Risk Prevention and Minimization

# 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*

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

Module 4b

*Risk Prevention and Minimization for Supervisors and Workers*

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# Table of Contents

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# 4 Module 4b: Risk Prevention and Minimization—For Supervisors and Workers

## 4.1 Learning Objectives

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

- identify important best practices to prevent and minimize risks to your health, the health of your family, the environment, and the surrounding community, through the use of: participating in important worker training on health and safety, understanding important health and safety protocols, following the guidance of health and safety committees, and always using your personal protective equipment properly.

### Notes

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## 4.2 Pre-questionnaire

1. Do you help prevent risks at your facility? If so, how?

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2. What precautions do you take when you are handling hazardous materials and substances?

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3. Do you feel safe at work? If yes, what makes you feel safe? If no, what might need to happen to make you feel safer?

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4. Given your responses to the previous questions, what would you like to learn about risk prevention and minimization?

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## 4.3 Check-in on Topics Previously Covered in Modules 1–3

### Module 1 (Introduction to ESM)

In Module 1 you learned about:

- the importance and benefits of environmentally sound management (ESM), including elements deemed necessary to achieve ESM at the facility-level;
- potential environmental, health and safety issues associated with refurbishing and recycling electronic products;
- worker health and environmental benefits of implementing ESM at your facility;
- economic benefits of implementing ESM at your facility;
- the benefits of management systems that are designed to minimize environment, health and safety concerns, such as environment, health and safety management (EHS) systems, and electronics recycling/refurbishment certification programs; and
- the waste management hierarchy and how it applies to activities undertaken at electronics refurbishing and recycling facilities.

*Module 2 dealt with the topic of Top Management Commitment to Environmentally Sound Management, so there wasn't a Module 2 for supervisors and workers.*

### Module 3 (Risk Assessment)

In Module 3 you learned about:

- specific best practices to implement, improve, and demonstrate risk assessment at your facility;
- hazards and risks to worker health and safety and the environment;
- how to apply the risk assessment process to your facility's operations; and
- how to determine if existing control measures to address identified risks at your facility are adequate or if more should be done.

## 4.4 Introduction and Overview of this Module

**What is risk prevention and minimization and how can you apply it to your facility?**

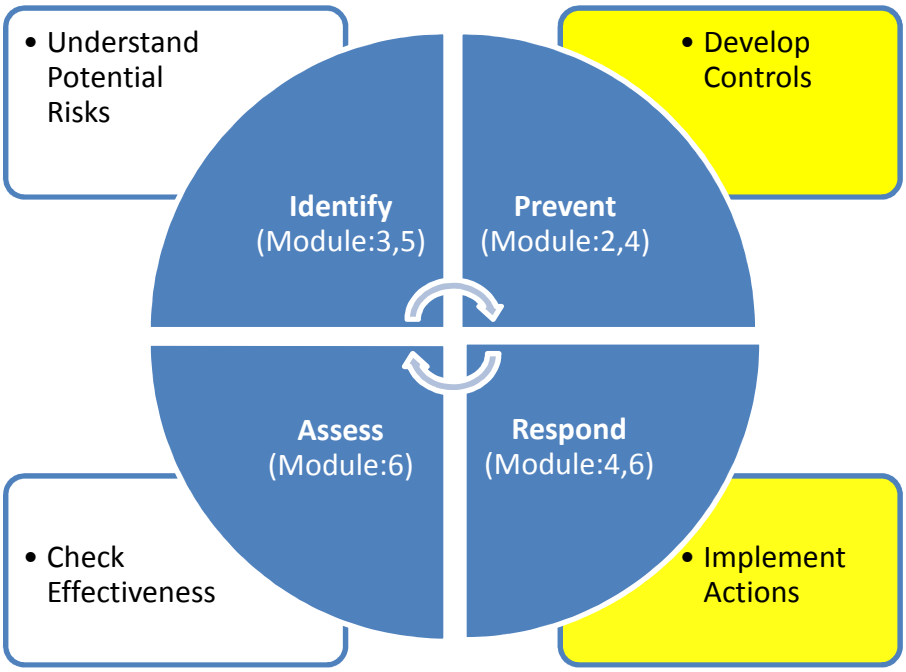
This module will answer this question and provide you with:

- an overview of the benefits of risk prevention and minimization in used, discarded and end-of-life electronics recycling and refurbishment operations; and
- an understanding of various types of controls that are recommended as best practices to eliminate, prevent and minimize risks, including engineering controls, administrative controls, and personal protective equipment controls.

