Introduction to ESM

Best Practices for Achieving Environmentally Sound Management (ESM)

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 at Facilities that Refurbish and Recycle Used and End-of-life Electronic Products in North America

Module 1b

Introduction to ESM for Workers and Supervisors

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Table of Contents

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1 Module 1b: Introduction to Environmentally Sound Management (ESM)—For Workers & Supervisors

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;
- identify environmental, health and safety concerns relating to processing electronic materials;
- define worker health and environmental benefits of implementing ESM; 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 do you think of when you hear "ESM"?

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

   a. You? _____

   _____

   b. Your facility? _____

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   c. The environment? _____

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1.3 Introduction and Overview of this Module

Would you like to know that your facility does the right thing to support the health of its workers, the surrounding community, and the environment? The concepts and tools offered by **environmentally sound management (ESM)** help facilities to do so.

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 waste electronic products,
- the common verification and certification programs used in Canada, Mexico and the United States, and the benefits of verification and certification,
- a brief overview of some key international agreements that highlight the importance of ESM, and
- a discussion of other legal requirements that your facility may need to comply with, related to 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; and 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 facilities (see Modules 3 and 4).

[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.

1.5 Why Is Implementing Environmentally Sound Management (ESM) Important?

"Why should I participate in environmentally sound management practices implemented at the company I work for?"

Answer: ESM offers many economic, health, and environmental benefits. These are described below and on the following pages.

1.5.1 Economic, Health, and Environmental Benefits

1. **ESM can increase business opportunities** for your company—clients more frequently are 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. ESM can be seen as a marketing advantage.

2. **ESM at your refurbishing or recycling business can potentially increase your company's profits because more materials are recovered.** 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 through implementation of new systems and procedures that focus on **reducing waste, reusing, and recycling**.

3. **ESM will protect your health and the health of your co-workers, your 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. This leads to improved relations with communities. ESM also requires compliance with health and safety regulations, and environmental protection regulations—this improves relations with regulators.

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

"My company is a *green* business—this stuff might otherwise end up in an unlined landfill. Why should we 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.

Answer: Each country uses a different process to define what a hazardous substance is. Exhibit 1 lists common substances of concern found in electronic products that can cause significant human health impacts from exposure, as well as environmental pollution.

Exhibit 1: Common Substances Found in Electrical and Electronic Components[2]

Electrical Component	Substances of Concern
Plastics	Phthalate plasticizers, brominated flame retardants
Cathode Ray Tubes (CRT)	Lead, antimony, mercury, phosphorus, barium oxide
Liquid Crystal Displays (LCD)	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, nickel
External Electric Cables	Brominated flame retardants, plasticizers
Light-emitting Diodes	Gallium arsenide
Mobile Phones	Cadmium, lead, arsenic, barium, beryllium, strontium

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

1.5.3 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 broader 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 2: Examples of Key Occupational Issues at E-waste Refurbishment and Recycling Facilities[3]

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.

[3] 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.).

1.5.4 *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[4] 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.

[4] 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 3: Examples of Environment and Community Issues from Electronic Product Refurbishment and Recycling Facilities that *Do Not Practice ESM*[5,6,7]

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.

[5] *Source*: UNEP. 2007. *E-waste. Volume I: Inventory Assessment Manual*. International Environmental Technology Centre.
[6] *Dioxins and furans* are highly toxic, causing reproductive and developmental problems and damage the immune system; and cause cancer in animals and humans who are exposed to them via inhalation.
[7] *PAHs* are a group of over 100 different toxic substances that are formed during incomplete burning, and can contaminate water, plants, animals and people.

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1.5.5 *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 4.

Exhibit 4: Key Environmental Benefits of Implementing ESM[8]

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.

[8] *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).

1.5.6 What Are the Worker and Community Benefits of Implementing Environmentally Sound Management?

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

- ✓ better morale—workers feel safe, leading to pride in the workplace and enhanced worker productivity;
- ✓ enhanced knowledge among workers regarding the importance 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 for your facility to realize by implementing ESM!

Group Discussion

ESM helps make sure that end-of-life electronics are managed in a way that will protect human health and the environment.

1. Think about what you do on a daily basis in your job. What parts of your job follow environmentally sound management?

2. What other procedures at your facility (something your co-workers do in their jobs) follow ESM?

3. Are there any parts of your job or other procedures at your facility that do not seem to follow ESM? As a group, discuss these questions.

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.	WORKER MODULES 1, 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.	WORKER MODULES 3, 4
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 activities are compatible with ESM.	WORKER MODULES 4, 6

OECD Core Performance Elements (CPEs) for ESM	UNITED NATIONS BASEL CONVENTION Criteria for ESM	Where to Find?
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.	**WORKER MODULES 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	**WORKER 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	**WORKER 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.

