Best Practices for Achieving Environmentally Sound Management (ESM) for Managers

At Facilities that Refurbish and Recycle Used and End-of-Life Electronic Products in North America

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Commission for Environmental Cooperation

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Commission for Environmental Cooperation

Best Practices for Achieving Environmentally Sound Management (ESM) at Facilities that Refurbish and Recycle Used and End-of-life Electronic Products in North America

Module 1a

Introduction to ESM for Managers

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1 Module 1a: Introduction to Environmentally Sound Management (ESM)—For Managers

1.1 Learning Objectives

By the end of this module you will be able to:

- describe the importance and benefits of ESM, including elements deemed necessary to achieve ESM at the facility-level;
- indicate potential environmental, health and safety issues associated with refurbishing and recycling electronic products;
- define worker health and environmental benefits of implementing ESM at your facility;
- list economic benefits of implementing ESM at your facility;
- identify the benefits of participating in ESM validation and certification programs and how this can increase your client base, your inventory volumes, and, ultimately, your potential profits; and
- summarize the waste management hierarchy and how it applies to activities undertaken at your facility.

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1.2 Pre-questionnaire

1. What would you like to achieve from this training?

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2. What is environmentally sound management (ESM), in your own words?

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3. Why do you think ESM is important?

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4. How does your facility already practice aspects of ESM?

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5. What benefits could ESM offer (list one benefit for each):

   a. Your business? _____

   b. Your facility workers? _____

   c. The local or global environment? _____

6. Can you prioritize the following activities of the waste management hierarchy to illustrate how wastes should be managed to optimize effective ESM?:

a. Energy Recovery	Highest Priority→ 1. _____
b. Disposal	2. _____
c. Minimization	3. _____
d. Reuse	4. _____
e. Prevention	5. _____
f. Recycling	6. _____

1.3 Introduction and Overview of this Module

Would you like to operate your facility knowing that you are doing the right thing to support the health of your workers, the surrounding community, and the environment? The concepts and tools offered by **environmentally sound management (ESM)** help facilities such as yours to do so, while enhancing your business profile.

What is **ESM**? This module will address the question by providing you with:

- an overview of the concept of ESM,
- an overview of important economic, social, and environmental benefits of implementing ESM at your facility,
- an outline of the waste management hierarchy and how it relates to ESM for used and end-of-life electronic products,
- the common verification and certification programs used in Canada, Mexico and the United States, and the benefits of verification and certification, and
- a brief overview of some key international agreements that highlight the importance of ESM.

1.4 What Is Environmentally Sound Management (ESM)?

Answer: ESM can be defined as:

Taking all practicable steps to ensure that used and/or end-of-life products and wastes are managed in a manner which will protect human health and the environment.

ESM applies to: all kinds of waste, whether hazardous or non-hazardous; all aspects of waste management, including storage (temporary), recovery, recycling/refurbishment (including disposal of residues from recovery operations), and any activity related to handling waste and used or scrap materials.[1]

ESM is particularly relevant to the handling of used and end-of-life electronic products and serves to:

- address the increased volume of electronic waste that is produced globally,
- capture and re-use valuable recovered metals such as gold, silver, copper and aluminum, and
- ensure worker safety, in relation to potentially hazardous materials that can be found or produced in electronic products recycling (see Modules 3 and 4).

Increasingly, governments, clients, investors, and the public are looking for assurances that a company practices ESM. ESM is also an important cornerstone of relevant international conventions and agreements, including those derived under the work of both the Organisation for Economic Co-operation and Development (OECD) and the United Nations (UN).

As member countries to the OECD, Canada, Mexico and the United States are expected to adhere to OECD recommendations and guidance, including those supporting ESM. Similarly, as Parties and/or signatories to the UN Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal,[2] Canada, Mexico and the United States are expected to abide by relevant Basel obligations and guidance, including those supporting ESM.

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1 Bureau of International Recycling (BIR). 2006. *Tools for Environmentally Sound Management—All You Need for an ISO Compliant Environmental Management System that Includes OECD Core Performance Elements for the World's Recycling Industries*.

2 Both Canada and Mexico are Parties to the Basel Convention. Although the United States is not a Party to the Basel Convention, it is a contributor to work under the Convention.

1.5 Why Should Implementing Environmentally Sound Management Be Important to My Business?

"Implementing ESM costs money, and my shareholders care about profit. Why should I implement ESM?"

Answer:

1. **ESM can increase business opportunities** with new clients, who are more frequently demanding that processors of electronic products use ESM practices. More and more Canadian provinces and American states have stewardship programs in place, for used and end-of-life electronic products, that require use of approved service providers which are validated or certified to be compliant with ESM standards. In addition, the use of ESM practices is increasingly in demand from stakeholders or other business partners who desire to do business with companies that care about corporate social responsibility (CSR).

2. **Implementing ESM can potentially increase profits.** ESM can increase the recovery of materials that are of high economic value, for example precious metals such as gold, nickel, copper or palladium. Implementing ESM improves your operational efficiency. In addition, in some Provinces and States, there may be financial incentives provided to refurbishers and recyclers of used electronic products. Lastly, facilities that implement ESM can have reduced liability costs through insurance companies and banks.

3. **Implementing ESM will protect the health of your workers, their families, your community, and the environment**. There are critical, worker health, community, and environmental concerns that come from facilities that process used and end-of-life electronic products. ESM can improve worker health and safety, as well as protect the local community and the environment. In addition, having healthy workers leads to improved productivity, healthier communities, and better relations with communities.

Each of these answers is explained in more detail below.

1.5.1 How Can Environmentally Sound Management (ESM) Increase Business Opportunities?

Answer:

ESM can increase business opportunities with new clients, who more frequently are requiring processors of electronic products to use ESM practices. More and more Canadian provinces and American states have stewardship programs in place for used and end-of-life electronic products, that *require use of approved service providers which are validated or certified to be compliant with ESM standards.* The trend has been growing steadily over the last decade and is anticipated to continue, both in North America and globally.

Examples from Canada:

- In Canada a national industry management structure has been implemented to harmonize the various electronic product stewardship programs operating across the country. This organization is called the Electronic Products Recycling Association (EPRA). All eight of Canada's provincially mandated electronic product recycling programs use the same Recycler Qualification Program (RQP), which defines minimum *environmental, health and safety requirements that must be in place for a business to be an approved refurbisher or recycler of electronic products* under any of the programs.[3] Many programs in the United States also require specific ESM criteria of their approved recyclers.

- In the province of Ontario, Canada, the Electronic Product Stewardship Program offers a financial incentive[4] to approved processors of used and end-of-life electronic products (the approved processors must use ESM practices). The processor incentive depends upon the efficiency of the processor's recycling operations—the higher the percentage of the computer that it can reuse or recycle, the higher the financial return. For example, if the processor can reuse or recycle 60% to 85% of a computer, it receives $150/tonne processed. However, if it reuses or recycles more than 85% of a computer, it can receive $300/tonne.

