycler/processor that agrees to be certified against the major appliances processing standard.

In addition, the program will track the participating retailers and municipalities according to geographic range and the proportion of the province they serve and will strive to continually increase the coverage provided by the program.

Because there is only limited existing information on the exact number of companies engaged in the decommissioning and processing of major appliances in BC, the program will need to gather information in Year 1 to more accurately determine this number. This information will be reported after Year 1. The program will focus on increasing the percentage of the recyclers and dismantlers that are participating in program year after year.

Processor Audits:

The program also intends to report annually on the number of processor audits it completes each year and, subject to privacy and confidentiality constraints, to report generally on the results of those audits.

Mercury Switch Recovery:

Through the reporting obligations to be established under the processing standard the Roundtable will gather data and report on the collection of mercury switches removed pursuant to the processing standard.

Refrigerant Extraction:

Through the reporting obligations to be established under the processing standard the Roundtable will gather data and report on the collection of refrigerants removed pursuant to the processing standard.

7.2 Annual Report

The Program will publish an annual report within 6 months of the end of each year of the program plan detailing the activities of the plan during the year and reporting on its performance.

8. Stakeholder Consultations

A stakeholder consultation process was held during the months of November and December 2011 as required by the Recycling Regulation. The consultation process included the following initiatives:

- The draft plan was posted on www.bcstewardsconsultations.com on November 10, 2011;
- The draft plan was also posted on the RCBC website;
- E-mail communication to stakeholders advising of the posting was completed at the time of posting and a notification to stakeholders was also issued through the RCBC member advisory service;
- 2 in person consultations meetings were held. One in Victoria (November 29) and in one Vancouver (November 30);
- 3 webinars were conducted including a general audience webinar (November 29), a southern interior webinar (November 30) and a northern webinar (November 30);
- Written submissions were also invited from all stakeholders up to the close of business on December 12, 2011;
- Meetings were also held with a variety of plan stakeholders including municipalities, metal recyclers, major appliance manufacturers and major appliance retailers.

Results of these consultations are summarized in Table #8 below. The left hand column describes the comment or question received either through a written submission or at any one of the in-person or webinar based consultation sessions. The right hand column provides the program plan sponsors' response to the question or comment. To avoid

repetition, comments or questions that were deemed thematically similar in nature have been grouped under a single summary comment or question.

Table #8
Summary of Comments/Questions Received at Consultation

Comment or Question Received	Response
General:	
Support the plan's general approach of proposing to build on and not disrupt the pre-existing recycling system for major appliances.	The most cost effective and least disruptive way to improve major appliances recycling is to build on the existing well-functioning system for major appliances recycling.
Why is this category of products being regulated under the Recycling Regulation when recycling markets are already adequately dealing with it?	The decision to include major appliances under the Recycling Regulation was taken by the BC MoE. The plan sponsors agree that existing recycling markets already achieve a high level of waste diversion performance for major appliances. The proposed plan seeks to improve on that performance and introduce a level of oversight and accountability that should improve the system over time.
The draft plan has insufficient detail to assess whether it will achieve its stated purpose. The Roundtable should be formally established and a more detailed plan developed.	The plan sponsors feel the plan has adequate detail on the operation of the existing market driven recycling system for major appliances and the proposed enhancements that the plan will provide to that system. The plan sponsors have also agreed to consult with stakeholders on the development of the proposed processing standard and to work with municipalities to explore issues related to abandoned appliances and the challenges of rural and remote municipalities.
Why is this program being carried out through the Recycling Regulation. Would it not be more cost effective to simply pass legislation setting standards for recyclers?	This is a question better addressed to the government of British Columbia. Major appliances have been included with the Recycling Regulation and as such the plan sponsors are required to develop a stewardship plan in accordance with the regulation.
Governance:	
What would be local government's role in the proposed plan?	Local governments involved in the collection of major appliances will be asked to participate in the program in two