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 methodical 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.

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 laws; and develop environment, health and safety objectives 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.

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 What Are the Benefits of an Environment, Health and Safety Management System?

Answer:

Following policies and procedures of an environment, health and safety management system will:[9]

- ✓ effectively manage risks to workers' health and the health of their families,
- ✓ effectively manage risks to the environment,
- ✓ improve performance and ensure continual improvement in all areas of company activity,
- ✓ 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,
- ✓ 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.

Some facilities may seek to certify their environment, health and safety management system to international standards such as ISO 14001, EMAS and/or OHSAS 18001**.**

For more information on EHS management systems, see Module 4

[9] 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.

1.7.2 What Does Certification Mean?

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 a 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.

Answer: There are also other verification and certification programs that are specific to the electronic product refurbishing and recycling industry—these are described on the following page. Some companies have several types of certifications.

Benefits of certification:

- ✓ 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). This is the case in Canada and many US states.
- ✓ With certification, your company will gain credibility, improve relations with regulators and the public, and likely generate more business.

However, ESM practices go beyond certification standards such as ISO 14001, EMAS and OHSAS 18001 because these standards by themselves are not specific to the electronic products refurbishing or recycling industry and so they do not address the unique health, safety and environmental needs of this sector that you work in.

1.7.3 Electronics Refurbishing/Recycling Verification and Certification Programs

Exhibit 5 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 5: Electronic Waste Recycling/Refurbishing 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.

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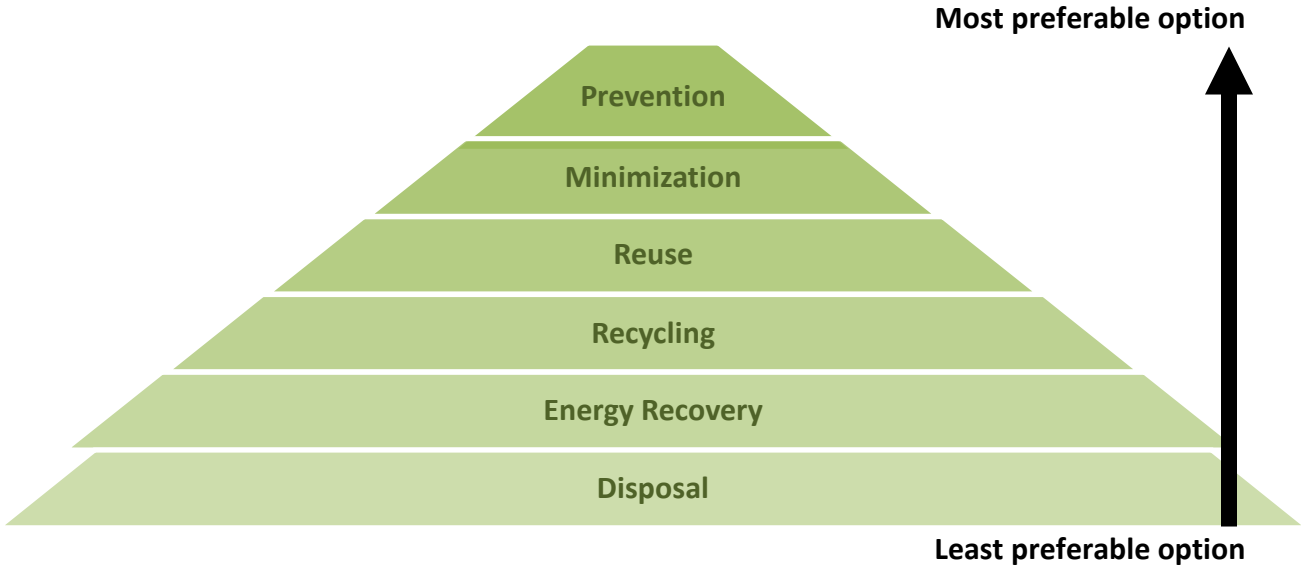
1.8 What Is the Waste Management Hierarchy and How Is It Connected to Environmentally Sound Management (ESM)?

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 6: 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 other plastic products such as garden furniture, license plate frames, non-food containers, and automotive parts.[10]

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

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

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

Exhibit 7: 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[11].
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, with 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 (e.g., boxboard, plastics, etc.) 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.[12] ▪ Use only approved, licensed final disposal facilities with proper environmental controls.

[11] 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>.

[12] 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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1.9 Are There International Agreements related to 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:

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[13] 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.[14]
   - Canada and Mexico have ratified the Basel Convention; the United States has signed but not ratified.

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.

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[13] "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.

[14] 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).

