

**Analysis of Environmental Handling Fee Schedules for Selected,
Regulated, Industry-led, End of Life Electronics Recycling
Programs in Canada**

***CALCULATION OF ENVIRONMENTAL HANDLING FEES
FOR PHASE II PRODUCTS***

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1.0 INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

Electronics Product Stewardship Canada (EPSC), along with the Retail Council of Canada (RCC), has spear-headed the development of industry-led and managed end-of-life electronics stewardship programs in response to provincial regulations. Currently, three non-profit programs are operational in Canada: SWEEP in Saskatchewan, ESABC in British Columbia and ACES in Nova Scotia.

Each of these programs uses an Environmental Handling Fee (EHF) to provide program revenue for the collection, transportation, responsible recycling and administration of regulated electronics in their jurisdictions. Currently all three programs use EHF's for the following Phase I regulated products: desktop and notebook computers, computer monitors, desktop printers, mice, keyboards and televisions. This fee applies to all suppliers of the regulated products, including consumers and Industrial, Commercial and Institutional (ICI) purchasers.

The advent of the province of Nova Scotia's regulation which designates February 1, 2009 for the implementation of recycling programs for "Phase II" electronic products, along with the province of British Columbia's intent to expand its "Phase I" electronics, means that a new schedule of fees are required for a range of telecommunication (phones, pagers, etc.) and audio-visual equipment (VCRs, DVD players, etc.).

The objective of this study is to analyze and make recommendations for EHF's for "Phase II" regulated products as listed in the Nova Scotia regulation. Although the initial focus is on Nova Scotia and the ACES program, this initiative has been jointly commissioned by ACES and its counterparts in Saskatchewan (SWEEP) and British Columbia (ESABC). The intent is to harmonize (as much as possible) these EHF's across jurisdictions as their respective programs are rolled out.

The EHF study was carried out by InterGroup Consultants Ltd. and Forkast Consulting (collectively the Research Team). Both have extensive experience in utility cost of service and rate design projects.

Overall leadership and guidance for the study was provided by the Study Advisory Committee which consisted of representatives of the three commissioning programs and key industry stakeholders as follows:

- Resource Recovery Board Fund (RRFB) – Program manager for ACES
- Product Care Association (PCA) – Program manager for SWEEP
- SARCAN Recycling – Depot manager for SWEEP
- Encorp Pacific (Canada) – Program manager for ESABC

- Electronic Products Stewardship Association (EPSC)
- Retail Council of Canada (RCC)
- Other industry stakeholders.

This Committee was involved in all facets of the study including determination of data requirements (and identification of data sources), data gathering, contributing knowledge from experience, providing feedback on ideas generated by the Research Team and reviewing the draft study report. The Research Team interacted extensively with the Study Advisory Committee through conference calls, a methodology workshop held in Winnipeg in September 2008, and review of the draft study report.

1.2 METHODOLOGY IN BRIEF

The methodology used in this study for developing the proposed EHF's is based on a set of Guiding Principles developed and adopted by the Study Advisory Committee, comprised of representatives from the three programs that commissioned the study and key industry stakeholders. These Guiding Principles drew heavily on long established and widely applied principles used in utility cost-of-service and rate design. At the core of the utility cost-of-service approach is fair allocation of utility costs to different customer classes. The overriding principle for achieving fair allocation is cost causation which requires costs to be allocated according to the reason the costs were incurred. Other principles include transparency, replicability and ease of understanding by both customers and the utility's regulator. These principles lead to specific technical and analytical means of determining fees. The fee calculations in this study are based on the application of these well established, principle based methodologies. The analysis is carried out for the three jurisdictions that commissioned the study – Nova Scotia, Saskatchewan and British Columbia using a three stage process of preparation, research and refinement, and documentation. Further details on the methods used in this study is provided in Chapters 6 and 7.

1.3 CAUTIONS AND LIMITATIONS

Design and implementation of The Phase II end-of-life electronics recycling program is in its formative stages. At the time this report was prepared, there were no active recycling programs in Canada that employed EHF's for Phase II products and very little practical experience with the collection, consolidation, processing and administration of Phase II products. For this reason, considerable professional judgment had to be applied to accommodate uncertain and imperfect data. Many assumptions were necessary in the calculation of the EHF's. The research team endeavoured at all stages of the research to cross check the information and assumptions used in this report with various stakeholders and industry professionals, as well as against the related research that has been completed to date. Specific limitations and cautions on the research include the following:

- i. Historic sales and shipping data were not available for all product categories that could be captured under the Phase II list of products within the time limitations on this research. Therefore, assumptions were made that EHF's could be applied to these products based on similar product categories for which information was available.

- ii. During the course of the research it became clear that the Canadian Wireless Telecommunications Association (CWTA) in Nova Scotia, had an interest in managing their own end-of-life recycling program. Although EHF's were calculated for cell-phones, the research team recognizes that they may be handled by way of a separate program that may not include a visible EHF.
- iii. Sales forecasts for future years are based on a simplified set of assumptions. Changes to economic conditions, sales trends and the introduction of new products can materially affect product sales and these forecasts.
- iv. Estimates for different product parameters (e.g., product service lives and weights) were based on the best available information from previous studies. Where published sources for these data could not be identified, estimates were developed by InterGroup and reviewed for reasonableness by the Study Advisory Committee.
- v. EHF calculations have been prepared with the goal of being harmonized between Nova Scotia, Saskatchewan and British Columbia; therefore, operating and administrative cost profiles have been based on representative costs across the three jurisdictions. While it is recognized that each jurisdiction has its own unique operating and cost characteristics, the research team is satisfied that the harmonized EHF's are appropriate for use in the three jurisdictions, based on the quality of data available at the time of this study.
- vi. It is expected that future fees will require adjustments as Phase II product collection experience evolves over the next few years. Program experience will provide a more robust historic data source from which to confirm or revisit future EHF's.

1.4 DOCUMENT STRUCTURE

The report is organized into the following chapters:

- **Chapter 2** Environmental Handling Fees Guiding Principles and Criteria: This chapter provides an overview of the key principles and criteria that guided the development of the EHF's for Phase II products.
- **Chapter 3** Current Programs: This chapter provides a brief overview of the current electronics recycling programs operating in Nova Scotia, Saskatchewan and British Columbia.
- **Chapter 4** Legal and Regulatory Framework: This chapter briefly reviews the legislation governing the electronics recycling programs and the status of the regulations with respect to Phase II electronics.
- **Chapter 5** Phase II Electrical and Electronic Equipment (EEE): This chapter provides an overview of the types of products included in the list of Phase II products.

- **Chapter 6** Process for Calculating EHF: This chapter reviews the process used to undertake the research.
- **Chapter 7** EHF Calculation Methods and Results: This chapter documents the methods used to calculate the EHF and provides proposed EHF for the different product categories.
- **Chapter 8** Monitoring and Recommendations: This chapter provides the Research Team's recommendations for monitoring and further research.

2.0 ENVIRONMENTAL HANDLING FEES GUIDING PRINCIPLES AND CRITERIA

The three programs have formally adopted a set of Guiding Principles that were developed to inform the methods used to calculate the proposed EHF in this study. The Research Team notes that these principles are consistent with first principles of utility cost-of-service analysis and rate setting for regulated utilities. The purpose of a utility cost-of-service study is to develop a method for fairly allocating utility costs to different customer classes. The overriding principle is one of cost causation, that is, costs should be allocated in a manner that reflects the reason the cost was incurred. While it is important for a utility cost-of-service study to be technically and analytically sound, there is also a degree of judgment involved. Further, a cost-of-service study must be transparent, replicable and understandable by customers and the utility's regulator. The Guiding Principles adopted by the three programs are as follows:

1. **The EHF will be set for each obligated product category** – Similar to customer classes for a utility, product categories can be defined based on common characteristics. As with the development of customer classes for a regulated utility, the definition of product categories should be analytically sound while also being feasible to administer and communicate. However, there is necessarily a degree of judgment involved.
2. **The EHF will be based on current estimated costs of each product category divided by the current estimated unit sales for the product category** – Similar to a utility cost-of-service study, both the costs to provide the service (or revenue requirement) and the forecast sales or revenues must be developed on a prospective or forward looking basis. The forecasts need to consider historic costs and revenues as well as consider expected trends in the forecast period.
3. **The EHF will cover costs of managing historic and orphaned products** – The EHF setting process needs to consider that there will be products whose steward or manufacturer is no longer in operation. Costs related to processing these products need to be considered in the EHF setting methodology.
4. **The EHF will consider cost estimates for operational costs (collection, transportation, processing); common costs (non-operating costs that are shared amongst product categories), including administration, communication, contingency accrual, common research and development costs; product specific costs, including specific research and development costs; end of life costs (dismantling and disposing material cost) and other non-operational category specific costs** – Similar to a utility cost-of-service study, it is necessary to develop reasonable, defensible cost estimates. Different estimation methods may be required for different cost categories.

5. **There will be no cross-subsidization of operational and product specific costs across product categories** – Similar to a utility cost-of-service study, it will be necessary to prepare cost and revenue forecasts in sufficient detail by category in order to ensure that costs incurred by specific categories are allocated to those categories.
6. **The costs of any obsolete product technology will be applied to the successive product technology** – The EHF setting methodology needs to consider products that are at all stages of their life cycle, from emerging technologies to those that are in decline.
7. **EHF will be set in a fair and transparent manner that is openly communicated with all program members** – As with a utility cost-of-service study, transparency and customer acceptability are important considerations in preparing a cost allocation method. The study must consider stakeholder input and be documented in a way that allows the cost allocation method to be clearly communicated.
8. **The program will not operate with an ongoing surplus or deficit. If market changes require the EHF to be updated, the deficit or surplus amount will be factored into setting the new EHF. However, the program may accumulate a sufficient operating contingency reserve (OCR) to ensure stable program operations through variable economic conditions (see “EHF Setting Criteria” 3 & 4 below for more details)** – Many regulated utilities maintain deferral accounts that track the differences between actual costs and revenues and forecasts used for rate setting. In the case of the electronics recycling programs, an operating reserve will be maintained that is sufficient to cover one year of operating expenses. The costs to build up the operating reserve will be included in the calculation of the EHF.
9. **Sufficient notification will be provided to all program members in the event of EHF changes, and the revised EHF will not commence in the period between September 1 and January 31** – Timing of EHF changes will be important to customer acceptability. Methods for clearly communicating the basis for EHF changes will need to be prepared.