	<p>ways:</p> <ol style="list-style-type: none"> 1.) By obligating any processor to whom they provide major appliances to be certified against the program's processing standard and to agree to periodic audits by the program against that standard; and, 2.) By participating in the Municipal Advisory Committee.
<p>Who are the parties that will make up the Roundtable? How will municipalities be included?</p>	<p>The Board of Directors of the Roundtable will be comprised of the Producers of the products included in the program plan (i.e., manufacturers and retailers).</p> <p>Municipalities will be invited to participate in the Roundtable's activities through the Municipal Advisory Committee.</p>
<p>Program Funding/Fees:</p>	
<p>Will there be any financial incentives provided by the Stewardship Agency to encourage the collection and recycling of the products?</p>	<p>The program will not be providing any financial incentives to collectors or processors. The plan sponsors believe that the successful functioning of the market driven collection and recycling system, which is financially supported by the value of the metals contained in appliances, is evidence that additional incentives are not needed. The plan will however, fund new activities to support the system including processor audits, communications and research and development activities.</p>
<p>The plan should provide financial incentives for collectors and processors in circumstances where the metals market declines.</p>	<p>The plan sponsors believe that the introduction of such a market price insurance program for collectors and processors would be extremely complex and costly to implement. Furthermore, in order to be equitable it would also likely require the creation of a fund financed by levies on metals and eventually other materials when market prices rise. The plan sponsors believe it is more appropriate to allow the economic players in the current system to benefit from metals prices when they rise and to develop strategies to address situations when metals</p>

	prices fall. The system has worked successfully on this basis for decades and is unlikely to be well served by the attempted introduction of a market distorting price insurance mechanism.
The plan appears to be piggy-backing on the financial value of scrap metals. There is no evidence that a stand-alone major appliances program would have positive economic value.	There is no evidence that the recycling of major appliances is being subsidized by other forms of scrap metal. Major appliances have been a sought after as a source of scrap metal by recyclers for decades because they have value. Furthermore, the plan does not propose to establish a stand-alone program for major appliances. To disaggregate major appliances from the existing scrap metals recycling stream would be economically unwise as it would destroy important economies of scale and drive up costs.
Some retailers and municipalities charge a fee to collect/dispose EoL major appliances. This suggests the entire cost of the system is not covered by the metals value. The charging of a collection fee may be a barrier to consumer participation and should be addressed in the plan.	Given the collection rates being achieved by the existing market-driven system, the plan sponsors do not believe there is evidence that where collection fees are being charged, they are deterring participation in the system. The plan sponsors are also prepared to work with other stewardship agencies and municipalities on researching and exploring the causes of and potential solutions to the illegal dumping of EoL products.
The cost of the stewardship program should be internalized in the price of the product.	Any fees that will be used to fund the program will be levied on the Producers of the regulated products. Whether individual Producers choose to internalize those fees in the product price or show them as a visible fee is a decision that will be made by individual Producers. How individual Producers choose to manage any fees levied under the program is not a decision within the control of the Stewardship Agency that will operate this program.
Is there an estimated cost for the administration of this program? Do you know what the fees charged to Producers will be?	The specific cost of the program and the fees necessary to cover those costs have not yet been developed. They will be developed in early 2012 following approval

	of the plan by the BC MoE.
There should be penalty applied for appliances that end up in local government landfills or incinerators.	This is a suggestion that is beyond the scope of authority of the plan sponsors.
Will there be an eco fee levied at the retail level?	Any fees that will be used to fund the program will be levied on the Producers of the regulated products. Whether individual Producers choose to internalize those fees in the products price or show them as a visible fee is a decision that will be made by individual Producers. How individual Producers choose to manage any fees levied under the program is not a decision within the control of the Stewardship Agency.
Processing/Reporting Standards:	
The plan's proposed reporting requirements for collectors or processors need to recognize that many collectors and processors do not separate appliances from the general scrap metal recycling stream. Reporting requirements must not be so onerous as to add unnecessary new costs to collectors or processors.	The plan sponsors intend to consult with collectors and processors before setting reporting requirements to ensure that they do not impose an unnecessary administrative or cost burden.
How will compliance with the proposed processing standard and reporting requirements be ensured?	Compliance with the standards will be achieved by having collectors (principally retailers and municipalities) obligate the processors to whom they provide appliances, as a condition of providing them appliances, to agree to be certified and audited against the processing standard. If the processor refuses to be certified and audited against the standard the collector will seek out another processor who is willing to operate in accordance with the standard. The Stewardship Agency will, if requested, assist collectors in identifying certified processors.
How will compliance with the processing standard be achieved for processors who don't elect to be part of the proposed Roundtable process?	As is the case with other stewardship programs, this program will not be able to force processors operating outside the program to conduct business in accordance with its standards. However, by seeking to involve as many collectors of major appliances as possible in its plan, the