Exhibit 1 shows how the responsibilities of operating a facility fit within the framework of ESM**,** and where these responsibilities will be covered in the training material.

Module 4 explains the important ways that facilities can put in place measures both to *prevent* risks and to *respond to* problems when they do happen (yellow box).

**Exhibit 1: Key Responsibilities within the Framework of Environmentally Sound Management**



## 4.5 What Is Risk Prevention and Minimization and Why Is It Important?

**REMINDER: ESM Criterion #3**
**Risk Prevention and Minimization:**
Eliminate where possible, and in all cases strive to minimize actual and/or potential hazards and risks to public and worker health and safety, and the environment that are associated with activities, products and services.

As discussed in Module 3 (Risk Assessment), electronic components are made up of more than 1,000 different substances, some of which are hazardous. As a result, your facility's activities can present a number of risks to the environment, worker health and safety, and the community. Your facility should identify these risks through a risk assessment process (Module 3). Risk prevention and minimization is the next stage where you manage these risks.

### *4.5.1 Why Is Risk Prevention and Minimization Important?*

**Answer:** Risk prevention and minimization is important because it allows you to:

- raise awareness within the facility about hazards and how to mitigate risks—this will contribute to safer work practices and reduce illnesses and accidents;
- improve workers' skills through regular risk management training programs—this will lead to more consistency in the implementation of safe work practices;
- enhance the facility's safety record and improve relations with the public and local community, as evidenced by healthy workers and community;
- reduce the likelihood of fines and penalties through a demonstrated commitment to best practices and ensuring legal compliance;
- demonstrate a safe work environment to government regulators, insurance agencies, financial institutions, and business partners by referring to documented risk management plans, procedures and other provisions; and
- improve your ability to respond to emergencies, allowing for more timely and effective responses.

**Recall from Module 3:**

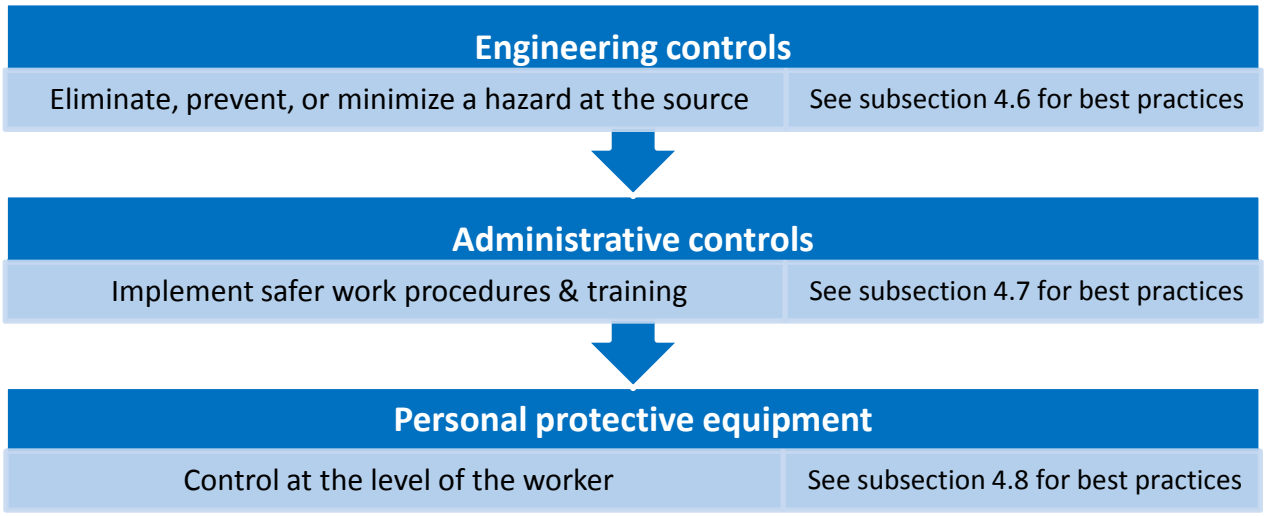
**Definition: Risk vs. Hazard**

Risk: the chance, likelihood, or probability that a person or the environment will be harmed if exposed to a hazard.