By demonstrating that your facility conforms to ESM best practices, you can become an approved service provider under electronic product stewardship programs, thereby increasing your business opportunities!

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[3] Electronic Products Recycling Organization. Recycler Qualification Program. Online at: <http://www.rqp.ca/>.

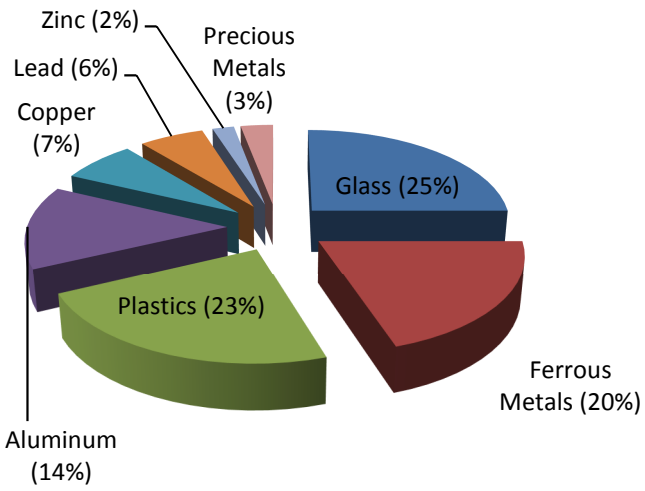
[4] Ontario Electronic Stewardship Processor Incentive Program. Online at: www.ontarioelectronicstewardship.ca/your-role/service-provider/recycler-processor/pi-program.

1.5.2 How Can Environmentally Sound Management (ESM) Increase Profits?

Answer:

By recycling discarded or used electronic products you can recover materials that are of high economic value, such as gold, nickel, platinum or palladium (precious metals), as well as copper. A typical computer is comprised of approximately 3% precious metals.[5] These metals can be extracted and sold to smelters for profit. Printed circuit boards are particularly valuable, as they contain valuable concentrations of copper, and precious metals such as gold, silver or palladium. One tonne of circuit boards can contain 40 to 800 times the amount of gold and 30 to 40 times the amount of copper as what is mined from one tonne of ore. One tonne of cell phones (about 10,000 cell phones) contain 300 to 400 grams of gold, while in a gold mine, one tonne of mined ore contains about five to 10 grams of gold.[6] Technologically, recycling precious metals can be very efficient: gold can be recycled to 99% efficiency, silver to 98% efficiency, palladium to 95% efficiency, and copper to 90% efficiency.

Exhibit 1: Composition of Desktop Computers and Monitors[7]



[5] Réseau Québecois des CFER. (Year unknown.) *Guide for Organizations that Want to Set Up Centres for Disassembling and Sorting End-of-life IT Equipment.* Environment Canada, and Réseau Québecois des CFER Guide for Organizations.

[6] Pollard, Karen. US EPA. Environmental Electronics Stewardship in the United States: A Lifecycle Approach. Presentation, June 2011. Available at: www.epa.gov.tw/FileLink/FileHandler.ashx?file=14845

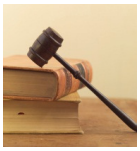
[7] *Source*: Microelectronics and Computer Technology Corporation. Electronics Industry Environmental Roadmap, as cited in: Réseau Québecois des CFER. (Year unknown.) *Guide for Organizations that Want to Set Up Centres for Disassembling and Sorting End-Of-Life IT Equipment.* Environment Canada and Réseau Québecois des CFER Guide for Organizations.

1.5.3 *What Are the Other Economic Benefits of Implementing Environmentally Sound Management (ESM) at My Facility?*

Answer:

- ✓ In today's economy you want to build and maintain trust with your clientele by having a strong and reputable business image. Being recognized as a company that is fully engaged in ESM gives you a distinct marketing advantage for your services.

- ✓ You will build improved relations with regulators and the public, as well as with other business partners,[8] by implementing an ESM system that addresses environmental protection, health and safety, and complaints handling in a way that enables continual improvement in a competitive business environment.



- ✓ You will demonstrate due diligence by ensuring legal compliance and enhancing communication through documentation of ESM practices.[9] In addition, you will be prepared for future and potentially costly requirements from new regulations. ESM supports best practices that are in line with the law.

- ✓ The implementation of ESM often involves a systematic management system, which can increase plant efficiency by streamlining operations and ensuring effective recycling of all reusable and recyclable components. It can also result in a reduction in waste generation because of more streamlined waste reporting and tracking, as well as from increasing the reuse and recyclability of components.

- ✓ Reduced operational costs. Some facilities have reported an operational cost reduction of 10% after implementing ESM.[10] This could occur through reduced waste disposal costs, since more materials are sent for recycling, or it could be through a potential reduction in costs associated with liability such as bank charges or insurance premiums if a facility is an approved service provider in a certified program.

There are many economic benefits to be realized by implementing ESM at your facility!

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8 Bureau of International Recycling (BIR). 2006. *Tools for Environmentally Sound Management: All you need for an ISO Compliant Environmental Management System that Includes OECD Core Performance Elements for the World's Recycling Industries*.

9 UNEP. Basel Convention. 2011 (Revised). *Environmentally Sound Management (ESM), Criteria Recommendations*. PACE.

10 Bureau of International Recycling (BIR). 2006. *Tools for Environmentally Sound Management: All You Need for an ISO Compliant Environmental Management System that Includes OECD Core Performance Elements for the World's Recycling Industries*.

Notes

1.5.4 *What Are the Substances of Concern Found in Used Electronic Products, which Affect Health, Safety and the Environment?*

"I am refurbishing and/or recycling, which is a *green* business—this stuff might otherwise end up in an unlined landfill. Why should I implement ESM?"

Answer: Implementing ESM will protect the health of your workers, their families, your local community, and the environment. Hazardous substances are contained within electronic products. These substances serve important purposes during the product's consumer life. However, when products require refurbishment or recycling they undergo disassembly or size reduction (e.g., shredding) that can result in exposures to and releases of hazardous substances if managed improperly. Hazardous substances can severely affect worker health and safety when they are inhaled or touched, and negatively affect the surrounding environment by contaminating local air, water or soil. Implementing ESM aims to minimize or eliminate human exposure to potentially hazardous materials and environmental impacts from releases of hazardous substances.

Each country uses a different process to define what a hazardous substance is. Exhibit 2 lists common substances of concern found in electronic products that can cause significant human health impacts from exposure, as well as environmental pollution.