	<p>program will attempt to ensure that the vast majority of EoL appliances will be collected by collectors who have agreed to deal only with certified processors. Over time it is envisioned that this will mean that vast majority of EoL major appliances will flow to processors who are operating in accordance with the standard. That progress will be monitored and reported by the plan.</p>
<p>The proposed processing standard should have been developed before submission of the plan to the BC MoE and should have included consultations with stakeholders including recyclers and municipalities</p>	<p>The plan sponsors intend to consult with stakeholders on the development of the processing standard post plan approval.</p>
<p>Plan should consider protocols to address the recycling of non-metal components.</p>	<p>During development of the standard consideration will be given to all component materials. When examining the different component materials consideration will also have to be given to the availability of recycling technologies for different material components, the cost of those technologies as well as the cost to recycle different materials. The introduction of certain components of a processing standard may have to be phased in over time when new and cost effective recycling technologies are developed and available.</p>
<p>The recycling and processing standard should be extended to include a component to promote reuse.</p>	<p>The channeling of EoL major appliances into the reuse stream already occurs within the market driven system as collectors can often obtain greater value selling newer collected units to second hand shops or refurbishers than to recyclers. The plan sponsors believe that this economic incentive is more than sufficient to drive the reuse of collected major appliances and that inclusion of a reuse requirement into the processing standard is unnecessary.</p>
<p>The value we receive for recycled metals from appliances does not cover our costs of collecting and processing appliances. Processing/reporting standards may increase these costs further.</p>	<p>During consultation, the plan sponsors heard from a number of municipalities who stated that recycling of major appliances was a net revenue generator for their recycling programs. That said, the Stewardship Agency to be developed under</p>

	<p>this plan will work with municipalities through the proposed Municipal Advisory Committee on developing a better understanding of major appliance recycling economics including options on how to structure financially profitable major appliance recycling programs.</p> <p>Regarding the processing/reporting standard the plan sponsors intend to consult with stakeholders before finalizing these standards to ensure that they do not impose an unnecessary administrative burden.</p>
<p>A higher level of sensitivity needs to be exhibited by recyclers in respect of handling refrigerants.</p>	<p>The processing standard will include elements related to the proper extraction of refrigerants in compliance with existing government of BC regulations.</p>

<p>Will the processing standard also address mercury switches and compressor oil?</p>	<p>The plan contemplates the removal of mercury switches being part of the processing standard. The removal of compressor oil will be discussed during the consultation process on the standard in the first half of 2012.</p>
<p>Appliance manufacturers are putting more and more technology and circuit boards into new appliances. The processing standard should address this.</p>	<p>During development of the standard consideration will be given to all component materials. However, in examining the different component materials consideration will also have to be given to the availability of recycling technologies for different material components, the cost of those technologies as well as the cost to recycle different materials. The introduction of certain processing standards may have to be phased in over time if and when new and cost effective recycling technologies are developed.</p> <p>It is also anticipated that the Sustainability Standards being developed for major appliances by AHAM will address issues such as this. The Stewardship Agency intends to report on progress on these sustainability standards in its annual reports.</p>
<p>Collection Network:</p>	
<p>What types of changes can the public expect to see with regard to the recycling of major appliances? Will they be able to leave appliances at curbside or take them to recycling depots?</p>	<p>The plan does not contemplate making changes to the current means of collecting major appliances. The plan's intent is to monitor and support the present highly effective system. There are no plans to either institute a curbside collection system or to require consumers to take their major appliances to the depots currently used for the collection of consumer electronics, beverage containers or small appliances.</p>
<p>The economics of the market driven system may not work as well in rural areas with limited access to local metal recyclers.</p>	<p>The plan sponsors believe that further research needs to be done to quantify and validate the issues associated with major appliances recycling in rural areas. The plan has been amended to reference this task as an area to be addressed as part of</p>