Hazard: the potential source of harm.

### 4.5.2 *Controls Used to Eliminate, Prevent and Minimize Risks—Overview*

Once your facility has assessed (evaluated and prioritized) environment, health and safety (EHS) risks (as discussed in Module 3, Risk Assessment) management and workers should *first* seek to eliminate the risk, and *then* seek to *prevent or minimize remaining risks*. EHS risks can be prevented and minimized by implementing the controls listed below:[1,2]




***What is included in each group of controls?***

**Answer:**

1. ***Engineering Controls:*** These controls eliminate or reduce exposure to a chemical or physical hazard through use of engineered machinery or physical equipment. Examples include: ventilation and exhaust systems; filters, scrubbers, and bag houses to trap airborne particulates; or ductwork equipped with fire suppression devices.

2. ***Administrative Controls:*** These controls refer to work procedures to reduce the duration, frequency, and severity of exposure to hazards by workers, or to processes to reduce potential impact to the environment from facility activities. Examples include: policies and procedures for pollution control and health and safety; emergency response plans and spill clean-up procedures; worker training; health and safety committees; incident reporting procedures; etc.

3. ***Personal protective equipment (PPE):*** These controls include all clothing and other work accessories designed to create a barrier between an individual worker and hazards. Examples include: safety glasses; work gloves; respirators; overalls, smocks, aprons; safety boots and shoes; and hard hats.

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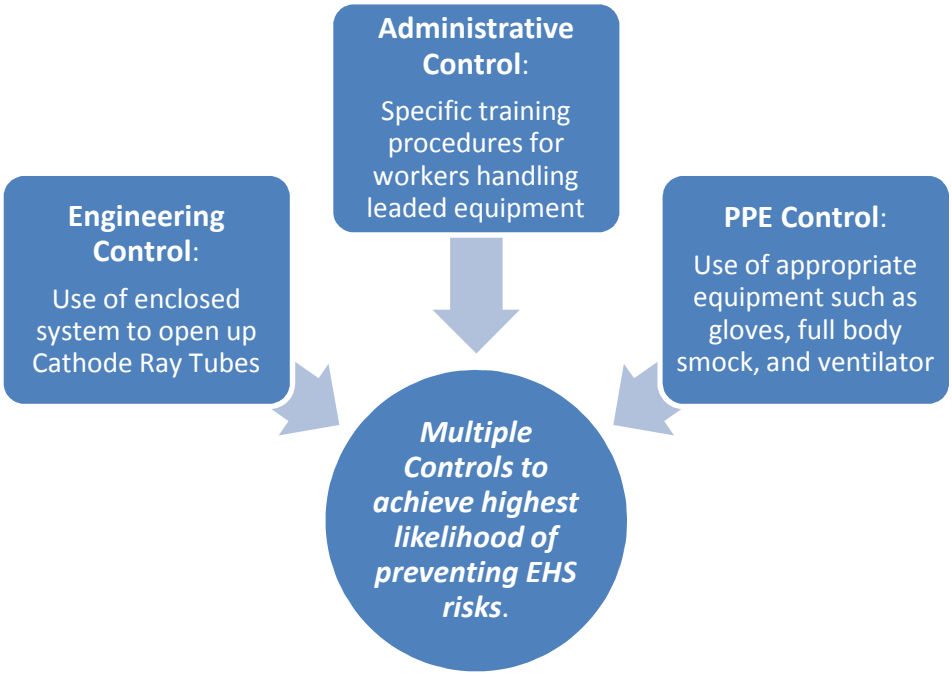
1 Electronics Product Stewardship Canada (EPSC). 2010. *Recycler Qualification Program for End-of-life Electronics Recycling*.

2 US Centers for Disease Control and Prevention. Engineering Controls, <http://www.cdc.gov/niosh/topics/engcontrols/>.

***Example of implementation of multiple controls***

To control hazards effectively, it is important for management to consider and implement, where appropriate, a combination of engineering, administrative and PPE controls, as outlined in the example below. This example demonstrates how multiple controls can be used to address a serious hazard, such as inhalation or ingestion of lead by workers or potential release of lead to the environment.