In addition to the Guiding Principles, the three programs developed and adopted specific criteria for the development of the Phase II product EHF. These EHF Setting Criteria are as follows:

1. **EHF Period: The EHF will be based on estimated costs and product sales for approximately a 3-year period with the intent of maintaining a consistent EHF throughout that period.** Cost forecasts have been prepared for three years using 2008 estimates as the base year. Cost estimates were prepared for Year 1, Year 2 and Year 3 after the base year. A set of EHF were calculated based on the three year average, such that a single set of EHF could be maintained for the three year period.

2. **Common cost allocation:** A method for allocating common costs was defined based on two ratios, one based on an equal allocation per category and the other based on the overall contribution of each product category to total operational and product specific costs. This is consistent with many cost-of-service allocation methods, which recognize that common costs can have multiple drivers, some relatively fixed and some more variable types of costs.
3. **Operating Contingency Reserve (OCR):** The program will maintain an OCR, per product category, to cover a projected 1 full year of operating costs. This requirement has been included in the development of the common costs used for calculating the EHF's.
4. **Accrual of the OCR:** The OCR will be accrued until the targeted amount of a projected 1 year of operating costs is achieved. This requirement has been adopted in the development of the cost forecasts to be recovered through the EHF's.
5. **Effectiveness & Efficiency Fund for research and development initiatives:** Funds for research and development projects will be accrued at a minimum rate of 1 per cent, and a maximum rate of 10 per cent of operational costs per annum. This provision will be reviewed in conjunction with the EHF rates. For the purposes of this study, an accrual of 5 per cent of operational costs has been included in the forecast costs assigned to each product category.

3.0 CURRENT PROGRAMS

EPSC, along with the RCC, has spear-headed the development of industry-led and managed end-of-life electronics stewardship programs in response to provincial regulations. Currently, the following three non-profit programs are operational in Canada: SWEEP in Saskatchewan, ESABC in British Columbia, and ACES in Nova Scotia.

3.1 ACES

The ACES program is an industry-led non-profit electronics recycling program regulated by the Province of Nova Scotia. The Resource Recovery Fund Board Inc. was selected to develop, implement and administer this stewardship program. The Program began February 1, 2008 and is intended to provide residents and businesses of Nova Scotia with an opportunity to recycle unwanted electronic components. Phase I included computers, monitors, printers, televisions and other related products. ACES has a collection network of 34 drop-off locations across Nova Scotia (as of June, 2008) where businesses and residents can take their unwanted products. The locations then prepare the electronics for transportation to a consolidation centre in the province where the material is sorted and shipped to approved recyclers.

On February 1, 2009 the Program will expand to include additional Phase II electronic products including audio and video recording equipment, telephones and a wide range of other products outlined in Chapter 5 of this report.

3.2 SWEEP

SWEEP is the non-profit corporation that has been established for the purpose of coordinating the collection and recycling of obsolete electronic equipment in Saskatchewan. Product Care Association (PCA) is tasked with managing the program. Residents and businesses are encouraged to recycle their equipment by dropping it off at any SARCAN depot. SARCAN coordinates the disassembly and recycling of the equipment and its components. There are almost 70 locations across the province.

Specific timelines for Phase II initiation have not been set but consultations are underway.

3.3 ESABC

ESABC is a member based, non-profit association responsible to the Province of British Columbia, for implementing end-of-life solutions for its electronic waste. Encorp Pacific (Canada) is the program manager for ESABC. There are close to 80 electronics collection sites distributed throughout the province.

The British Columbia Ministry of the Environment released a notice to industry product stewardship stakeholders and other interested parties in June, 2007 regarding their intent to add new product categories to industry-led product stewardship (one of which is Electronics). ESABC subsequently initiated consultations on the topic.

3.4 STEWARDS AND STEWARDSHIP PLANS

Stewardship plans for the respective provincial programs have been developed in response to relevant provincial regulations. EPSC has been engaged in providing assistance to the provincial programs and their program managers. Details outlined within these stewardship plans may include (but are not limited to) the following:

- Program principles
- Governance structure
- Consultation details
- Program details
- Funding arrangements
- Communication and awareness
- Quality control and assurance
- Program milestones
- Products included

Program stewards include manufacturers, importers, distributors, retailers, and others that sell regulated electronic products. Pursuant to government regulation (where applicable), these parties are obligated to participate in an approved stewardship program plan that provides for the recycling of certain end-of-life electronics identified in that regulation.

4.0 LEGAL AND REGULATORY FRAMEWORK

Electronics recycling in each of the jurisdictions is governed by provincial legislation. The following table identifies applicable legislation, regulations and regulatory status for Phase II products in Nova Scotia, Saskatchewan and British Columbia.

Table 4.1
Applicable Legislation and Regulations in Nova Scotia,
Saskatchewan and British Columbia

Province	Governing Legislation	Governing Regulations	Status for Phase II Products
Nova Scotia	<i>Environment Act</i>	Solid Waste-Resource Management Regulations	Implementation of recycling programs for Phase II electronics products is designated to begin on February 1, 2009. This is the primary catalyst for the development of EHF's for Phase II electronics products.
Saskatchewan	<i>The Environmental Management and Protection Act</i>	Waste Electronic Equipment Regulations	There is no formal legal or regulatory requirement related to Phase II products, however, such requirements are anticipated in the near future.
British Columbia	<i>Environmental Management Act</i>	Recycling Regulation	In a June, 2007 notice, The British Columbia Ministry of the Environment identified Electronics as an existing product category that is subject to expansion using a phased approach. The Ministry subsequently requested that ESACBC provide a list of products for possible inclusion in the Phase II electronics category.

Although Nova Scotia is the only jurisdiction at present that currently has a legal requirement to implement a program for Phase II electronics by February 1, 2009, this review was undertaken with the view that all three jurisdictions would have such a requirement within the short-term. Therefore, the methods used to calculate the EHF's were designed to enable harmonization across all three jurisdictions.

5.0 PHASE II ELECTRICAL AND ELECTRONIC EQUIPMENT (EEE)

Phase II EEE products consist of computer scanners, audio and video playback and recording systems, telephones and fax machines, cell phones, PDAs and pagers. A more precise delineation of the scope of these products is required to develop their EHF. This section provides further definition of each product category and clarifies what items are included and not included.

5.1 PHASE II DESCRIPTIONS AND DEFINITIONS

The Phase II products included in this chapter are based on the Nova Scotia regulatory requirements. As mentioned previously however, the programs (Nova Scotia, Saskatchewan and British Columbia) are seeking to harmonize their efforts. Therefore, for the purposes of this study, the Phase II product lists are anticipated to be similar for all three jurisdictions.

5.1.1 Information Technology Equipment

Although computer scanners are identified in the Nova Scotia regulation, for practical purposes most new scanners are sold as part of combination print/copy/scan products. Such products are already generally being managed as part of the printers category for Phase I products. As such, no new EHF is calculated for scanners as part of this study. The EHF for these products will be revisited as part of a review of Phase I product EHF.

5.1.2 Audio/Visual Equipment

The audio/visual equipment that is being included in Phase II is summarized in Table 5.1.

Table 5.1
Products included in the Audio/Visual Equipment Category

Products	Definition	Products Included	Product Not Included
<p>Audio and video playback and recording system</p>	<p>Audio and video recording and/or playback systems intended for residential use, including:</p> <p>Audio equipment</p> <ul style="list-style-type: none"> - Amplifiers - Receivers - Speakers - CD players - Radios - Turntables - Cassette and other tape players - Portable cassette, CD and digital audio players. <p>Video equipment</p> <ul style="list-style-type: none"> - Data projectors - VCRs - DVD players - Laser disc players - Digital and non-digital cameras, including video cameras/ camcorders. 	<ul style="list-style-type: none"> • AM/FM Radios • Video Cassette Recorders (VCRs) • Digital Video Disk (DVD) players/recorders, including Personal Video Recorders (PVRs), satellite and cable receivers, set-top boxes • Home stereo amplifiers • Speaker systems, including computer speakers • Home stereo systems • Home theatre audio and video equipment • Turntables/record players • Portable audio cassette players/recorders • MP3 players and other digital music recorders/players • Home analog and digital video cameras and camcorders • Digital and non-digital cameras, including web cams • Audio and video products for installation in motor vehicles aftermarket. 	<ul style="list-style-type: none"> • Audio and visual equipment imbedded in original equipment manufacturer (OEM) supplied motor vehicles of any type • Industrial/commercial quality amplifiers, speakers and related equipment used for musical performances and/or public address • Single-use or one-time use cameras • Children's toy cameras.

5.1.3 Telecommunications

Phase II telecommunications products are summarized in Table 5.2. Although fax machines are identified in the original regulation for Phase II, similar to scanners they have generally been managed within the printers category for Phase I products. As such, no new EHF is calculated for fax machines as part of this study. EHF's for these products will be revisited as part of a review of Phase I product EHF's.