	the program's research and development fund
Some municipalities have a policy to discontinue collection of products once a stewardship plan is approved for those products. This may leave consumers in these areas without a collection option. The plan should develop a collection infrastructure in these areas.	During consultation the plan sponsors heard from a number of municipalities who stated that major appliances recycling was a net revenue generator for their recycling programs. In light of this it may be financially disadvantageous for municipalities to exit the major appliances recycling business. The plan sponsors believe that it may be more beneficial for municipalities considering exiting the major appliances recycling business to work with the program on developing a better understanding of major appliance recycling economics including options on how to structure a financially profitable major appliance recycling program.
Will the plan have a specific strategy to address the unique needs of smaller and remote municipalities?	The plan sponsors believe that further research needs to be done to quantify and validate the issues associated with major appliances recycling in rural areas. The plan has been amended to reference this task as an area to be addressed as part of the program's research and development fund
The plan is lacking a description of current service level/depot coverage standards. The plan doesn't contain any commitments regarding service levels for consumers seeking a recycling option for their appliances.	Based on the research that the major appliance industry has conducted over the years on the functioning of the market-driven recycling system and the very high collection and diversion rates those studies have demonstrated, the plan sponsors are of the opinion that the current system provides extremely good disposal option coverage for consumers. That said, the plan sponsors have committed in the plan to conduct a more detailed study on the BC major appliances collection system in the first 12 months of plan operation. This study will include a component that will assess the level of geographic coverage provided by the market-driven system.
Illegal dumping of end-of-life appliances is occurring in some rural and some urban municipalities. The plan should include something to address this issue including	The plan sponsors are prepared to work with other stewardship agencies and municipalities on better understanding the causes of illegal dumping of EoL products

working with other stewardship agencies and local governments to develop solutions.	and exploring potential solutions. A reference to engaging in this work has been included in the plan under the research & development section of the plan.
Included Products:	
Why is this program only addressing household appliances? If the manufacturers sponsoring this plan don't manufacture commercial appliances and that is the reason they are not included that should be stated in the plan.	This plan has been developed by the manufacturers and retailers of household/residential appliances. Commercial appliances are manufactured, and distributed by a different set of companies than those involved in this program. A reference to this fact has been included in the plan.
Are window air conditioners or water heaters covered under the plan?	Window air conditioners are included in the program but water heaters are not.
Is there another plan being developed for commercial appliances?	The manufacturers and retailers of residential appliances who are sponsors of this plan are not aware of what the manufacturers and distributors of commercial appliances may be contemplating.
Performance Measures & Reporting:	
The ESABC annual report provides a detailed breakdown of the ultimate disposition of collected materials including recycling, energy recovery, and residual disposal including the country. All stewardship programs should include a similar accounting.	The Stewardship Agency will produce an annual report that meets the requirements of the Recycling Regulation. As noted in the plan that report will also include information on other environmental performance measures for major appliances including energy and water efficiency improvements.
The plan should include performance measures on average lifespan of recycled appliances and energy efficiency.	The inclusion of such performance measures is beyond the scope, authority or influence of this program. Issues like energy efficiency are driven by markets, incentive programs like Energy Star [®] and U.S., Canadian and other international energy standards set by government. The proposed major appliances program for BC would have no ability to influence these matters and therefore it would be inappropriate to use them as a performance measure. That said, the plan sponsors have agreed to include in the program's annual report information on improvements in the areas of energy and water use efficiency.

Communications:	
Consumers don't understand the recycling value of these products and that may be a disincentive to participation. The plan should do something to address this.	The plan will have communication program with a component targeted at consumers. Inclusion of this type of messaging will be considered in the development of that communication program.