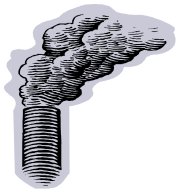
3. ***North American Free Trade Agreement—Commission for Environmental Cooperation (CEC), Sound Management of Electronic Wastes Project:***

- 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.

1.10 Are There Legal Requirements related to Environmentally Sound Management that I Should Be Aware of?

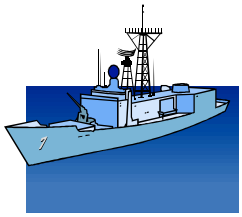
Answer: Yes. Refurbishing and recycling facilities in North America must meet all applicable legal requirements in the jurisdiction in which they are located, including local, state/provincial/territorial, and national laws. Some of these include:

Occupational Health and Safety



Environmental Approvals and Reporting

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. Being compliant with legal requirements will guide your facility in providing an effective environment, health and safety (EHS) system—certified or not.

1.10.1 What are the Reasons for Worker Health and Safety Regulations?

Answer: Ensuring a safe workplace is a critical element of a facility's legal requirements. Ensuring health and safety is important for moral, legal, and financial reasons.

- ✓ Moral obligations would involve the protection of employee safety, health and well-being.
- ✓ Legal reasons for ensuring health and safety practices refer to the preventive, punitive and compensatory laws that protect workers.
- ✓ Following health and safety requirements can also be good for your company's corporate bottom line, since it can reduce employee injury- and illness-related costs, including medical care, sick leave and disability benefit costs.

By placing a priority on worker health and safety, your facility:

- ✓ ***commits to health and safety measures and other provisions at the workplace,***
- ✓ ***creates a healthier and safer working environment, and***
- ✓ ***fosters a culture that supports worker health and safety.***

- International Labour Organization (ILO) and the World Health Organization (WHO)

Health and Safety Requirements Concerning Releases of Hazardous Substances During Processing

To protect workers from hazardous substances that may be released during refurbishing or recycling electronic products and to prevent illness, the use of personal protective equipment is extremely important. Facility managers must make this equipment available to you, and must train all workers to properly use it. Make sure that you understand what types of personal protective equipment are necessary to do your job and how to use and care for them.





1.10.2 Why Is It important for Facilities to Possess Environmental Approvals?

Answer: Wherever your facility is located, it will need certain environmental approvals, such as licenses, permits and other authorizations, to undertake business and manage and process materials and wastes in a manner that protects human health and the environment. Environmental approvals usually identify the conditions under which a facility can operate, including special infrastructure and design requirements, specific operating and processing restrictions (e.g., allowable operating hours, noise levels, processing thresholds) and authorized emission and discharge types and limits (e.g., wastewater, air emissions). The intention of environmental approvals is to protect the environment, workers and local communities. Facility non-compliance with the terms of environmental approvals can be subject to legal penalties (such as fines, revoking permits, or shutdowns).

Companies that engage in processing that involves practices such as open burning, open dumping, backyard smelting and uncontrolled acid leaching do not practice ESM and are usually not operating in compliance with the law.

1.10.3 Why Is It Important for Facilities to Comply with Laws Governing Movement of Dangerous Goods and Hazardous Wastes?

Answer: Products and materials that are transported to or from refurbishing and recycling operations for used and end-of-life electronics may be controlled as dangerous goods or hazardous waste under local, domestic, foreign and/or international law. Businesses must make sure that they understand and comply with all applicable laws, including laws governing the transportation of dangerous goods and transboundary movement of hazardous waste and hazardous recyclable materials. This includes complying with applicable legal requirements for all of the regions in which a business operates, as well as the countries it exports to and ships through. These laws are important because they impose provisions to ensure the safe transport of these dangerous and hazardous substances which can pose risks to the environment, workers and public health and safety if improperly managed.

1.11 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
- ✓ A monitoring, recording and reporting program
- ✓ A training program for all personnel
- ✓ An emergency plan
- ✓ A 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

Introduction to ESM: Checklist for Action

How Can You Apply ESM and Its Benefits to Your Work?	Key Aspects You Learned and Want to Apply to Your Job (include page # reference from the module)
Benefits of ESM ❒ Can you implement ESM to make any changes to your work practices to achieve health benefits of workers at your facility? ❒ Can you implement ESM to make any changes for environmental protection at your facility? ❒ Can you apply the principles of the waste management hierarchy to your job?	•

1.12 Post-questionnaire

1. What are some of the top environment, health and safety issues that can come from processing e-waste that are a concern to you?

_____

_____

_____

2. Name at least one thing that you learned in this module that you could apply to your work right away.

_____

_____

_____

1.13 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.

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-Sized 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 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.