**Example of Using Multiple Controls for a Hazardous Substance such as Lead**




**Best Practice: Implement multiple and overlapping control schemes (i.e., engineering, administrative, *and* PPE) to heighten protection for the environment and worker health and safety.**

*Best practices identified for each of these three types of controls are presented in three separate sections of this module.*

**Notes**

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# Best Practices to Prevent and Minimize Risks to EHS through Engineering Controls

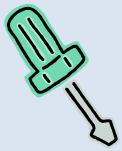
## 4.6 Best Practices to Prevent and Minimize Risks to Environment, Health and Safety through Engineering Controls

**Engineering Controls**: Controls physically placed at the source of the contaminant to eliminate, prevent or minimize hazards.

### *4.6.1 Engineering Controls—Manual Processing at Recycling or Refurbishing Facilities*

- Manually remove potentially hazardous components before mechanical processing, to keep hazardous substances contained within the casing of each item. Otherwise, a mechanical process such as shredding will open the casing, releasing hazardous substances that could harm you and the environment and contaminate equipment.
- When disassembling computing equipment, use appropriate tools to prevent physical damage and to preserve the value of the component.

**On the Floor**



Examples of hazardous components that should be removed manually before mechanical processing include:

- mercury-containing components, including batteries, lamps, switches and subcomponents,
- cathode ray tubes (CRTs),
- batteries, including nickel-cadmium, lead-acid, lithium-ion, alkaline, or any batteries containing lead, cadmium, or other hazardous substance,
- toners, inks, ink cartridges,
- photoreceptive drums containing selenium and/or arsenic, found in printers and copying devices,
- components containing polychlorinated biphenyls (PCBs),
- radioactive materials, and
- glycolant-based coolants (e.g., in rear-projection CRT display devices).

NOTE: Repair should only be undertaken if you are trained to conduct repair work.[3] Follow company procedures for disassembling used and end-of-life electronic products, which should outline any hazards associated with components, and proper handling procedures to prevent any unintended releases of hazardous substances.[4] See Section 4.7 of this module for related procedures.

[3] UNEP. Basel Convention. 2011. *Guideline on Environmentally Sound Testing, Refurbishment & Repair of Used Computing Equipment*. Partnership for Action on Computing Equipment (PACE) Project 1.1.

[4] Electronics Product Stewardship Canada (EPSC). 2010. *Recycler Qualification Program for End-of-life Electronics Recycling*.

## Engineering Controls – **Manual Processing**

### *Facility Enclosure Equipment, Filtration and Ventilation Systems*

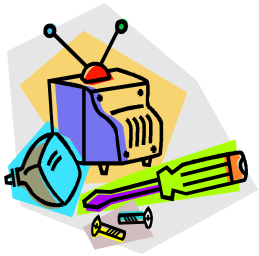
Some refurbishment operations contribute to air emissions (for example, soldering circuit boards) which could harm worker health or the environment if they are not contained.[5,6] Similarly, during recycling operations, potential release of hazardous substances could occur if proper enclosures and ventilation systems are not in place (for example, specialized and enclosed cutting equipment is important for removal of cathode ray tube glass safely so that lead is not airborne or on worker table surfaces).

**Best Practice: Conduct all repair and recycling work indoors. Utilize facility enclosure, ventilation and filtration equipment where appropriate, to ensure that airborne particulates are not simply redirected outside.**

Cleaning undertaken at both refurbishment and recycling operations could contribute to hazardous indoor air emissions from solvent fumes.

**Best Practice: Ensure proper ventilation is used to collect solvent fumes during equipment cleaning.**

**For further safety information on the dismantling and repair process, see Microsoft Refurbishment Programs' online slide deck, available free at:**
http://www.techsoup.org/learningcenter/hardware/7. Demanufacturing.pdf.



[5] UNEP. Basel Convention. 2011. *Guideline on Environmentally Sound Testing, Refurbishment & Repair of Used Computing Equipment*. Partnership for Action on Computing Equipment (PACE) Project 1.1.