During the course of the research it became clear that the CWTA in Nova Scotia had an interest in managing their own end-of-life recycling program. CWTA submitted a Stewardship Plan to the Province of Nova Scotia for the recycling of cellular telephones and has indicated that it intends its program to operate without a visible handling fee. Therefore, although EHF's were calculated for cell-phones, the research team recognizes that they may be handled by way of a separate program that may not include an EHF.

Table 5.2
Products included in the Telecommunications Category

Products	Definition	Products Included	Product Not Included
Telephones	A telecommunication device with a handset or headset that is used to transmit and receive sound (most commonly speech). [Note: fax machines are not included here as they have been accepted into Phase I definitions]	<ul style="list-style-type: none"> • Telephones (corded and cordless, VoIP, satellite phones) • Telephone line answering machines (cassette and digital). 	<ul style="list-style-type: none"> • Telecommunication equipment developed for embedded use in motor vehicles of any type • Commercial-grade "pay phones".
Cell phones, and pagers	<p>A hand-held telecommunication device which accesses a cellular network for transmission of voice or data.</p> <p>A cell phone includes the rechargeable battery that may be connected to that cell phone.</p>	<ul style="list-style-type: none"> • Cellular phones • Smart phones • Communication-enabled or cellular compatible PDAs • Pagers. 	<ul style="list-style-type: none"> • A wireless device that is functionally or physically a part of a larger device or system designed and intended for use in an industrial, commercial, medical or governmental setting • Walkie-talkies.

6.0 PROCESS FOR CALCULATING EHF_s

The study was undertaken in a relatively short time-frame with the first Study Advisory Committee conference call taking place August 15, 2008, and a final report delivered by October 31, 2008. In order to be as efficient as possible in the research process, a staged approach to the research was developed with key milestones identified for each phase.

The study was carried out in three stages – preparation, research and documentation. The process was developed with the intent of being transparent, similar to methods used for designing rates for regulated public utilities. The Research Team and the Study Advisory Committee interacted extensively throughout the study process including:

- Numerous conference calls from project initiation to the review of draft report comments;
- A one-and-a-half-day methodology workshop in Winnipeg; and
- Targeted conversations with key personnel from the commissioning agencies and their program managers.

The remainder of this chapter describes the purpose and key activities of each study stage.

6.1 PREPARATION

The purpose of the preparation phase was to ensure that the research methods were appropriate and that there was a common understanding of the research methods and objectives between the Research Team and the Study Advisory Committee.

Key activities in this phase of the project included the following:

- A literature review was conducted with a focus on studies/documents deemed most relevant by the Study Advisory Committee. The Research Team obtained copies of the background documents referenced in the project terms of reference as well as the relevant provincial regulations. Case studies of other experiences in Alberta and Ontario were also considered during the literature review.
- A conference call was held on August 27th to ensure that the proposed research methods were consistent with the project terms of reference. Discussions regarding data collection were held with Study Advisory Committee members to identify and address issues and challenges.

6.2 RESEARCH AND REFINEMENT

The research phase included data collection from external sources as well the three programs. An analytical approach to calculating the EHF was also developed and the project schedule was finalized.

Key activities in this phase of the project included:

- Data collection, including sales and shipping data for Phase II products from external sources and program administrative and operational costs.
- Development of an analytical approach to the calculation of EHF based on the Guiding Principles and EHF Setting Criteria outlined in Chapter 2.
- Development of initial revenue and cost estimates through consultation with key program personnel.
- Development of preliminary EHF calculations.
- Testing of the analytical approach and initial estimates with the Study Advisory Committee via conference calls and a workshop in Winnipeg.
- Refinement of assumptions and data parameters to reflect the input/feedback provided during the methodology workshop in Winnipeg.

Following the Study Advisory Committee workshop in Winnipeg, several follow-up conference calls took place to finalize the methodology. These calls were completed on September 29th, October 14th and October 21st.

6.3 DOCUMENTATION

This phase of the project included documenting the research process and outcomes to ensure accurate outcomes and clear and transparent communication.

Key activities during this phase of the project included:

- Recording of data sources and associated assumptions;
- Recording of conference call and workshop minutes; and
- Report drafting.

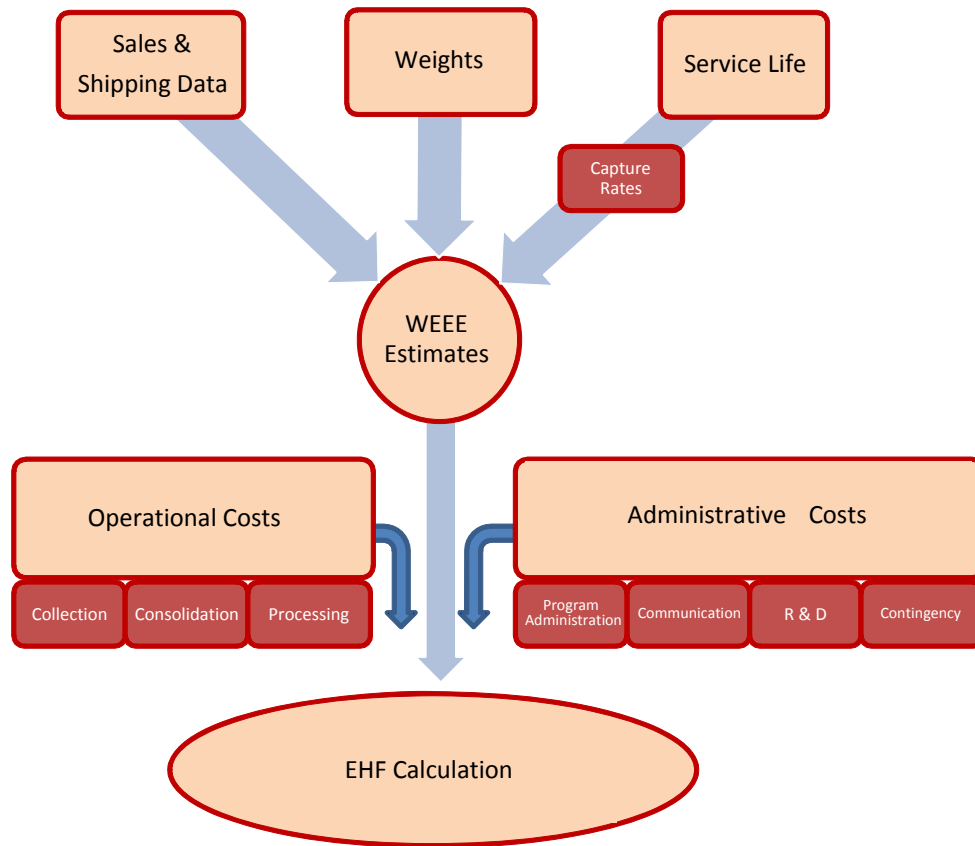
7.0 EHF CALCULATION METHODS AND RESULTS

In general the approach to the EHF calculations involves three steps:

- Developing estimates of Electric & Electronic Equipment (EEE) sold in the forecast period and estimates of Waste Electric & Electronic Equipment (WEEE) available for collection each year.
- Estimating Operational and Administrative Costs including funds for Research & Development and providing allowances for Contingencies.
- Calculating EHFs for a consolidated set of product categories.

This process is depicted graphically in Figure 7.1. Details on the methods and assumptions used to calculate the EHFs are provided in this section. Throughout the course of the research different sensitivity analyses were conducted to identify variables that required additional review. Adjustments to these variables were reviewed for reasonableness with the Study Advisory Committee.

Figure 7.1
Overview of EHF Calculation Inputs



7.1 WASTE ELECTRICAL & ELECTRONIC EQUIPMENT – INPUTS AND ESTIMATES

The first step in developing EHF for the Phase II list of products involves estimating the amount of EEE expected to be sold and WEEE material that is expected to be processed. There is no program currently operating in Canada that employs EHF related to Phase II products, and no single comprehensive data source on the amount of EEE and WEEE in the marketplace. As such, it was necessary to develop a method to estimate the EEE and WEEE figures for this study using a variety of sources and assumptions. The data required to prepare these estimates includes:

1. Actual sales and shipping data for Phase II products;
2. Product weights; and
3. Service lives for Phase II products.

Data sources and assumptions used to develop these estimates are reviewed in detail below.

7.1.1 Sales and Shipping Data

The study team worked in conjunction with the Study Advisory Committee to identify potential data sources for actual sales and shipping data for Phase II products. No single source was able to provide data for all Phase II products. Historic sales and shipping data at the national level were compiled from the sources described below.

Consumer Electronics Marketers of Canada – Electro-Federation Canada: The Consumer Electronics Marketers of Canada (CEMC) is a division of Electro-Federation Canada (EFC). Its members include manufacturers, importers and distributors of consumer electronic products in Canada. CEMC collects detailed statistical information on wholesale industry shipments for a wide variety of product categories. In addition to tracking member company shipments, CEMC has developed methods for providing adjustments to the data for non-member shipments and other sources of uncertainty. CEMC provided actual shipping data up to 2007 for the following product categories:

- Audio player (tape) Portable Stereos
- Audio player – Personal CD Player
- Audio player – CD Player Single/multi
- Audio player Mini/Mid/Full Size package systems
- Audio recorder/Portable Tape/Radio Players
- Clock Radios
- Amplifiers and Receivers
- Headphones
- Home-theatre-in-a-box (“HTB”) Systems
- Digital Cameras
- VCRs
- DVD Players
- Video Cameras/Camcorders
- Cordless and wire-line telephones
- Telephone answering machines

NPD Group: NPD Group is a market research firm that provides services to manufacturers, retailers and other clients. Actual unit sales data were purchased from NPD Group for 2002 through 2007 (where available) for the following product categories:

- Speakers – Home Theatre
- Speakers – Home Speakers
- Speakers – Multimedia
- Docking speakers
- MP3 players
- Car Stereo Amps & Equalizers
- Car Stereo Speakers
- In-Dash CD players
- Solid State Voice Recorders
- Data Projectors (including projectors for business applications and home theatre use)

IDC Canada: IDC Canada is a market research firm that provides services for the information technology; telecommunications; and consumer technology markets. Unit shipment data were purchased from IDC for the actual years 2004 through 2007 and forecasts for 2008 through 2011 for the following product categories:

- Traditional mobile phones
- Converged mobile devices

Statistics Canada: Statistics Canada collects and publishes data related to digital cable and satellite subscribers as part of its Broadcasting and Telecommunications Service Bulletin. Increases in reported subscriptions were used as a proxy for purchases of digital cable and satellite cable equipment. Efforts were made to contact a number of cable companies to provide estimates of the average number of units in each subscriber household, however, no such estimates could be obtained within the timeframe of this study.