Exhibit 2: Common Substances Found in Electrical and Electronic Components[11]

Electrical Component	Substances of Concern
Plastics	Phthalate plasticizers, brominated flame retardants
Cathode Ray Tubes (CRTs)	Lead, antimony, mercury, phosphorus, barium oxide
Liquid Crystal Displays (LCDs)	Mercury
Rubber	Phthalate plasticizer, brominated flame retardants
Wiring/Electrical (Interior)	Phthalate plasticizer, lead, brominated flame retardants, copper
Motherboards / Circuit Boards	Lead, beryllium, antimony, brominated flame retardants
Fluorescent Lamps	Mercury, phosphorus, flame retardants
Batteries	Lead, lithium, cadmium, mercury
External Electric Cables	Brominated flame retardants, plasticizers
Light-emitting Diodes	Gallium arsenide
Mobile Phones	Cadmium, lead, arsenic, barium, beryllium, strontium

[11] *Source*: UNEP. 2007. *E-waste. Volume I: Inventory Assessment Manual*. International Environmental Technology Centre.

1.5.5 *How Are Workers Exposed to these Potentially Hazardous Substances?*

Answer:

Exposure to hazardous substances can directly affect worker health, and can also affect the health of the community. Depending on the policies of the facility for selecting downstream vendors for secondary or tertiary processing, substances of concern can also cause **global** health impacts. This can happen if electronic waste is exported to service providers in other countries that lack the necessary infrastructure and capacity to ensure ESM.

Workers can be exposed to hazardous materials from electronic waste during receiving, sorting, holding, processing, and packaging at refurbishing and recycling facilities.

Exhibit 3: Examples of Key Occupational Issues at E-waste Refurbishment and Recycling Facilities[12]

Receiving	•Incoming shrink-wrapped products stacked on a skid can fall and break when they are unwrapped—workers need to handle broken and sharp materials with care. •Workers need to deal with contaminants that may have leaked out of broken materials, including from clean-up of materials and contaminated wrapping.
Sorting	•Primarily a manual process, sorting can include handling electronic waste and breakage is a primary issue. Possible contaminants during breakage at this stage include heavy metals (lead, mercury, beryllium, cadmium), antimony, barium oxide, lithium, phosphorus,or arsenic.
Holding	•Materials have designated holding areas for processing. If materials are not stored properly (i.e., outdoors), they could be exposed to the elements and contaminants could leach out, exposing workers to hazardous substances.
Processing (Manual)	•Manual processing includes testing for reuse, removal of hazardous items (e.g., mercury lightbulbs, nickel-cadmium or lithium-ion batteries) or complete disassembly. •Workers must deal with contaminants that may have leaked from broken materials or with hazardous dust from grinding, cutting and soldering operations.
Processing (Mechanical)	•Mechanical processing may include: shredding, size reduction, material separation, and smelting. Workers can be exposed to dust and vapor emissions via inhalation or ingestion after touching materials. Secondary substances can be formed, such as dioxins and furans, that are hazardous to workers' health.
Packaging and Storage	•Containment is required for broken or shredded materials, leachable materials, or electrically charged materials. Packing is performed manually, so there is a potential for exposure to hazardous materials at that time.

[12] Only occupational issues which are linked to ESM have been highlighted, rather than other occupational issues of a more general nature that would be applicable to many industries (e.g., ergonomic issues, etc.).

1.5.6 *What Are the Potential Environmental Impacts from NOT Implementing Environmentally Sound Management (ESM)?*

Answer: Facilities that do not regularly practice ESM have a higher likelihood of contaminating local air, soil, or water. Practices such as open burning, open dumping, backyard smelting and uncontrolled acid leaching[13] do not conform to ESM and should not be undertaken under any circumstances. In contrast, facilities that do practice ESM take precautions for worker health and safety and environmental protection in all of their business operations.

OPEN BURNING:

OPEN DUMPING:

Open burning, open dumping, backyard smelting and uncontrolled acid leaching can seriously affect the health of workers, and communities. These actions can also contaminate air, water, and soil.

[13] Photo credits: Basel Action Network, 2006, as cited in The Center of Information and Communication, and Technology for Development; and CETIC.BO/Quipus Foundation of Bolivia, 2007, *A Hemispheric Initiative: A Manual for the Management of Electronic Components in Latin America and the Caribbean*.

Environmental Impacts from Not Implementing Environmentally Sound Management (ESM) (Continued)

Exhibit 4: Examples of Environment and Community Issues from Electronic Product Refurbishment and Recycling Facilities that *Do Not Practice ESM*[14,15,16]

Air Pollution	Water Pollution	Soil Contamination
• Lead, mercury, metals or dioxins and furans can be released to air during electronics recycling processing, such as crushing, shredding, melting or smelting.	• Discharges of metals from accidents, lack of spill prevention, and runoff from improper storage can contaminate surface water and ground water. • Arsenic, chromium, lithium, molybdenum, antimony, silver, cobalt, cadmium, copper, nickel, lead and zinc have been documented near waterbodies of facilities that do not practice ESM.	• Concentrations of polycyclic aromatic hydrocarbons (PAHs) can contaminate soil near electronic waste recycling facilities that do not practice ESM—especially those with incineration or open burning.

[14] *Source*: UNEP. 2007. *E-waste. Volume I: Inventory Assessment Manual*. International Environmental Technology Centre.

[15] *Dioxins and furans* are highly toxic, causing reproductive and developmental problems and damage to the immune system; and cause cancer in animals and humans who are exposed to them via inhalation.

[16] *PAHs* are a group of over 100 different toxic substances that are formed during incomplete burning, and can contaminate water, plants, animals and people.

Notes

1.5.7 What Are Some Key Environmental Benefits of Implementing Environmentally Sound Management (ESM)?

Answer:

Some of the key environmental benefits that electronic product refurbishing and recycling facilities can see from implementing ESM practices are presented in Exhibit 5.

Exhibit 5: Key Environmental Benefits of Implementing ESM[17]

Landscape Impacts Reduced from Mining Precious Metals	Ecosystem Health Enhanced	Greenhouse Gas Emissions Reduced	Energy Savings
Recycling metals (both ferrous and precious), glass, and plastic from used electronics reduces the need for mining to extract resources for manufacturing new metals, glass or plastics. This preserves natural resources, saves energy required by mining and preserves natural habitat that is often destroyed by mining.	Releases (to air, water, or land) of potentially hazardous substances are prevented by using emission controls during processing, preventing spills and improving safety practices throughout the facility.	In 2007, the US recycled 414,000 tons of electronics. This avoided 974,000 megatons of carbon dioxide equivalent emissions, the same as the annual emissions from more than 178,000 passenger vehicles.	Recycling one million laptops saves energy equivalent to the electricity used by 3,657 homes in a year.

[17] *Sources*: US EPA. Wastes, Resource Conservation. E-cycling website, at: <http://www.epa.gov/osw/conserve/materials/ecycling/faq.htm#benefits>. Accessed 31 August 2012. And: Perry Johnson Registrars Inc. R2: Responsible Recycling—A Different Approach to a Different Waste Stream (slide deck).