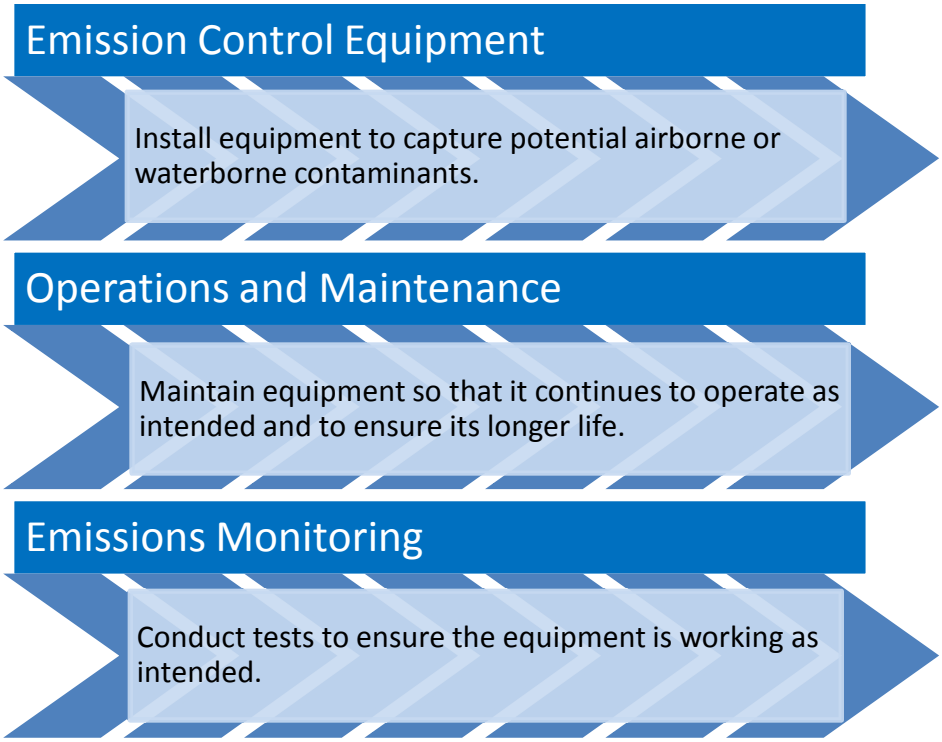
[6] Electronic Products Recycling Association (EPRA). 2012. *Electronics Reuse and Refurbishing Program*. Part B: Implementation Guide.

### 4.6.2 *Engineering Controls—Mechanical Processing at Recycling or Refurbishing Facilities*

***Emissions Management***

**Best Practice: Facilities that undertake mechanical processing should be capable of using the equipment they have installed, and should have an emissions management program for the specified equipment.**

Electronics refurbishment and recycling facilities that undertake mechanical processing such as shredding, chipping, pulverizing, and smelting or melting should be proficient in how to use equipment and the technology properly, and have in place an emissions management program that consists of the following elements[7,8] (related best practices are on the following pages):




[7] Basel Action Network. 2009. *Performance Requirements Excerpted from the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.

[8] Electronics Product Stewardship Canada (EPSC). 2010. *Recycler Qualification Program for End-of-life Electronics Recycling*.

## Engineering Controls – Mechanical Processing – **Emission Controls**

### *Emission Controls*

**Best Practice: Perform all mechanical processing indoors. Put in place engineering controls as listed below in order of recommended priority. Know what emission controls should be in place in each area of your facility.**

It is important that all mechanical processing occurs indoors, with suitable emission control equipment.[9] The recommended priority for emission control equipment is:[10]

1. substitution (e.g., replacing a toxic solvent with one less toxic during equipment cleaning),
2. isolation (e.g., automating and isolating a process to avoid worker exposure),
3. ventilation and capture (e.g., enclosure or fume hood),
4. control and capture (e.g., dust filters, or, if spills, through non-pervious flooring), and
5. emergency shut-off systems and fire suppression systems.

Isolation

- Your facility should conduct all mechanical processing indoors, and some processes can be isolated to reduce worker exposure. For example, a hopper can be used to convey material for shredding into a mechanical separator, with screening and granulating machines to separate constituent metal and plastic fractions. Such recycling machinery is automated and isolated (enclosed) and usually uses a dust collection system.

Ventilation and Capture

- In areas where mechanical processing (e.g., shredding, chipping, pulverizing, and smelting or melting) occurs, your facility should have systems to collect airborne particulates and flue gases and remove contaminates (e.g., using filters, cyclones, scrubbers, and/or baghouses). Use of closed-loop ventilation systems is recommended.