It is recognized that there are certain limitations on the data that were available within the timeframe of this study. In particular, the following limitations are noted:

1. With respect to the data provided by CEMC, NPD and IDC, it is recognized that the methods used to collect this data varies by data source (for example, wholesale shipments compared to units sold). With respect to the Statistics Canada data, it is recognized that this provides only a coarse estimate of the number of digital cable and satellite cable units in the marketplace. However, for the purposes of this study it was assumed that the figures are comparable enough to provide a reasonable basis for this analysis. Further research and data sources, together with program collection data, could assist in developing more robust estimates in the future.
2. Historic sales and shipping data were not available for all product categories that could be captured under the Phase II list of products within the time limitations on this research. For example, a reasonable source for sales/shipping information for pagers could not be identified in time to be included in this research. However, it is assumed that the range of products for which data were available is sufficiently representative of the range of Phase II products in the marketplace to provide a reasonable basis for the analysis. In all cases where specific data could not be obtained for a particular product type, assumptions were made regarding the similarity of these items to other product categories for which information was available.

Where forecasts for the complete period 2008 through 2011 could not be obtained from another source, forecasts for 2008, and operating Years 1 through 3, were prepared by either inflating or deflating the most recent actual year's figures by 1 per cent (depending on whether the recent trend in the product category was for increasing or declining sales). Where forecasts for the complete period 2008 through 2011 were available, the forecasts for operating Years 1 through 3 were prepared using 2009 through 2011 forecasts respectively. As noted previously, economic conditions and other variables can have a material impact on actual sales for consumer electronics.

For some products with longer service lives, the historic data available did not provide enough history to calculate the WEEE available. In those cases, estimates for historic data were prepared based on flat sales trends in the data that were available.

Table 7.1 summarizes the historic and forecast shipping and sales data and estimates in Canada by product category. National level data were then scaled down to estimates for Nova Scotia, Saskatchewan and British Columbia based on 2006 Census population figures – 19 per cent of total population. Other methods for scaling down the national level estimates were considered, but the simple approach using population estimates was considered most appropriate because it was transparent and simple to implement. The scaled down estimates are presented in Table 7.2.

Calculation of Environmental Handling Fees for
Phase II Products

October 31, 2008

Table 7.1
Estimated Phase II Products Supplied for Use in Canada – Actuals and Forecasts (000s of units)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	FORECAST				Source	
																2008	YEAR 1	YEAR 2	YEAR 3		
Speakers - Home Theater										217	351	453	408	421	452	457	461	466	470	2	
Speakers - Home Speakers										693	626	629	287	269	262	259	256	254	251	2	
Speakers - Multimedia										445	445	445	445	883	902	911	920	930	939	2	
Speakers - Docking Speakers													251	354	658	664	671	678	684	2	
Audio player (tape) Portable Stereo		687	660	664	662	640	672	770	807	754	657	554	432	634	493	488	483	478	474	1	
Audio player - Personal CD Player		319	486	585	554	652	832	1,081	1,240	1,207	1,442	1,281	707	405	203	201	199	197	195	1	
Audio player - CD Player Single/multi		304	272	250	230	215	228	195	119	71	39	28	26	27	24	24	24	23	23	1	
Audio player - Mini/Mid/Full Size		425	466	508	645	656	806	888	823	691	961	569	483	660	495	490	485	480	475	1	
Package Systems		1,147	1,280	1,186	1,029	803	833	680	434	254	236	216	189	161	102	101	100	99	98	1	
Audio recorder/Portable Tape/Radio Players		748	816	810	916	991	930	1,012	994	959	1,048	1,000	1,151	986	1,318	1,403	1,417	1,431	1,446	1,460	1
Clock Radios		202	212	223	190	182	211	237	234	194	171	173	160	158	148	147	145	144	142	1	
Amplifiers/Receivers		717	1,802	1,250	1,313	1,300	1,273	1,386	1,377	1,542	2,260	1,840	2,491	3,222	3,169	3,201	3,233	3,265	3,298	1	
Headphones					47	41	50	64	126	237	350	436	430	452	540	545	551	556	562	1	
HTB Systems							194	194	421	338	257	407	473	493	498	503	508	513	518	4	
Digital Cable Equipment							484	484	642	409	187	120	167	137	139	140	141	143	144	4	
Satellite Cable Equipment					32	56	101	235	433	881	1,488	2,301	2,463	3,031	3,767	3,805	3,843	3,881	3,920	1	
Digital Cameras										98	264	975	2,342	3,526	4,189	4,231	4,273	4,316	4,359	2	
MP3 Players							109	109	109	109	109	107	57	64	57	56	56	55	55	2	
Car Stereo Amps & Equalizers							513	513	513	513	513	522	308	322	288	285	282	279	277	2	
Car Stereo Speakers										496	532	605	430	421	407	403	399	395	391	2	
In-Dash CD players													98	134	164	166	167	169	171	2	
Solid State Voice Recorders							34	34	34	34	34	34	34	43	36	37	37	37	38	2	
Data projectors		1,301	1,205	1,272	1,257	1,365	1,464	1,516	1,605	1,176	910	559	302	166	80	79	78	78	77	1	
VCRs		n/a	n/a	n/a	n/a	59	202	542	1,181	1,983	2,561	2,835	3,029	4,353	3,964	4,004	4,044	4,084	4,125	1	
DVD players		227	222	225	246	255	260	328	314	350	365	374	355	381	413	417	421	426	430	1	
Video Cameras/Camcorders		1,363	1,313	1,269	1,192	1,181	1,269	1,386	1,316	1,449	1,242	1,168	753	861	801	793	785	777	769	1	
Telephones (Wire Line)		1,218	1,190	1,363	1,563	1,558	1,856	2,493	2,281	2,640	3,550	4,088	5,174	6,498	6,725	6,792	6,860	6,929	6,998	1	
Cordless Telephones		650	628	395	496	444	409	529	468	448	411	372	291	254	158	156	155	153	152	1	
Telephone Answering Machines												5,522	6,513	6,782	7,861	8,618	9,742	10,519	11,220	3	
Cellular Phones												296	516	805	1,304	1,780	2,312	2,871	3,490	3	
Converged Mobile Devices																					

Sources:

- 1994-2007 Data from Consumer Electronics Marketers of Canada and Electro-Federation Canada. Forecasts for 2008, Year 1, Year 2 and Year 3 were prepared by IG not EFC.
- 2002-2007 (where available) from NPD Group/Retail Tracking Service (data prior to 2005 involved slightly different methodology that affected the data trend in those prior years, but the sales data provided reflects NPD's best estimates at that time). Actual data for Speaker-Multimedia from 2002-2004, Car Stereo Amps & Equalizers 1999-2003, Car Stereo Speakers 1999-2003 and Data Projectors 1999-2004 was estimated by IG not NPD. Forecasts for 2008, Year 1, Year 2 and Year 3 were prepared by IG not NPD.
- 2004-2007 actual data and 2008-2011 forecasts from IDC Canada Mobile Phone Tracker - August 2008.
- Estimates by IG prepared based on Stat Can reports for subscribers to digital television and satellite television.

Table 7.2
Estimated Phase II Products Supplied for Use in Nova Scotia,
Saskatchewan and British Columbia – Actuals and Forecasts (000s of units)