1.5.8 What Are the Worker and Community Benefits of Implementing Environmentally Sound Management (ESM)?

Answer: By improving both employee and community safety by implementing **ESM** practices, you can achieve:

- ✓ better morale—workers feel safe, leading to pride in the workplace and enhanced worker productivity;
- ✓ enhanced knowledge of the importance of the appropriate use of personal protective equipment—managers must make this an important part of employee training, and part of the everyday culture of safety;
- ✓ healthier workers and healthier families of workers;
- ✓ less risk of spills and air/water/land emissions to the local environment—this leads to healthier local communities; and
- ✓ improved community safety through reduced environmental and public health risks.

There are many community benefits to be realized by implementing ESM at your facility!

1.6 Criteria to Demonstrate Environmentally Sound Management (ESM)

The Organisation for Economic Co-operation and Development (OECD) is an international organization helping governments tackle the economic, social and governance challenges of a globalized economy. Canada, Mexico and the USA are members of the OECD. The OECD defined six core performance elements (CPEs) as a way to identify ESM needs. Work under the United Nations Basel Convention also defined eight ESM criteria to offer *further guidance* for a facility to identify ESM needs. Both are similar forms of guidance to assist a facility in identifying what it needs to have in place for ESM. These elements and criteria are outlined in the table below.

OECD Core Performance Elements (CPEs) for ESM	UNITED NATIONS BASEL CONVENTION Criteria for ESM	Where to Find?
CPE-1: The facility should have an applicable environmental management system (EMS) in place. The EMS should include: measurable objectives for continual improvement; monitoring and re-examination of progress; collection and evaluation of adequate and timely environmental, health and safety information.	**Top Management Commitment to a Systematic Approach** to achieve ESM in all aspects of facility operations, which often includes an environmental health and safety management system. **Corrective Action:** Take appropriate action to address significant actual and/or potential risks to public and worker health and safety, and the environment and to correct identified deficiencies in achieving ESM.	MODULES 1, 2, 4, 6
CPE-2: The facility should take sufficient measures to safeguard occupational and environmental health and safety. Adequate measures should be taken to avoid unacceptable occupational health and safety risks.	**Risk Assessment:** Identify and assess actual or potential hazards and risks to public and worker health and safety and the environment from company operations. **Risk Prevention and Minimization:** Eliminate where possible and strive to minimize hazards and risks to public and worker health and safety and the environment. **Legal Requirements:** Identify and strive to fulfill legal requirements.	MODULES 3, 4, 5
CPE-3: The facility should have an adequate monitoring, recording and reporting program, to cover relevant legal requirements; compliance with applicable safety requirements and effluent and emission controls; and tracking of incoming, stored and outgoing waste.	**Record-keeping and Performance Measurement:** Maintain records, monitor, track and evaluate facility performance at achieving ESM. **Transparency and Verification:** Provisions to support transparency and verification to provide public assurances that operations and	MODULES 2, 4, 6

OECD Core Performance Elements (CPEs) for ESM	UNITED NATIONS BASEL CONVENTION Criteria for ESM	Where to Find?
	activities are compatible with ESM.	
CPE-4: The facility should have an appropriate and adequate training program for personnel, including handling of any hazardous components in incoming waste.	**Awareness, Competency and Training:** Ensure employees have an appropriate level of awareness, competency and training with respect to the effective management of occupational risks.	MODULES 2, 4, 6
CPE-5: The facility should have an adequate emergency plan. The facility should have a regularly updated plan for monitoring, reporting and responding to accidental or otherwise exceptional pollutant releases, including emergencies such as accidents, fires, explosion, abnormal operating conditions, etc. *This is part of CPE-1.*	-N/A	MODULE 4
CPE-6: The facility should have an adequate plan for closure and after-care. Closure plans should be updated periodically and financial guarantees should ensure that the necessary measures are undertaken upon definite cessation of activities to prevent any environmental damage and return the site of operation to a satisfactory state, as required by applicable laws and regulations. *This is part of CPE-1.*	-N/A	MODULE 4

Both the* Basel Convention Criteria *(2nd column in above table) and the* OECD Core Performance Elements *(1st column in above table) outlined above identify important criteria for ensuring Environmentally Sound Management, and both are compatible with one another. For the purpose of this training, ESM criteria as defined under the work of the Basel Convention will be used, for consistency.

Notebook

Why do you think each of the following has been identified as an important criterion that a facility should have in place to demonstrate a commitment to environmentally sound management (ESM)?

- ❒ Top Management Commitment_____

_____

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- ❒ Risk Assessment_____

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- ❒ Risk Prevention and Minimization _____

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- ❒ Legal Requirements _____

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- ❒ Record Keeping and Performance Measurement_____

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- ❒ Awareness, Competency and Training_____

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1.7 Environmentally Sound Management (ESM) and Environment, Health and Safety Management Systems

The "top management commitment" to a systematic approach to ensuring ESM describes the importance of having an environment, health and safety management system in place.

An environment, health and safety (EHS) management system provides a set of administrative controls to ensure safe work practices. An EHS system weaves environmental and worker health decision-making into the identity of a business, facilitating compliance while improving overall performance. The systematic approach of an EHS management system focuses on environmental risk minimization and worker health and safety. Each facility's EHS system is unique, but follows a simple plan-do-check-act model. The components of this model include:

1. **Policy**. An EHS policy includes objectives, targets, and programs to achieve ESM (see Module 2, on Top Management Commitment).

2. **Planning**. A facility makes plans to: identify the environmental aspects of its activities which could have a significant impact on health or the environment; control those impacts; identify all applicable environment, health and safety regulations; and develop objectives and targets for the EHS management system.

3. **Implementation and operation**. A facility implements and organizes processes, to control and improve the procedures that are critical for environmental and worker health and safety.

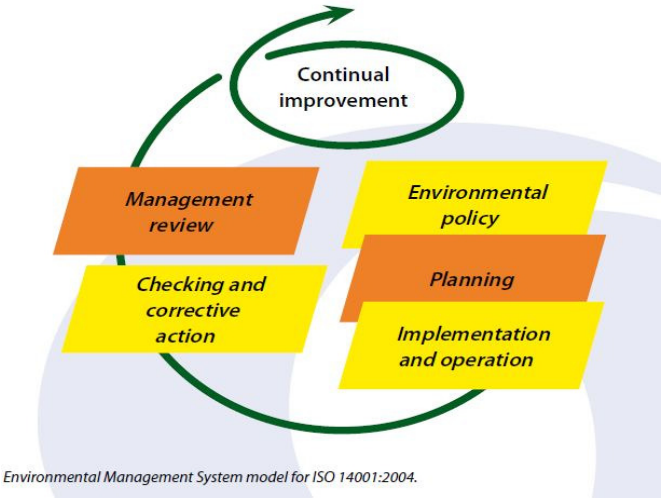
4. **Checking and corrective action**. A facility should monitor, measure, and check to make sure that the EHS management system is being implemented and is achieving its objectives and targets.