- Air emission controls should reduce emissions to meet the most stringent regulatory exposure limits that apply to your facility. If legal limits on air emissions do not exist in your jurisdiction, use the precautionary principle, with a goal of preventing exposure. If established limits are exceeded, workers should be informed and removed from the hazard.

**Precautionary Principle**

"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." United Nations. 1992. Conference on Environment and Development. Rio de Janeiro.

In other words, the absence of complete scientific evidence to take precautions does not mean that precautions should not be taken—especially when there is a possibility of irreversible damage.

[9] ibid.
[10] Basel Action Network. 2009. *Performance Requirements Excerpted From the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.

## Engineering Controls – Mechanical Processing – **Emission Controls**

### *Control and Capture*

- Air emission controls should always be implemented at the source of the contaminant, to minimize or eliminate potential uncontrolled releases of dust or air particulates. See Operations and Maintenance (below) for other clean-up controls.
- Other types of controls should be considered, to prevent or minimize releases to land and water, such as enclosed storage containers for out-of-doors storage, and wastewater collection and treatment systems in the event that material must be stored onsite until enough has been accumulated to justify processing and/or transport. Materials should be protected from atmospheric and weather effects (e.g., heat, cold, moisture, dust, etc.), and accidental spills and breakage. All materials and components should be stored in a way that:[11,12] protects them from the atmospheric and weather effects (e.g., using weatherproof covering and a rain catchment system); and protects against accidental spills or breakage (e.g., using an impermeable surface with a sealed drainage system and sealed sump pump pits[13]).

### *Fire Suppression*

**Best Practice: Facilities that undertake mechanical processing should have adequate fire suppression equipment in place for the type and size of the facility, and workers should all know how to use this equipment.**

- Adequate fire suppression equipment for the type and size of the facility should be maintained, particularly in areas where mechanical processing such as grinding and shredding is undertaken. Consideration should be given to the installation of sprinkler systems. At a minimum, the facility should be equipped with readily accessible and charged fire extinguishers suitable to the size and type of fire that might occur.[14]

[11] UNEP. Basel Convention. 2011. *Guideline on Environmentally Sound Testing, Refurbishment & Repair of Used Computing Equipment*. Partnership for Action on Computing Equipment (PACE) Project 1.1.

[12] Basel Action Network. 2009. *Performance Requirements Excerpted From the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.

[13] UNEP. 2007. *E-waste Volume II: E-Waste Management Manual*. International Environmental Technology Centre.

[14] Electronics Product Stewardship Canada (EPSC). 2010. *Recycler Qualification Program for End-of-life Electronics Recycling*.

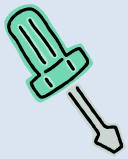
## Engineering Controls – Mechanical Processing – **Operations and Maintenance**

### *Operations and Maintenance (O&M)*

**Best Practice: Perform regular maintenance on all emission control equipment. Preventive maintenance should take place based on the manufacturer's and equipment instructions.**

All air emission control equipment will have operating manuals that specify the type of maintenance required for the equipment. Maintenance includes routine, preventive, predictive, scheduled and unscheduled actions. All mechanical controls should be tested to ensure adequate protection from the hazard. For example, ventilation systems should be tested to ensure they remove the intended contaminants and maintain adequate air flow rates.[15]

**On the Floor**



Dust collection systems can be a significant source of lead exposure if not properly operated, cleaned, and maintained. As an example of maintenance needed for air emissions control equipment:

- Remove flue dust from separators and manage it appropriately as per your supervisor's instructions (for example, transport it to storage, recycle streams, or for disposal off-site).
- At a minimum, safely remove and replace air filters from processing equipment ventilation systems, to prevent exposure to dusts and particulate.[16]
- Preventive maintenance tasks for ventilation systems should include airflow testing, ductwork inspections and filter replacements.

[15] ibid.
[16] Basel Action Network. 2009. *Performance Requirements Excerpted From the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.

## Engineering Controls – Mechanical Processing – **Emissions Monitoring**

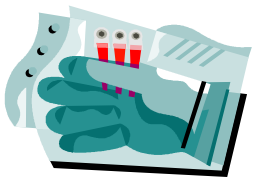
### *Emission Monitoring*

**Best Practice: Support your manager's efforts to monitor indoor air quality and surface deposits of potentially hazardous substances.**

The following identified best practices[17,18] help to inform whether engineering controls are working as intended.