	FORECAST																		
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	YEAR 1	YEAR 2	YEAR 3
Speakers - Home Theater										41	67	86	77	80	86	87	88	89	89
Speakers - Home Speakers										132	119	119	55	51	50	49	49	48	48
Speakers - Multimedia										85	85	85	85	168	171	173	175	177	178
Speakers - Docking Speakers													48	67	125	126	127	129	130
Audio player (tape) Portable Stereo		131	125	126	126	122	128	146	153	143	125	105	82	120	94	93	92	91	90
Audio player - Personal CD Player		61	92	111	105	124	158	205	236	229	274	243	134	77	39	38	38	37	37
Audio player - CD Player Single/multi		58	52	48	44	41	43	37	23	13	7	5	5	5	5	5	4	4	4
Audio player - Mini/Mid/Full Size Package Systems		81	89	97	123	125	153	169	156	131	183	108	92	125	94	93	92	91	90
Audio recorder/Portable Tape/Radio Players		218	243	225	196	153	158	129	82	48	45	41	36	31	19	19	19	19	19
Clock Radios	142	155	154	174	188	177	192	189	182	199	190	219	187	250	267	269	272	275	277
Amplifiers/Receivers		38	40	42	36	35	40	45	44	37	32	33	30	30	28	28	28	27	27
Headphones		136	342	238	249	247	242	263	262	293	429	350	473	612	602	608	614	620	627
HTB Systems					9	8	10	12	24	45	67	83	82	86	103	104	105	106	107
Digital Cable Equipment							37	37	80	64	49	77	90	94	95	95	96	97	98
Satellite Cable Equipment							92	92	122	78	35	23	32	26	26	27	27	27	27
Digital Cameras				6	11	19	45	82	167	283	437	468	576	716	723	730	737	745	
MP3 Players									19	50	185	445	670	796	804	812	820	828	
Car Stereo Amps & Equalizers							21	21	21	21	21	20	11	12	11	11	11	11	10
Car Stereo Speakers							97	97	97	97	97	99	59	61	55	54	54	53	53
In-Dash CD players										94	101	115	82	80	77	77	76	75	74
Solid State Voice Recorders													19	26	31	32	32	32	32
Data projectors							7	7	7	7	7	7	7	8	7	7	7	7	7
VCRs		247	229	242	239	259	278	288	305	223	173	106	57	32	15	15	15	15	15
DVD players						11	38	103	224	377	487	539	576	827	753	761	768	776	784
Video Cameras/Camcorders		43	42	43	47	48	49	62	60	67	69	71	67	72	78	79	80	81	82
Telephones (Wire Line)		259	249	241	226	224	241	263	250	275	236	222	143	164	152	151	149	148	146
Cordless Telephones		231	226	259	297	296	353	474	433	502	675	777	983	1,235	1,278	1,291	1,303	1,316	1,330
Telephone Answering Machines		124	119	75	94	84	78	101	89	85	78	71	55	48	30	30	29	29	29
Cellular Phones												1,049	1,237	1,289	1,494	1,637	1,851	1,999	2,132
Converged Mobile Devices													56	98	153	248	338	439	663

7.1.2 Product Weights

The next step in determining the amount of WEEE that is expected to be collected and processed requires that weight estimates be developed for each of the product categories. This is a difficult exercise for the following reasons:

1. There is no currently operating program in Canada that uses EHF's for Phase II products. As such, there is no reliable dataset for actual weights processed by these types of programs.
2. The range of products in the marketplace for each product category can be extensive.
3. Historic products are often heavier than newer products.

In order to estimate product weights two sources were used. Where available, weight estimates were taken from the Waste Electronic and Electrical Equipment Study prepared for Waste Diversion Ontario ("WDO") in 2005.¹ Where weight estimates were not available from the WDO study, estimates were developed by InterGroup (IG) based on internet research. The internet research attempted to canvass a broad range of products available in each product category.

It is acknowledged that product weights are an important variable in the analysis for this research, and that average product weights by category can change substantially over time as new products enter the marketplace. Therefore, the product weights were reviewed by the Study Advisory Committee for reasonableness, and adjustments to the weights were made where necessary. The product weights used in the analysis are summarized in Table 7.3.

Total WEEE product weights for the historic period were prepared by multiplying the estimated historic WEEE supplied for use in Nova Scotia, Saskatchewan and British Columbia (Table 7.2) by the product weights (Table 7.3). The resulting WEEE weight estimates for products supplied are summarized in Table 7.4.

¹ Waste electronic and Electrical Equipment Study. Prepared by CST, RIS International Ltd., MacViro Consultants Inc. & Jack Mintz & Associates Inc. July 2005.

Table 7.3
Estimated Phase II Product Average Unit Weights²

	Weight (kg)	Source
Speakers - Home Theater	22.9	IG Estimate based on Web Research
Speakers - Home Speakers	14.4	IG Estimate based on Web Research
Speakers - Multimedia	4.6	IG Estimate based on Web Research
Speakers - Docking Speakers	2.3	IG Estimate based on Web Research
Audio player (tape) Portable Stereo	3.1	IG Estimate based on Web Research
Audio player - Personal CD Player	0.4	WDO Report
Audio player - CD Player Single/multi	4.8	IG Estimate based on Web Research
Audio player - Mini/Mid/Full Size Package Systems	8.2	IG Estimate based on Web Research
Audio recorder/Portable Tape/Radio Players	0.5	IG Estimate - similar to Portable CD
Clock Radios	2.0	WDO Report
Amplifiers/Receivers	18.3	WDO Report - Avg of Receivers/Amplifiers
Headphones	0.3	IG Estimate based on Web Research
HTB Systems	18.6	IG Estimate based on Web Research
Digital Cable Equipment	2.7	IG Estimate based on Web Research
Satellite Cable Equipment	11.7	IG Estimate based on Web Research
Digital Cameras	0.3	IG Estimate based on Web Research
MP3 Players	0.2	WDO Report
Car Stereo Amps & Equalizers	4.8	IG Estimate based on Web Research
Car Stereo Speakers	2.3	IG Estimate based on Web Research
In-Dash CD players	1.6	IG Estimate based on Web Research
Solid State Voice Recorders	0.1	IG Estimate based on Web Research
Data projectors	2.4	IG Estimate based on Web Research
VCRs	6.0	WDO Report
DVD players	2.3	WDO Report
Video Cameras/Camcorders	2.5	WDO Report
Telephones (Wire Line)	1.0	WDO Report
Cordless Telephones	1.1	IG Estimate based on Web Research
Telephone Answering Machines	1.5	WDO Report
Cellular Phones	0.2	WDO Report
Converged Mobile Devices	0.2	IG Estimate - similar to Cell phones

² Satellite cable equipment weights include estimates both for the television receiver and the satellite dish itself.

Table 7.4
Estimated Phase II Products Supplied Weights for Products Currently Supplied in Nova Scotia,
Saskatchewan and British Columbia – Actuals through 2007 (tonnes)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Speakers - Home Theater										944	1,526	1,971	1,775	1,831	1,967
Speakers - Home Speakers										1,902	1,717	1,725	788	738	717
Speakers - Multimedia										389	389	389	389	772	789
Speakers - Docking Speakers													109	155	287
Audio player (tape) Portable Stereo		405	389	391	390	377	396	454	475	444	387	326	254	373	290
Audio player - Personal CD Player		24	37	44	42	50	63	82	94	92	110	97	54	31	15
Audio player - CD Player Single/multi		277	248	228	210	196	208	178	109	65	36	26	24	25	22
Audio player - Mini/Mid/Full Size Package Systems		663	727	793	1,007	1,024	1,258	1,386	1,285	1,079	1,500	888	754	1,030	773
Audio recorder/Portable Tape/Radio Players		109	122	113	98	76	79	65	41	24	22	21	18	15	10
Clock Radios	284	310	308	348	377	353	385	378	364	398	380	437	375	501	533
Amplifiers/Receivers		702	737	775	661	633	734	824	814	675	595	602	556	549	515
Headphones		41	103	71	75	74	73	79	78	88	129	105	142	184	181
HTB Systems					166	145	177	226	445	838	1,237	1,541	1,520	1,597	1,908
Digital Cable Equipment							99	99	216	173	132	209	242	253	255
Satellite Cable Equipment							1,075	1,075	1,427	910	415	266	370	305	308
Digital Cameras					2	3	6	13	24	50	84	129	139	171	212
MP3 Players										4	10	37	89	134	159
Car Stereo Amps & Equalizers							100	100	100	100	100	98	52	58	52
Car Stereo Speakers							224	224	224	224	224	228	135	141	126
In-Dash CD players										151	162	184	131	128	124
Solid State Voice Recorders													1	2	2
Data projectors							16	16	16	16	16	16	16	19	17
VCRs		1,483	1,374	1,450	1,433	1,556	1,669	1,728	1,830	1,341	1,037	637	344	189	91
DVD players						26	88	237	516	867	1,119	1,239	1,324	1,902	1,732
Video Cameras/Camcorders		108	105	107	117	121	124	156	149	166	173	178	169	181	196
Telephones (Wire Line)		259	249	241	226	224	241	263	250	275	236	222	143	164	152
Cordless Telephones		255	249	285	327	326	388	521	477	552	742	854	1,081	1,358	1,406
Telephone Answering Machines		185	179	113	141	127	117	151	133	128	117	106	83	72	45
Cellular Phones												210	247	258	299
Converged Mobile Devices												11	20	31	50

7.1.3 Product Service Lives

Once the volume of WEEE material estimated to be supplied in each year has been calculated, it is necessary to estimate the amount of material that will be available to be collected in each of the forecast years. This process involves the following variables:

1. Estimates of the lifespan for each product, which is the amount of time the product is kept in use by the first owner.
2. Assumptions related to the fate of the product at the end of its first life (whether the product is discarded, reused by another person or for another purpose, or simply stored before disposal).
3. Estimates of the number of years the product remains in storage or reuse prior to ultimate disposal.

This basic approach has been used in other studies, including the 2005 WDO report and the 2008 Ontario Final WEEE program plan. Previous research has been done into the service lives for many Phase II products. The 2005 WDO report included estimates for many of these products. These were used as the initial starting point for this analysis. For products that were not included in the WDO report or for products that had undergone substantial technological advances since the 2005 WDO report, estimates were prepared based on similarity to other product categories. All of the product lifespan estimates were reviewed for reasonableness by the Study Advisory Committee. Table 7.5 summarizes the estimated service lives for each product category used in the analysis.