5. **Management review**. Top management should review the EHS management system at least once per annum to ensure that it remains suitable, adequate and effective. Management also needs to evaluate internal audits and regulatory developments and decide whether to modify the existing EHS management system.

An important criterion of ESM is having an environment, health, and safety management system in place at your facility, to ensure continual improvement.

1.7.1 The Environment, Health and Safety (EHS) Model of Continual Improvement

Exhibit 6: The EHS Plan-Do-Check-Act Management System Model of Continual Improvement



Environmental Management System model for ISO 14001:2004.

1.7.2 What are the Benefits of an Environmental, Health and Safety Management System?

Answer: Implementation of an environmental, health and safety management system can:[18]

- ✓ improve performance and ensure continual improvement in all areas
- ✓ effectively manage risk,
- ✓ reduce operational downtime and workplace related accidents, injuries and incidents,
- ✓ help to acquire a symbol of international recognition,
- ✓ reduce waste of resources,
- ✓ improve overall efficiency,
- ✓ consistently control key processes,
- ✓ improve public relations,
- ✓ meet requirements of vendors for bidding on goods and services,
- ✓ help to ensure that applicable legal requirements are met, and
- ✓ help to re-brand refurbishment or recycling of electronic products as an environmentally friendly business to be in.

For more information on EHS management systems, see Module 4

[18] Bureau of International Recycling (BIR). 2006. *Tools for Environmentally Sound Management: All You Need for an ISO Compliant Environmental Management System that Includes OECD Core Performance Elements for the World's Recycling Industries*.

1.8 Overview of Verification and Certification Programs for Electronic Product Refurbishers and Recyclers in North America

1.8.1 What Do Verification and Certification Mean?

Answer: Verification and certification programs are management systems that validate or "certify" that a facility meets criteria for ESM as prescribed in a standard. Existing verification and certification programs used in North America share common elements:

- ✓ They advance best management practices and offer a way to assess the environmental, worker health and safety practices of entities managing used electronic products.
- ✓ They are based on strong environmental standards that maximize reuse and recycling, minimize exposure to human health and the environment, and ensure safe management of materials by downstream handlers.

1.8.2 Standards for Environmental Management Systems—What Is It and What Are the Benefits?

Answer: Two of the most common sets of international standards for environmental management systems are the ISO 14000 series of standards, which was established by the International Organisation for Standardization (ISO), and the Eco-Management and Audit Scheme (EMAS), which was established as a harmonized scheme throughout the European Union. In addition, some facilities may seek certification under the OHSAS 18000 series of standards, which is an international occupational health and safety management system specification that was established by number of the world's leading national standards bodies, certification bodies, and specialist consultancies. A number of refurbishers and recyclers of electronic products in North America and elsewhere in the global community are certified under at least one of these sets of standards.

Benefits of certification:[19]

- ✓ It fosters the involvement of top-level management because it requires that top management define an overall environmental policy for its firm.
- ✓ It establishes a framework for a systematic approach to environmental management, in which companies are encouraged to view their environmental performance holistically.
- ✓ It establishes a framework for continuous improvements in a firm's environmental management system, something that is completely absent in command-and-control regulations such as best available technology standards and emission standards.
- ✓ It encourages innovation at the facility level, among all employees, because it requires that all employees are made aware of their environmental responsibilities and trained to exercise care when performing duties that have environmental consequences.
- ✓ It encourages international awareness about environmental performance.

[19] OECD. 2003. *Use of Environmental Management Systems (EMS) as a Key Component for Environmentally Sound Management (ESM) of Wastes and Used and Scrap Materials*. Working Group on Waste Prevention and Recycling. ENV/EPOC/WGWPR(2001)5/FINAL.

1.8.3 Electronic Products Refurbishing/Recycling Verification and Certification Programs

"I am already ISO 14001-, EMAS- or OHSAS 18001-certified. Why should I implement ESM?"

Answer: ESM practices go beyond EMS standards such as ISO 14001, EMAS and OHSAS 18001 because:

1. These standards by themselves are generic, non-industry-specific standards that do not address the unique health, safety and environmental needs of the electronic products refurbishing / recycling sector.
2. These standards are management standards and therefore do not prescribe any specific requirements for improved environmental performance in this sector. They do not demonstrate assurance that specific ESM best management practices are used.
3. These standards require an organization to commit to compliance with applicable regulatory requirements, but allow organizations that are not in full compliance to be certified as being in conformance with the standard.

Exhibit 7 presents an overview of industry-specific North American ESM verification and certification programs for refurbishers and recyclers of used and end-of-life electronic products. These are generally considered to go one step further than ISO 14001, EMAS or OHSAS 18001.

Exhibit 7: E-recycling / E-refurbishing Verification and Certification Programs Used in North America

Responsible Recycling (R2)	Recycling Industry Operating Standard (RIOS)	e-Stewards	Recycler Qualification Program (RQP)	Electronics Reuse and Refurbishing Program (ERRP)
United States	United States	International	Canada	Canada
Specifically designed for electronics recyclers, it is a comprehensive environmental, health, and safety management system.	Designed for the recycling industry, it provides a management system framework that includes elements for continual improvement of environmental quality, health and safety.	Designed by the Basel Action Network to be an "all-in-one" certification – it encompasses an ISO 14001 environmental management system and incorporates R2 practices.	Defines the minimum requirements for auditing and approving electronics recyclers to ensure ESM to protect the environment and worker health and safety.	Defines the minimum requirements for organizations performing reuse and/or refurbishing functions and seeking to be recognized by the Stewardship Program.

1.8.4 What Are the Benefits of Verification and Certification Programs for Refurbishers and Recyclers of Electronic Products?

Answer:

- ✓ Certified companies demonstrate through external third party audits and continual oversight by an independent, accredited certifying body[20] that they continue to meet high environmental standards and safely manage used and end-of-life electronic products.
- ✓ Certification may be required if you want to participate in your state/provincial refurbishment or recycling programs for used and end-of-life electronic products (sometimes called "stewardship" or "extended producer responsibility" programs).
- ✓ With certification, you will gain credibility, improve relations with regulators and the public, and likely generate more business.
- ✓ The recycling market is expected to be a growing industry during the next few years as a result of constant technology advancements[21] and new legal requirements that will require facilities to manage used and end-of-life electronic products in a responsible way.
- ✓ Many SMEs might find it expensive to obtain formal certification, despite all of the benefits. Costs include registration to the accredited body, annual auditing services for a third party, and annual renewal of accreditation. It is important to note, however, that these costs are often scalable to the size and complexity of your facility. If the costs of accreditation are still deemed to be too expensive for a facility, the information contained in this training material can show you how you can still practice ESM in the absence of formal accreditation, while preparing your facility for pursuing certification in the future.