- If workers remove mercury-containing components (e.g., fluorescent lamps and LCD screens), air monitoring for mercury and mercury compounds should be performed routinely, including in worker zones and the areas surrounding these zones.
- If your facility is using thermal processes for smelting, melting or combustion, then tests for hazardous substances such as inhalable hydrocarbons, bromated flame retardants, and compounds of mercury, lead, beryllium, and cadmium should be performed.
- If your facility uses acids or solvents for precious metals or plastics recovery, you should perform workplace exposure tests for any acid or solvent that is inhalable.
- If your facility conducts processing that involves breaking, cutting, crushing, shredding or pulverizing CRTs, it should perform semi-annual air testing for heavy metal compounds, including silica dust, lead, beryllium, and cadmium.
- The practice of taking wipe samples from processing areas, such as work surfaces where CRTs are manually cut and removed, and testing them for heavy metals is important to protecting worker health. Some facilities also take wipe samples from common areas (e.g., lunchrooms, change rooms, washrooms).

Test results help to determine the effectiveness of existing housekeeping or occupational health and safety practices, and may indicate a need to revise existing or introduce new control measures to enhance protection for worker health and safety.[19,20]



[17] Electronics Product Stewardship Canada (EPSC). 2010. *Recycler Qualification Program for End-of-life Electronics Recycling*.

[18] Basel Action Network. 2009. *Performance Requirements Excerpted From the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.

[19] Institute of Electrical and Electronics Engineers (IEEE). 2004. IEEE International Symposium on Electronics and the Environment, 10–13 May, Scottsdale, Arizona.

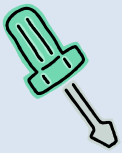
[20] For further information, see United States Centers for Disease Control, National Institute for Occupational Safety and Health, *Pocket Guide to Chemical Hazards* and *Manual of Analytical Methods*, available at: <http://www.cdc.gov/niosh/>.

### *4.6.3 Engineering Controls—Management of Processed and Waste Materials*

**Best Practice: Follow relevant environment, health and safety practices when preparing hazardous materials/components previously removed (e.g., batteries, mercury lamps, CRTs, printer cartridges) prior to mechanical processing, or other hazardous substances generated/recovered during processing. Process all hazardous materials that have been generated or recovered at authorized facilities that undertake environmentally sound management operations and activities.**

Below are important ESM best practices related to materials management.[21]

**On the Floor**

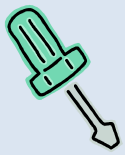


- **Mercury:** As a hazardous substance, mercury must be handled extremely carefully. It is very important to protect fragile mercury-containing components from breakage (e.g., liquid crystal display (LCD) backlighting, mercury lamps and tubes, some batteries) and to properly seal and label containers of mercury containing devices for transport to authorized facilities.
- **Lead:** As a hazardous substance, lead must be handled extremely carefully. When packaging for transport, make sure to seal containers holding CRTs, CRT cullet/glass, or equipment containing CRT glass. These materials should only be processed at appropriate facilities capable of managing lead in an environmentally sound manner. This is also the case for phosphorus and coatings or residues from CRTs. Some batteries may also contain lead.
- **Toner and ink:** When handling toner and ink printer cartridges, make sure to minimize dispersal, to reduce worker exposure. Toner and ink cartridges should be managed in the following order of preference: 1) Refill or reuse cartridges, refurbishing or remanufacturing them where feasible. 2) Remove color inks and toners and dispose of these in hazardous waste landfills. Black toners can remain in cartridges and be disposed of in a solid waste landfill. Emptied and fully cleaned cartridges can be remanufactured, recycled or reused. 3) Dispose of the remaining printer cartridges in authorized waste landfills or incinerators. Components containing selenium, including printer drums, should be removed intact and sent to a facility authorized to manage selenium.
- **Collections from air controls:** All collected dust and residues from routine maintenance on equipment (e.g., filters that were changed or cleaned) should be sealed, packaged, and managed as hazardous wastes at authorized facilities, especially collections from air control devices designed to control heavy metal and other hazardous airborne particulates.[22]

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

[22] Basel Action Network. 2009. *Performance Requirements Excerpted From the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.