Table 7.5
Estimated Phase II Product Service Lives

	% to 2nd life Reuse	% to 2nd life Storage	% to Discard	Years in Storage	Age at 1st Life	Age at End of Life	Source
Speakers - Home Theater	40%	10%	50%	3.0	7.0	8.5	WDO Report
Speakers - Home Speakers	40%	10%	50%	3.0	7.0	8.5	WDO Report
Speakers - Multimedia	40%	10%	50%	3.0	4.0	5.5	Assume similar to Pers CD Players
Speakers - Docking Speakers	40%	10%	50%	3.0	1.5	3.0	Assume similar to MP3 Players
Audio player (tape) Portable Stereo	40%	10%	50%	3.0	4.0	5.5	Assume similar to Pers CD Players
Audio player - Personal CD Player	40%	10%	50%	3.0	4.0	5.5	WDO Report
Audio player - CD Player Single/multi	40%	10%	50%	3.0	7.0	8.5	Assume similar to Mini/Mid Systems
Audio player - Mini/Mid/Full Size Package Systems	40%	10%	50%	3.0	7.0	8.5	WDO Report
Audio recorder/Portable Tape/Radio Players	40%	10%	50%	3.0	4.0	5.5	Assume similar to Pers CD Players
Clock Radios	40%	10%	50%	3.0	13.0	14.5	WDO Report - Radios
Amplifiers/Receivers	40%	10%	50%	3.0	7.0	8.5	Assume similar to Mini/Mid Systems
Headphones	40%	10%	50%	3.0	1.5	3.0	Assume similar to MP3 Players
HTB Systems	40%	10%	50%	3.0	7.0	8.5	Assume similar to Mini/Mid Systems
Digital Cable Equipment	40%	10%	50%	3.0	4.0	5.5	Assume similar to DVD players
Satellite Cable Equipment	40%	10%	50%	3.0	4.0	5.5	Assume similar to DVD players
Digital Cameras	40%	10%	50%	3.0	3.0	4.5	IG Estimate
MP3 Players	40%	10%	50%	3.0	1.5	3.0	IG Estimate
Car Stereo Amps & Equalizers	40%	10%	50%	3.0	7.0	8.5	Assume similar to Mini/Mid Systems
Car Stereo Speakers	40%	10%	50%	3.0	7.0	8.5	Assume similar to Mini/Mid Systems
In-Dash CD players	40%	10%	50%	3.0	7.0	8.5	Assume similar to Mini/Mid Systems
Solid State Voice Recorders	40%	10%	50%	3.0	1.5	3.0	Assume similar to MP3 Players
Data projectors	40%	10%	50%	3.0	7.0	8.5	Assume similar to DVD Players
VCRs	40%	10%	50%	3.0	4.0	5.5	IG Estimate
DVD players	40%	10%	50%	3.0	4.0	5.5	IG Estimate
Video Cameras/Camcorders	40%	10%	50%	3.0	6.0	7.5	WDO Report
Telephones (Wire Line)	40%	10%	50%	3.0	7.0	8.5	WDO Report
Cordless Telephones	40%	10%	50%	3.0	3.0	4.5	IG Estimate
Telephone Answering Machines	40%	10%	50%	3.0	6.0	7.5	WDO Report
Cellular Phones	40%	10%	50%	3.0	1.5	3.0	WDO Report
Converged Mobile Devices	40%	10%	50%	3.0	1.5	3.0	Assume similar to cellphone

7.1.4 Estimated WEEE Available for Collection

The final step in estimating the WEEE available for collection in each of the forecast years was to estimate the capture rates or the percentage of the total WEEE available for collection, that would be collected by the recycling program. As there are no currently operating electronics recycling programs for Phase II products in Canada, there was no practical experience from an operating program available for this analysis. Capture rates were estimated in consultation with the Study Advisory Committee and considered the following factors:

1. Compared to the Phase I products, the Phase II products cover a broader range of products and many of these are smaller and lighter than the Phase I products. This suggests that Phase II products may be easier for users to dispose of into the municipal waste stream and therefore less likely to be recycled.
2. Generally, it is expected that capture rates would improve over time as more people become familiar with the electronics recycling programs available in their area.

Based on these considerations, the Research Team determined, in consultation with the Study Advisory Committee, that it would be reasonable to assume a capture rate of 40 per cent for the first year with this capture rate increasing by 5 per cent in each subsequent year to 45 per cent in year 2 and 50 per cent in year 3. The resulting estimates of WEEE to be collected in each of the forecast years are summarized in Table 7.6.

Table 7.6
Estimated Phase II WEEE to be Collected (tonnes)

	Year 1	Year 2	Year 3
Speakers - Home Theater	188.7	343.3	492.7
Speakers - Home Speakers	380.3	386.4	431.1
Speakers - Multimedia	155.7	261.2	294.5
Speakers - Docking Speakers	68.7	95.4	129.0
Audio player (tape) Portable Stereo	139.7	171.1	154.2
Audio player - Personal CD Player	29.1	31.6	28.2
Audio player - CD Player Single/multi	54.5	48.0	33.5
Audio player - Mini/Mid/Full Size Package Systems	467.4	649.4	543.2
Audio recorder/Portable Tape/Radio Players	8.4	8.5	7.6
Clock Radios	126.5	154.5	165.3
Amplifiers/Receivers	281.6	319.2	353.8
Headphones	61.0	77.9	91.8
HTB Systems	202.9	329.2	496.5
Digital Cable Equipment	83.2	86.6	116.0
Satellite Cable Equipment	256.1	162.0	143.5
Digital Cameras	50.8	76.8	88.2
MP3 Players	44.6	61.4	77.4
Car Stereo Amps & Equalizers	39.9	44.9	49.4
Car Stereo Speakers	89.6	100.8	113.1
In-Dash CD players	30.2	36.4	46.0
Solid State Voice Recorders	0.6	0.9	1.2
Data projectors	6.3	7.1	7.9
VCRs	337.0	276.0	182.1
DVD players	438.0	679.8	742.8
Video Cameras/Camcorders	65.8	73.5	83.7
Telephones (Wire Line)	103.3	112.3	118.0
Cordless Telephones	420.0	508.5	625.2
Telephone Answering Machines	53.6	53.9	52.7
Cellular Phones	108.3	135.3	165.8
Converged Mobile Devices	14.8	23.1	34.6
Totals	4,306.8	5,315.0	5,868.9

7.2 OPERATIONAL AND ADMINISTRATIVE COSTS

Once the estimates of the WEEE to be collected in each forecast year were prepared, estimates of the operational and administrative costs of the recycling programs needed to be prepared. This section summarizes the development of the operational and administrative cost forecasts.

7.2.1 Operational Costs

Operational costs of the Phase II electronics recycling programs include the costs related to the following functions:

- **Collection Costs:** Related to the depots that collect and sort the material to be recycled, as well as associated transportation costs.
- **Consolidation Costs:** Related to the storage of recyclable material prior to transport to the processing locations.
- **Processing Costs:** Related to the transportation and processing of the recyclable material.

As a starting point, actual and forecast operational costs for Phase I materials were reviewed with each of ACES, SWEEP and ESABC. Through conversations with each of the programs/operators, it was determined that the costs to collect, consolidate and process the Phase II materials would be most similar to the current operational costs for printers and peripherals. Therefore, the estimated operational costs for Phase II materials started with existing costs for printers and peripherals. Adjustments were then made to the existing operational costs to consider known, or likely, changes to the operating cost profiles, such as higher transportation costs or lower processing costs due to the entry of new processors. This resulted in estimated costs per tonne related to collection, consolidation and processing for each jurisdiction.

Each of the programs has different cost profiles for each operational category. In order to develop a cost profile that could be reasonably transferred across the three jurisdictions, a "representative cost" per tonne for collection, consolidation and processing was developed. The representative costs are not the simple average of each jurisdiction's costs, but are intended to be reasonably indicative, or more closely aligned, to the current and forecasted operational costs in each jurisdiction. These representative costs were reviewed for reasonableness with the Study Advisory Committee. While it is recognized that the use of these representative costs means the analysis is not perfectly indicative of the operational costs in each jurisdiction, this approach was considered reasonable for the purposes of this analysis.

Operational costs include collection, consolidation and processing costs for all product types except for cellular telephones and converged mobile devices. As noted in Chapter 5, at the time this research was conducted it was anticipated that cell phone recycling in Nova Scotia would be handled via a separate program. The implementation of the cell phone program may involve collection through the ACES collection network. As such the operational costs for cell phones used in this report include only the collection costs.

Once the representative operational costs for the first year were prepared, the costs for the second and third years were developed based on an inflation rate of two per cent for the second year and one per cent for the third year. A lower inflation rate was chosen for the third year in recognition of the expectation that after two years of operation there would be productivity improvements to offset some of the expected cost inflation. Tables 7.7, 7.8 and 7.9 summarize the operational cost parameters and operational costs by product category for each of the forecast years.

Calculation of Environmental Handling Fees for
Phase II Products

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Table 7.7
Estimated Phase II Product WEE Operational Costs for Year 1

	Material Collected (tonnes)	Collection (\$000)	Consolidation (\$000)	Processing (\$000)	Total (\$000)
Speakers - Home Theater	188.7	\$64	\$9	\$180	\$253
Speakers - Home Speakers	380.3	\$129	\$19	\$363	\$511
Speakers - Multimedia	155.7	\$53	\$8	\$149	\$209
Speakers - Docking Speakers	68.7	\$23	\$3	\$66	\$92
Audio player (tape) Portable Stereo	139.7	\$47	\$7	\$133	\$188
Audio player - Personal CD Player	29.1	\$10	\$1	\$28	\$39
Audio player - CD Player Single/multi	54.5	\$18	\$3	\$52	\$73
Audio player - Mini/Mid/Full Size Package Systems	467.4	\$158	\$23	\$446	\$628
Audio recorder/Portable Tape/Radio Players	8.4	\$3	\$0.4	\$8	\$11
Clock Radios	126.5	\$43	\$6	\$121	\$170
Amplifiers/Receivers	281.6	\$95	\$14	\$269	\$378
Headphones	61.0	\$21	\$3	\$58	\$82
HTB Systems	202.9	\$69	\$10	\$194	\$272
Digital Cable Equipment	83.2	\$28	\$4	\$79	\$112
Satellite Cable Equipment	256.1	\$87	\$13	\$245	\$344
Digital Cameras	50.8	\$17	\$2	\$49	\$68
MP3 Players	44.6	\$15	\$2	\$43	\$60
Car Stereo Amps & Equalizers	39.9	\$14	\$2	\$38	\$54
Car Stereo Speakers	89.6	\$30	\$4	\$86	\$120
In-Dash CD players	30.2	\$10	\$1	\$29	\$41
Solid State Voice Recorders	0.6	\$0.2	\$0.0	\$1	\$1
Data projectors	6.3	\$2	\$0.3	\$6	\$8
VCRs	337.0	\$114	\$17	\$322	\$453
DVD players	438.0	\$148	\$21	\$418	\$588
Video Cameras/Camcorders	65.8	\$22	\$3	\$63	\$88
Telephones (Wire Line)	103.3	\$35	\$5	\$99	\$139
Cordless Telephones	420.0	\$142	\$21	\$401	\$564
Telephone Answering Machines	53.6	\$18	\$3	\$51	\$72
Cellular Phones	108.3	\$37	\$0	\$0	\$37
Converged Mobile Devices	14.8	\$5	\$0	\$0	\$5
Totals	4,306.8	\$1,460	\$205	\$3,995	\$5,660