Increasing business opportunities through certification

In the United States, Executive Order (EO) 13514 (Federal Leadership in Environmental, Energy, and Economic Performance), requires government agencies to employ ESM when electronic products are disposed of.

Additionally, the US General Services Administration Federal Management Regulation Bulletin B-34, *Disposal of Federal Electronic Assets*, strongly encourages the use of certified recyclers and refurbishers for the recycling of electronic equipment.

If a federal agency opts to use a certified refurbisher or recycler of electronic products, it does not need to perform additional due diligence to ensure compliance with EO 13514 and GSA FMR Bulletin B-34.

US EPA. 2012. *Checklist for the Selection of an Electronic Products Recycler.*

[20] A certification accreditation board accredits certifying bodies and oversees them to ensure that they meet specific responsibilities and are competent to audit and provide certification.

[21] Frost & Sullivan. Global Opportunities in the Waste Electrical and Electronic Equipment (WEEE) Recycling Services Market. Part of the Environment Markets Growth Partnership Service program, as posted on the Business Review Canada website, <http://www.frost.com/prod/servlet/press-release.pag?docid=265644758>. Viewed 28 August 2012.

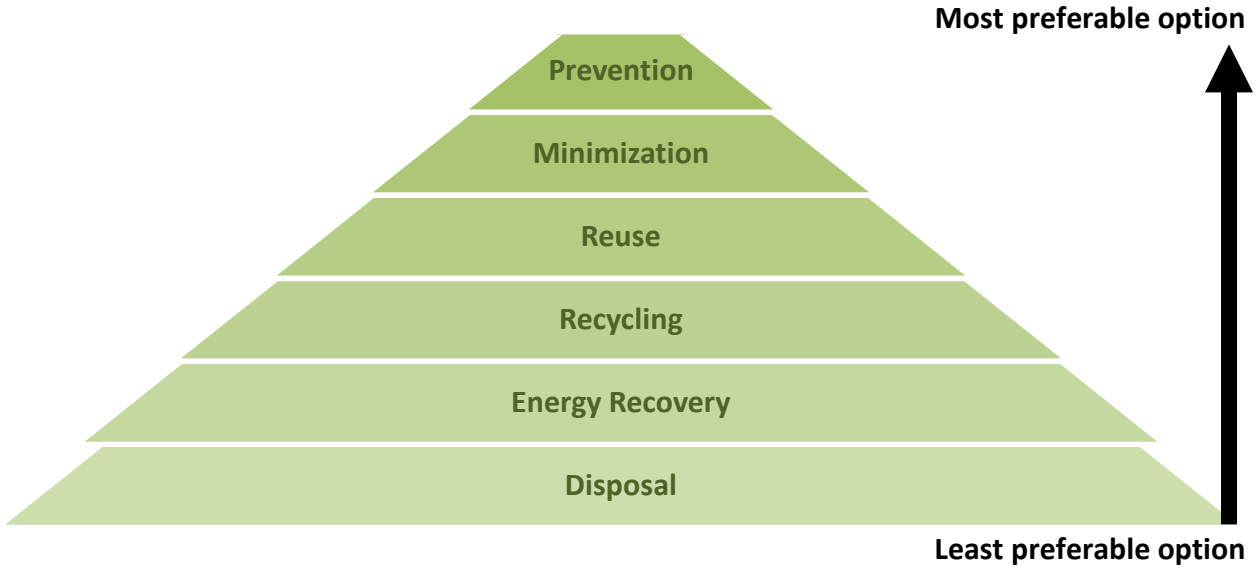
Notes

1.9 What Is the Waste Management Hierarchy and How Is It Connected to Environmentally Sound Management (ESM)?

Answer:

ESM of used and end-of-life electronic products encourages your facility to apply the waste management hierarchy. Most-preferable waste management options are at the top of the hierarchy, while the least preferable options are at the base of the hierarchy. Waste should be dealt with at the highest stage of the hierarchy as is possible.

Exhibit 8: The Waste Management Hierarchy



You can achieve many direct and indirect environmental benefits from reusing and refurbishing electronic products because this stage actually extends the life of the product while increasing the usefulness of the energy and material inputs that were used in the manufacture of the product. Benefits from recycling electronic products include: recovery of precious metals for use in jewelry, plating, electronics, automotive, and art foundries; recovery of glass; and recovery of plastics that can be recycled into plastic components for new electronic devices and products such as garden furniture, license plate frames, non-food containers, and automotive parts.[22]

Computation: Going Green for Green—Computer Reuse and Recycling: An example of how Computation, a refurbishing company for used electronic products, located in Toronto and Montreal, Canada, uses the waste hierarchy to divert waste from landfill.
<http://www.youtube.com/watch?v=QYapyok7DFo&feature=related>

E-waste Recycling: Giving New Life to An Old PC: A video demonstrating how Materials Processing Corporation (MPC), an e-waste recycler based in Eagan, MN, recycles old electronic products and ensures that 95% of what enters the facility is reused or recycled.
<http://www.youtube.com/watch?v=uSvfun8FC-c&feature=related>

[22] US EPA. Wastes, Resource Conservation. E-cycling website, at: <http://www.epa.gov/osw/conserve/materials/ecycling/faq.htm#benefits>. Accessed 31 August 2012.

1.9.1 *What Are the Roles of Recyclers and Refurbishers in the Waste Management Hierarchy?*

Exhibit 9: The Roles of Refurbishers/Recyclers in the Waste Management Hierarchy

Stage in hierarchy	About this stage	Role for the refurbisher and recycler
Waste Prevention & Minimization	▪ For manufacturer: design for environment or design for disassembly rather than disposal.	▪ During processing at the facility, aim to not discard potentially reusable or recyclable parts or materials.
Reuse	▪ Reuse of components and electronic products. ▪ Ideally, every part can continue to be used in some way.	▪ Direct reuse: reuse without any, or with minimal, repair or other work. ▪ Refurbishment (after needed repair): reuse of parts and components as well as reuse of the equipment after repair and/or refurbishment. In Canada, a reuse/refurbishment program called Computers for Schools, for example, collected 356,246 computers between 2008 and 2011, refurbishing 60% of them and recycling the rest.[23]
Recycling	▪ Used materials are collected, sorted, and processed to produce new products. ▪ Reduces the consumption of raw materials. ▪ Reduces energy usage and environmental damage from mining raw materials. Minimizes disposal and conserves landfill space.	▪ Electronic products recycling typically involves many stages of recycling, and multiple facilities, involving multiple players. ▪ Facilities should carefully select recycling processors which also practice ESM, or that are certified with either a general environmental management system, or a specific electronic waste accreditation. ▪ Example: In Mexico, only 10% of all e-waste goes to a formal recycling system. There is a lot of potential for resource utilization.
Energy Recovery	▪ Energy recovery is the process of creating energy in the form of electricity or heat from the incineration of waste. This is often called waste-to-energy (WTE). The viability for use of waste materials for WTE should be assessed on a case-by-case basis. Processes include combustion, gasification, pyrolization, anaerobic digestion, and landfill gas (LFG) recovery.	▪ Facilities may engage in energy recovery in situations where residual components cannot be reused or recycled. This may be done onsite, or offsite at licensed facilities.
Disposal	▪ Waste requiring final disposal should be sent to authorized landfill facilities or authorized incinerators that are designed and equipped to deal with the waste constituents. Open burning and open dumping are NOT viable options for disposing of electronic products. It is also not recommended to use small-batch incinerators to process e-waste and batteries.	▪ Use disposal where no alternative options exist.[24] ▪ Use only approved, licensed final disposal facilities with proper environmental controls.