Cost Parameters Year 1	
Collection	
Collection cost (\$/tonne)	\$339
<i>Includes Transport to Consolidation and materials costs.</i>	
Consolidation	
Consolidation cost (\$/tonne)	\$49
<i>Includes storage</i>	
Processing	
Processing cost (\$/tonne)	\$955
<i>Includes transportation to Processing</i>	

Calculation of Environmental Handling Fees for
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Table 7.8
Estimated Phase II Product WEE Operational Costs for Year 2

	Material Collected (tonnes)	Collection (\$000)	Consolidation (\$000)	Processing (\$000)	Total (\$000)
Speakers - Home Theater	343.3	\$119	\$17	\$334	\$470
Speakers - Home Speakers	386.4	\$134	\$19	\$376	\$529
Speakers - Multimedia	261.2	\$90	\$13	\$254	\$358
Speakers - Docking Speakers	95.4	\$33	\$5	\$93	\$131
Audio player (tape) Portable Stereo	171.1	\$59	\$9	\$167	\$234
Audio player - Personal CD Player	31.6	\$11	\$2	\$31	\$43
Audio player - CD Player Single/multi	48.0	\$17	\$2	\$47	\$66
Audio player - Mini/Mid/Full Size Package Systems	649.4	\$225	\$32	\$633	\$890
Audio recorder/Portable Tape/Radio Players	8.5	\$3	\$0.4	\$8	\$12
Clock Radios	154.5	\$53	\$8	\$150	\$212
Amplifiers/Receivers	319.2	\$110	\$16	\$311	\$437
Headphones	77.9	\$27	\$4	\$76	\$107
HTB Systems	329.2	\$114	\$16	\$321	\$451
Digital Cable Equipment	86.6	\$30	\$4	\$84	\$119
Satellite Cable Equipment	162.0	\$56	\$8	\$158	\$222
Digital Cameras	76.8	\$27	\$4	\$75	\$105
MP3 Players	61.4	\$21	\$3	\$60	\$84
Car Stereo Amps & Equalizers	44.9	\$16	\$2	\$44	\$61
Car Stereo Speakers	100.8	\$35	\$5	\$98	\$138
In-Dash CD players	36.4	\$13	\$2	\$35	\$50
Solid State Voice Recorders	0.9	\$0.3	\$0.0	\$1	\$1
Data projectors	7.1	\$2	\$0.4	\$7	\$10
VCRs	276.0	\$95	\$14	\$269	\$378
DVD players	679.8	\$235	\$34	\$662	\$931
Video Cameras/Camcorders	73.5	\$25	\$4	\$72	\$101
Telephones (Wire Line)	112.3	\$39	\$6	\$109	\$154
Cordless Telephones	508.5	\$176	\$25	\$495	\$697
Telephone Answering Machines	53.9	\$19	\$3	\$52	\$74
Cellular Phones	135.3	\$47	\$0	\$0	\$47
Converged Mobile Devices	23.1	\$8	\$0	\$0	\$8
Totals	5,315.0	\$1,838	\$258	\$5,023	\$7,119

Cost Parameters Year 2	
Collection	
Collection cost (\$/tonne)	\$346
<i>Includes Transport to Consolidation and materials costs.</i>	
Consolidation	
Consolidation cost (\$/tonne)	\$50
<i>Includes storage</i>	
Processing	
Processing cost (\$/tonne)	\$974
<i>Includes Processing Transportation costs</i>	

Calculation of Environmental Handling Fees for
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Table 7.9
Estimated Phase II Product WEE Operational Costs for Year 3

	Material Collected (tonnes)	Collection (\$000)	Consolidation (\$000)	Processing (\$000)	Total (\$000)
Speakers - Home Theater	492.7	\$172	\$25	\$485	\$682
Speakers - Home Speakers	431.1	\$151	\$22	\$424	\$597
Speakers - Multimedia	294.5	\$103	\$15	\$290	\$407
Speakers - Docking Speakers	129.0	\$45	\$7	\$127	\$178
Audio player (tape) Portable Stereo	154.2	\$54	\$8	\$152	\$213
Audio player - Personal CD Player	28.2	\$10	\$1	\$28	\$39
Audio player - CD Player Single/multi	33.5	\$12	\$2	\$33	\$46
Audio player - Mini/Mid/Full Size Package Systems	543.2	\$190	\$27	\$534	\$752
Audio recorder/Portable Tape/Radio Players	7.6	\$3	\$0.4	\$7	\$10
Clock Radios	165.3	\$58	\$8	\$163	\$229
Amplifiers/Receivers	353.8	\$124	\$18	\$348	\$489
Headphones	91.8	\$32	\$5	\$90	\$127
HTB Systems	496.5	\$173	\$25	\$489	\$687
Digital Cable Equipment	116.0	\$40	\$6	\$114	\$160
Satellite Cable Equipment	143.5	\$50	\$7	\$141	\$199
Digital Cameras	88.2	\$31	\$4	\$87	\$122
MP3 Players	77.4	\$27	\$4	\$76	\$107
Car Stereo Amps & Equalizers	49.4	\$17	\$2	\$49	\$68
Car Stereo Speakers	113.1	\$39	\$6	\$111	\$156
In-Dash CD players	46.0	\$16	\$2	\$45	\$64
Solid State Voice Recorders	1.2	\$0.4	\$0.1	\$1	\$2
Data projectors	7.9	\$3	\$0.4	\$8	\$11
VCRs	182.1	\$64	\$9	\$179	\$252
DVD players	742.8	\$259	\$37	\$731	\$1,028
Video Cameras/Camcorders	83.7	\$29	\$4	\$82	\$116
Telephones (Wire Line)	118.0	\$41	\$6	\$116	\$163
Cordless Telephones	625.2	\$218	\$32	\$615	\$865
Telephone Answering Machines	52.7	\$18	\$3	\$52	\$73
Cellular Phones	165.8	\$58	\$0	\$0	\$58
Converged Mobile Devices	34.6	\$12	\$0	\$0	\$12
Totals	5,868.9	\$2,050	\$286	\$5,577	\$7,913

Cost Parameters Year 3	
Collection	
Collection cost (\$/tonne)	\$349
<i>Includes Transport to Consolidation and materials costs.</i>	
Consolidation	
Consolidation cost (\$/tonne)	\$50
<i>Includes storage</i>	
Processing	
Processing cost (\$/tonne)	\$984
<i>Includes transportation to Processing</i>	

7.2.2 Administrative Costs

Administrative costs for the Phase II electronics recycling programs include costs related to the following functions:

- **Program Administration Costs:** Are costs related to general administration of the program including processor audits, compliance reviews, program management fees and other administration costs.
- **Communication Costs:** Are costs related to advertising and other communication.
- **Research and Development (R&D) Costs:** Are costs incurred to pursue research and development activities.
- **Contingency Costs:** An allowance for unforeseen or unpredictable costs.

As a starting point, actual and forecast program administration and communication costs for the existing Phase I programs were reviewed with each of ACES, SWEEP and ESABC. Program administration and communication costs were then aggregated across the three programs.

Through conversations with representatives from each of the programs it was determined that program administration costs are generally of the following two types: fixed costs and variable costs. Fixed program administration costs are those costs that are not generally expected to increase materially with increased program operating costs. Fixed program administration costs were considered to include costs such as general office costs, insurance, executive director and board of director costs and other similar costs. The Phase II program was allocated 25 per cent of the total forecast fixed program administration costs in each of the initial forecast years based on a rough estimate that Phase II products would be expected to be 25 per cent of the volume by weight of the combined Phase I and Phase II material processed.

Variable program administration costs are costs that are expected to increase as a result of processing a higher volume of material and having more steward companies involved due to the broader range of Phase II products. Variable program administration costs include costs related to processor audits, compliance reviews and program management fees. Through conversations with representatives from each of the programs and the Study Advisory Committee it was determined that variable costs might be expected to increase by 30 per cent as a result of implementing programs for Phase II products. In arriving at an estimated increase of 30 per cent, the Research Team and the Study Advisory Committee considered the increased number of stewards that would be involved and also efficiency improvements that may result from streamlining and centralizing compliance reviews and processor audits. The 30 per cent estimated increase in variable program administration costs were included in the total program administration costs for Phase II products.

Communication costs were estimated based on existing communication costs. An extra amount of 30 per cent of existing communication costs was added to Year 1 in contemplation of costs related to rolling out the Phase II program. Contingency costs and research and development costs were developed based on accruals of 5 per cent of operating costs. It is anticipated that the contingency accrual would remain in place until a reserve fund of one year of operating expenses has been attained.

Once the Year 1 costs were developed, the program administration and communication cost forecasts for subsequent years were developed based on two per cent inflation for Year 2 and one per cent inflation for Year 3. A lower inflation rate was chosen for Year 3 with the expectation that there would be productivity improvements to offset the full cost of inflation. Year 2 and Year 3 communication costs do not include the Year 1 communication costs associated with the roll-out of the Phase 2 program. Table 7.10 summarizes the estimated Administrative Costs.

**Table 7.10
Estimated Phase II Product WEEE Administrative Costs**

	Year 1	Year 2	Year 3
Total Operational Costs	\$5,660	\$7,119	\$7,913
R&D Accrual	5.0%	5.0%	5.0%
Common Cost Contingency Accrual	5.0%	5.0%	5.0%
Program Administration (\$000)	\$622	\$634	\$640
Communication (\$000)	\$1,088	\$504	\$509
Common R & D Costs (\$000)	\$283	\$356	\$396
Contingency (\$000)	\$283	\$356	\$396
Total Administrative Costs	\$2,276	\$1,850	\$1,941

7.3 CALCULATION OF ENVIRONMENTAL HANDLING FEES

Once the operational costs and administrative costs were developed, the next step involves calculating the EHF for each product category. The first step in calculating the EHF was to determine the number of product classes for which an EHF would be calculated. In regulated utility rate-making or design, customer classes are created to group together customers with similar use and operating characteristics. While it is possible to calculate an EHF for each product for which there was sales or shipping data, the Research Team and the Study Advisory Committee considered the following in determining the number of EHF categories to be developed:

1. There were some Phase II products for which no reasonable sales data could be obtained within the time constraints of the study. Further, the pace at which new products enter the marketplace means that within the three-year planning period of this study it is possible that new products not contemplated at the time of this research might emerge. The EHF categories should be broad enough to allow EHF to be administered for these products.

2. The EHF's would vary dramatically for projects at different stages of their life cycle. For example, products like VCRs, for which there are many units in distribution but relatively few new units being sold, would have very high EHF's if they were calculated for that specific product. In this case the EHF might approach or exceed the total cost of the unit itself.
3. For administrative purposes, and for communication purposes to stewards and consumers, it would be desirable to have a manageable number of EHF's, rather than a multitude of different EHF's. Further, it is anticipated that the EHF's will be applied to each product based on the stock-keeping unit (SKU).
4. The EHF product categories need to be diverse enough to recognize operating cost differences in order to reduce cross-subsidization between product categories.

This step is similar to creating or designing customer classes for a rate-regulated utility. While each individual customer may impose slightly different costs on the system, and in theory it would be possible to calculate an individual rate for each utility customer, there are practical limits on the analytical ability to provide meaningful forecasts at that level. There are also limitations on the ability to administer dozens of EHF categories.

7.3.1 Preliminary EHF Calculations

The Research Team and the Study Advisory Committee reviewed several options for EHF classes. Considering the criteria described above, EHF's were developed for the following six categories:

- **Personal/Portable Audio/Video Systems:** Includes portable devices used primarily for personal use including docking speakers; portable stereos/tape players/radios; personal CD players, portable audio recorders/portable tape/radio players; headphones; MP3 players; solid state voice recorders; digital cameras and video cameras/camcorders.
- **Car Audio Systems:** Includes car stereo amplifiers and equalizers, car stereo speakers and in-dash CD players.
- **Home Theatre in a Box (HTB) Systems:** Due to the unique characteristics of this product it was determined that a separate EHF category was appropriate.
- **Home Audio/Video Systems:** Includes VCRs and DVD players; mini/mid/full size package systems; single/multi CD players; clock radios; digital cable equipment; satellite cable equipment; speakers (home speakers; home theatre speakers and multi-media speakers), amplifiers, receivers, data projectors and similar audio/video systems.
- **Non-Cellular Telephones:** Includes wire telephones, cordless telephones and telephone answering machines.
- **Cellular Phones:** Includes traditional mobile phones and converged mobile devices.

Operational costs from Tables 7.7, 7.8 and 7.9 related to the products in each of these categories were directly assigned to these categories. Administrative costs (as allocated and forecast in Section 7.2.2) were shared across these categories using the following two ratios:

- 15 per cent of the administrative costs were allocated in equal shares to the six EHF categories. This allocation was made in recognition of the fact that there are a certain amount of fixed costs associated with administering each EHF category.
- The remaining 85 per cent of the administrative costs were allocated based on the weighted share of the total operational costs.

EHF's were calculated based on the three year forecast period. The total operational and administrative costs for the six EHF categories were summed across the three year period and divided by the total number of units forecast to be shipped or sold. Table 7.11 shows the Preliminary EHF calculations.

Table 7.11
Preliminary EHF Calculation

	Total Operational Costs (\$000)	Common Costs Equally Shared (\$000)	Common Costs Proportional to Category Specific Costs (\$000)	Total Costs (\$000)	Projected Sales (000s units)	EHF (\$/unit)
Personal/Portable Audio/Video Playback Systems	\$2,362	\$152	\$587	\$3,101	7,700	\$0.40
Car Audio Systems	\$752	\$152	\$189	\$1,092	416	\$2.63
Home Audio/Video Systems	\$13,200	\$152	\$3,306	\$16,658	4,900	\$3.40
Home Theatre in a Box (HTB) Systems	\$1,410	\$152	\$336	\$1,898	317	\$5.98
Non-Cellular Telephones	\$2,800	\$152	\$699	\$3,650	4,480	\$0.81
Cellular Phones	\$167	\$152	\$41	\$359	7,629	\$0.05
Totals	\$20,691	\$910	\$5,157	\$26,758	25,443	

Notes:

1. **Personal/Portable Audio/Video Playback Systems:** include Docking speakers, Audio player (tape) Portable Stereo, Headphones, MP3 Players, Personal CD Players, Audio recorder/Portable Tape/Radio Players, Solid State Voice Recorders, Digital Cameras and Video Cameras/Camcorders.
2. **Car Audio Systems:** include Car Stereo Amps & Equalizers, Car Stereo Speakers and In-dash CD players.
3. **Home Audio/Video Systems:** include all other Audio/video Playback and Recording Systems except HTB Systems.
4. **Cellular Phones:** do not include Consolidation and Processing costs in Operational Costs.

7.3.2 Proposed Environmental Handling Fees

One further refinement was made to the proposed EHF. It was determined by the Research Team and the Study Advisory Committee that for ease of communication and administration it would be desirable to implement EHF that were in rounder numbers than those prepared by the preliminary EHF calculation. However, it was recognized that the degree of rounding could influence the revenue collected by each of the EHF categories. Therefore the Research Team and the Study Advisory Committee adopted a two-step approach to rounding the preliminary EHF:

1. Preliminary EHF were rounded up to the nearest twenty-five cent increment.
2. Where the results from step 1 would increase the preliminary EHF by more than 10 per cent, the rounding mechanism was adjusted downward to the nearest five cent increment.

Following this two-step process, all of the Proposed EHF are within 5 per cent of the Preliminary EHF. The Proposed EHF are presented in Table 7.12. In reviewing these results with the Study Advisory Committee, and considering the quality of data available, the Proposed EHF are considered reasonable for implementation.

Table 7.12
Proposed EHF

	Preliminary EHF (\$/unit)	EHF Rounded to Next \$0.25 (\$/unit)	Per cent Increase (\$/unit)	Proposed EHF (\$/unit)	Per cent Increase (\$/unit)
Personal/Portable Audio/Video Playback Systems	\$0.40	\$0.50	25.0%	\$0.40	0.0%
Car Audio Systems	\$2.63	\$2.75	4.6%	\$2.75	4.6%
Home Audio/Video Systems	\$3.40	\$3.50	2.9%	\$3.50	2.9%
Home Theatre in a Box (HTB) Systems	\$5.98	\$6.00	0.3%	\$6.00	0.3%
Non-Cellular Telephones	\$0.81	\$1.00	23.5%	\$0.85	4.9%
Cellular Phones	\$0.05	\$0.25	400.0%	\$0.05	0.0%

8.0 MONITORING AND RECOMMENDATIONS

Throughout the research phase it has been noted that there were many assumptions and estimates required to prepare the EHF calculations. While care has been taken at each step to identify the best available data and to cross-check all assumptions and estimates with the Study Advisory Committee, the estimates are not based on actual experience in handling of Phase II products. As experience is gained, a more sound basis for producing the estimates will emerge reflecting actual revenues and costs. In addition, this is a rapidly evolving field in terms of regulatory requirements, technology and operating approaches. Such changes will affect EHF calculations. It will be important as part of program implementation for Phase II products to develop and implement systems that monitor the parameters and variables that are used in the EHF calculations and to use the information generated to assess and modify the EHFs arising from this study. Within this context, the following activities are recommended:

1. Monitor on an ongoing basis key product parameters and variables including product weights and collection rates to assist in future refinements of the EHF calculations.
2. Conduct a high level review of the Phase II EHFs following the first year of program implementation. This review can be used to identify any material problems related to revenue over-collection or under-collection and to ascertain if the EHFs are reasonable.
3. Undertake a detailed review and assessment of the Phase II EHFs at the end of the three year period. The EHFs have been calculated assuming a three year operating period. New estimates will be required to take into account actual operating experience and changes in technology, products and operating environments.
4. Maintain on-going communication with stakeholders, including stewards and consumers, to help to identify opportunities to further refine the EHF calculation methods.
5. As the actual experience develops with Phase II products (as with Phase I), a more robust historical data bank will become available to confirm or revisit the basic assumptions and the methodology used to generate the EHFs going forward.