[23] Industry Canada. 2012. Evaluation of the Computers for Schools Program. Online at: <http://www.ic.gc.ca/eic/site/ae-ve.nsf/eng/03515.html>.

[24] UNEP. Basel Convention. 2011. *Guideline on Environmentally Sound Material Recovery/Recycling of End-of-life Computing Equipment*. CHW.10/20 PACE.

Notebook

How does your facility practice the principles of the waste management hierarchy?

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Where could improvements be made?

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1.10 Are There International Agreements related to Environmentally Sound Management (ESM) and Electronic Products that I Should Be Aware of?

Answer: Yes. There are three key international multilateral environmental agreements that you should be aware of. These are presented below.

1. *United Nations Environment Programme: Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal* (1989):

   - Controls the transboundary movement of hazardous and other wastes through its provisions on "prior informed consent" (PIC), which must be met before any shipment of wastes[25] is permitted.

   - Shipments without proper documentation are considered illegal under the terms and conditions of the Convention. Each Party to the Convention is required to take appropriate measures to regulate the transboundary movement of wastes.

   - Transboundary shipments of hazardous wastes under the Convention include, but are not limited to, used and end-of-life electronic products, components and scrap. [26]

   - Canada and Mexico have ratified the Basel Convention; the United States has signed but not ratified it.

Basel Convention Work

1. Basel Convention Partnerships Programme:

- Technical guidelines on refurbishing, recycling, and transboundary movement of used and end-of-life mobile phones and computing equipment under the Mobile Phone Partnership Initiative (MPPI) and the Partnership for Action on Computing Equipment (PACE).

2. Other areas of engagement:

- Development of technical guidelines for the transboundary movement of e-waste
- Development of a Framework for the Environmentally Sound Management of Hazardous Wastes and Other Wastes.

[25] "Wastes" under the Basel Convention refers to substances or objects that are disposed of using any disposal operation identified in Annex IV of the Convention, which includes resource recovery, recycling, and direct re-use.

[26] Annex VIII, List A of the Basel Convention characterizes the following as hazardous, unless otherwise demonstrated to not possess any of the hazard characteristics identified in Annex III of the Convention: waste batteries (A1160, A1170), waste electrical and electronic assemblies or scrap (A1180), metal wastes and other waste consisting of antimony, arsenic, beryllium, cadmium, lead, selenium, tellurium, or thallium (A1010, A1020, A1030, A1040).

International Agreements related to ESM and Electronic Products (Continued)

2. *Organisation for Economic Cooperation and Development (OECD) Decision on the Control of Transboundary Movements of Wastes Destined for Recovery Operations (2001):*

   - Applies when transboundary movements of wastes destined for recovery operations take place from one OECD member country to another, and is harmonized with the Basel Convention.

   - Aims to facilitate trade of recyclables in an environmentally sound and economically efficient manner by using a simplified procedure as well as a risk-based approach to assess the necessary level of control for materials. Wastes exported outside the OECD area, whether for recovery or final disposal, do not benefit from this simplified control procedure.

   - Canada, Mexico, and the United States are members of the OECD.

3. *North American Free Trade Agreement—Commission for Environmental Cooperation (CEC), Sound Management of Electronic Wastes Project:*

   - The environmentally sound management of used and end-of-life electronic products is an issue of concern in North America, given the rapidly growing number of electronic devices being discarded each year that contain hazardous materials and substances.

   - Under the CEC's strategic priority "Greening the Economy of North America," this project includes work to enhance capacities of the refurbishing and recycling sectors for used and end-of-life electronic products to implement environmentally sound management practices.

1.11 Are There Legal Requirements related to Environmentally Sound Management (ESM) that I Should Be Aware of?

Answer:

Yes. Refurbishing and recycling facilities in North America must meet all applicable legal requirements in the jurisdiction in which they are located, including local, state/provincial/territorial, and national laws. Some of these include:

- ✓ occupational health and safety,
- ✓ environmental approvals and reporting, and
- ✓ transportation and transboundary movement of hazardous waste.

Facilities must make sure that they have the licenses and permits needed to operate and that their operations are safe for workers and surrounding communities.

Businesses which participate in international trade must also make sure that they comply with all applicable domestic and foreign export and import laws concerning the transboundary movement of used and waste electronic products.

What this means is that your facility needs to identify and comply with applicable legal requirements for all of the regions in which it operates, as well as the countries it exports to and ships through. To ensure ESM**,** your facility will want to make sure that all downstream processors that process material from your facility also comply with applicable domestic legislation and any import, transit and export requirements, and obtain any necessary permits, licenses or other authorizations prior to shipment.

1.12 Summary—Key Take-away Messages

Definition of environmentally sound management (ESM):

Taking all practicable steps to ensure that used and/or end-of-life products and wastes are managed in a manner which will protect human health and the environment.

Reasons to implement ESM:

- ✓ to protect the health of your workers, their families, your local community, and the environment;
- ✓ to ensure that all potential environmental and occupational health and safety risks associated with refurbishing and recycling operations are effectively managed and that workers are adequately protected from these risks;
- ✓ to place your company in a better position to meet or exceed applicable existing, new and future environment, health and safety regulations—implementing ESM helps to ensure due diligence with these requirements and goes beyond basic compliance to ensure a higher level of health and safety and environmental protection;
- ✓ to increase business opportunities with new clients, who more frequently are demanding that processors of electronic products use ESM practices;
- ✓ to potentially increase your company's profit margins through increasing the recovery of materials that are of high economic value, and can improve operational efficiency while reducing costs;
- ✓ to provide your company with a distinct marketing advantage over competitors, particularly if verification and certification against ESM standards is achieved; and
- ✓ to build improved relations with regulators, the public, and business partners.

OECD criteria for ESM (core performance elements):

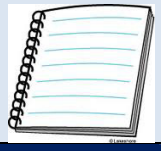
- ✓ An environment, health and safety management system
- ✓ Environment, health and safety policy and procedures
- ✓ Monitoring, recording and reporting program
- ✓ Training program for all personnel
- ✓ An emergency plan
- ✓ Plan for closure and after-care

United Nations Basel Convention ESM criteria:

- ✓ Management commitment to a systematic approach (a management system)
- ✓ Risk assessment process
- ✓ Risk prevention and minimization process
- ✓ Compliance with legal requirements
- ✓ Appropriate level of awareness and competency among employees
- ✓ Maintaining records, and monitoring, tracking and evaluating facility performance
- ✓ Taking corrective action to address environmental, health and safety risks
- ✓ Measures to support transparency and verification in all the above criteria

Notebook

Please use the checklist below to indicate key items that you want to apply to your work



ESM

Are ESM and Its Benefits Understood at Your Facility	Priorities for Action
Benefits of ESM ❒ Are managers at your facility aware of the worker health benefits that can be realized through the implementation of ESM? ❒ Are managers at your facility aware of the environmental benefits that can be realized through the implementation of ESM? ❒ Are managers at your facility aware of the potential positive improvements to relationships with regulators and other businesses that could result from implementing ESM practices at your facility? ❒ Are managers at your facility aware of the potential economic benefits of implementing ESM, including more-efficient operations from improved management systems, increased valuable material recovery, and increased volumes of used and end-of-life electronic products from refurbishing and recycling programs that wish to do business with facilities that practice ESM? ❒ Are there ways for the principles of the waste management hierarchy to be more integrated in your facilities operations or are they already well-integrated?	• • • • • • • • • • •

Hazardous Substances Below is a list of some hazardous substances and components found in used and end-of-life electronic products: -Batteries -Capacitors -Cathode ray tubes -LCD panels -Beryllium -Brominated flame retardants -Cadmium -Hexavalent chromium -Lead -Mercury -Phosphorus ❒ Are you aware of the hazards of these substances and components? ❒ Do you feel that you need to find out more about potential exposure of workers and the environment to these or other hazardous substances or components?	• • • • • • •

1.13 Post-questionnaire

1. Remind yourself of how you described ESM in the Pre-questionnaire (question #2). Would you change it and, if so, what would your new description be (in your own words)?

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2. Identify at least one thing that you learned in this module that you could immediately apply to your facility.

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1.14 Additional Resources

Videos / other media identified:

E-waste recycling: Giving new life to an old PC
A video demonstrating how Materials Processing Corporation (MPC), an e-waste recycler based in Eagan, MN, recycles old electronics and ensures that 95% of what enters the facility is reused or recycled.
<http://www.youtube.com/watch?v=uSvfun8FC-c&feature=related>

Computation: Going Green for Green—Computer (e-waste) Reuse and Recycling
An example of how Computation, an e-waste refurbishing company located in Toronto and Montreal, Canada, uses the waste hierarchy to divert waste from landfill.
<http://www.youtube.com/watch?v=QYapyok7DFo&feature=related>

E-Waste Ethical Recycling. E-waste Done Right!
A video discussing electronic recyclers' perspective of the opportunity presented by electronics recycling: to clean up the environment and create thousands of jobs.
<http://www.youtube.com/watch?v=WUDF-i6uieg&feature=related>

E-Waste Recycling - A Simple Step For A Better Future
ARC International's promotional video gives a tour of its facilities and processes. The video includes how ARC International tracks the materials it handles and ensures data security.
<http://www.youtube.com/watch?feature=endscreen&v=Lh5Vft8Q0FY&NR=1>

International Agreements / Publications Online

OECD. 2007. ***Guidance Manual on Environmentally Sound Management of Waste***—available free at: <http://www.oecd.org/environment/resourceproductivityandwaste/39559085.pdf>

OECD. 2003. ***Technical Guidance for ESM of Used and Scrap Personal Computers*** (v. 18 Feb. 2003)—available free at: <http://www.oecd.org/officialdocuments/displaydocumentpdf/?cote=ENV/EPOC/WGWPR(2001)3/FINAL&doclanguage=en>

UNEP. 2010. ***Approved Draft UN Basel PACE ESM Criteria Recommendations*** (v. 9 Mar. 2010)—available free at: <http://www.basel.int/industry/compartnership/docs/FinalApprovedReportESM-22March2010.pdf>

UNEP. 2011. ***Draft UN Basel PACE Guideline on Environmentally Sound Testing, Refurbishment & Repair of Used Computing Equipment***—available free at: <http://www.basel.int/industry/compartnership/docs/>

UNEP. 2011. ***Draft UN Basel PACE Guideline on Environmentally Sound Material Recovery/Recycling of End-of-Life Computing Equipment***—available free at: <http://archive.basel.int/industry/compartnership/docdevpart/ppg21DraftGuidelineFinal-2011-03-15.pdf>

UNEP. 2010. ***Draft UN Basel Technical Guidelines on Transboundary Movement of E-waste, in Particular Regarding the Distinction Between Waste and Non-Waste*** (v. 22 Sep. 2010)—available free at: <http://www.basel.int/techmatters/index.html>

UNEP. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal—official website: <http://www.basel.int/. Includes information about the Basel Agreement,

technical guidelines, methods of implementation, and other work under the Convention.

UNEP. Partnership for Action on Computing Equipment (PACE)—website: <http://archive.basel.int/industry/compartnership/index.html>. Provides guidance documents on ESM.

Mobile Phone Partnership Initiative (MPPI)—website: <http://archive.basel.int/industry/mppi.html>. Provides guidelines and documents on the environmentally sound management of end-of-life mobile phones.

Commission for Environmental Cooperation. Sound Management of Electronic Wastes Initiative—website: <http://www.cec.org/Page.asp?PageID=924&SiteNodeID=1026

US Environmental Protection Agency. Pollution Prevention—website on environmental management systems: <http://www.epa.gov/ems/>; and also *Environmental Management Systems: An Implementation Guide for Small and Medium-size Organizations* (2001).

US National Environmental Education & Training Foundation (NEETF)—*Standardizing Excellence: Working with Smaller Businesses to Implement Environmental Management Systems* (2001).

Verification and Certification Programs and Standards in the United States and Canada (some Mexican facilities also apply these):

UNITED STATES:

- **Responsible Recycling (R2)**: <http://www.r2solutions.org>
- **Recycling Industry Operating Standard (RIOS)**: <http://www.r2rios.org/>
- **E-Stewards**: <http://e-stewards.org/>

CANADA:

- **Recycler Qualification Program (RQP)**: <http://www.rqp.ca/>
- **Electronics Reuse & Refurbishing Program**: <http://www.rqp.ca/>

MEXICO:

- None particular to Mexico.