## On the Floor



- **Polychlorinated biphenyl (PCB)–containing components:** PCBs should be destroyed in accordance with the Stockholm Convention on Persistent Organic Pollutants, utilizing de-chlorination, OR high-temperature incineration equipped with pollution prevention.[23] Under no circumstances should PCB-containing devices be dismantled to expose its contents, refurbished or recycled.

- **Plastics and resin materials containing bromated flame retardants (BFR)s or polyvinyl chlorides (PVCs)** should be disposed of in a manner that prevents harmful releases, and in a manner that is consistent with applicable Basel Convention technical guidelines.

- **Batteries:** Batteries from electronic devices (such as rechargeable nickel cadmium, nickel metal hydride or lithium-ion batteries; or lead acid or mercury-containing batteries) should be removed manually and sorted by type prior to mechanical processing such as shredding (as previously noted in the Receiving Best Practice herein).

  Management processes should be established to avoid inadvertent external short circuits and current flows (e.g., discharging capacitors prior to refurbishing or recycling). These processes may include, for example:[24]

  - pack lithium-ion (Li-ion) batteries in vermiculite,
  - bag any corroding or leaking batteries,
  - tape battery terminals to prevent short circuiting, and
  - line the inside of metal drums with plastic if used to collect batteries.

  Large inventories of batteries held in storage should be avoided. They should be transported to authorized battery refurbishing or recycling facilities and in accordance with applicable laws.

[23] E-Stewards 2012. *e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*. Appendix A: Guidance on the Interpretation and Application of the e-Stewards Standard.

[24] Stewardship Ontario. Service provider standards for Municipal Hazardous or Special Waste Program, <http://www.stewardshipontario.ca/service_providers/vendor_standards>.

### *The Waste Management Hierarchy in Final Material Disposition*

**Best Practice: Follow your manager's recommendation regarding final material disposition for end-of-life electronic products. Preferred options should be consistent with the waste management hierarchy.**

**Exhibit 2: Material Disposition Hierarchy, and Acceptable Processes and Points of Final Disposition[25]**

| | | Disposition Hierarchy | | | Acceptable Processes & Points of Final Disposition | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Material recovery required | Energy recovery permitted | Other disposition permitted | Manual dismantling and material separation | Mechanical material separation | Extraction/ purification/ refinement | Smelting to reclaim metal | EFW incineration (use of material as an energy substitute) | Landfill | Hazardous waste landfill | Export to a non–OECD/EU country for processing |
| Electronic scrap | End-of-life electronics (EOLE) | ★ | | | ✓ | ✓ | × | × | × | × | × | × |
| | Components (hard drives, chips, etc.) | ★ | | | ✓ | ✓ | ✓ | ✓ | × | × | × | × |
| | Wires/Cables | ★ | | | ✓ | ✓ | ✓ | ✓ | × | × | × | × |
| | Copper yokes | ★ | | | ✓ | ✓ | ✓ | ✓ | × | × | × | × |
| | Circuit boards | ★ | | | ✓ | ✓ | ✓ | ✓ | × | × | × | × |
| | Metal/Plastic laminates | ★ | | | ✓ | ✓ | ✓ | ✓ | × | × | × | × |
| Non-hazardous | Metal | ★ | | | | | | | × | × | × | × |
| | Mixed metals | ★ | | | | | | | × | × | × | × |
| | Metal dusts (baghouse) | ★ | | | | | | | × | × | × | × |
| | Non-leaded glass | ★ | | | | | | × | × | × | × | × |
| | Plastic | | ★ | ★ | | | | × | | | × | ✓ |
| | Mixed plastics | | ★ | ★ | | | | × | | | × | ✓ |
| | Wood | | ★ | ★ | | | | × | | | × | × |
| | Leather, cotton and other fibres | | ★ | ★ | | | | × | | | × | × |
| | Insulation (fibreglass/composite) | | ★ | ★ | | | | × | | | × | × |
| Substances of concern | Leaded glass | ★ | | | ✓ | ✓ | ✓ | ✓ | × | × | × | × |
| | Washed leaded-glass cullet | ★ | | | × | ✓ | ✓ | ✓ | × | × | × | × |
| | Mercury lamps | ★ | | | × | ✓ | ✓ | × | × | × | × | × |
| | Mercury | ★ | | | × | ✓ | ✓ | × | × | × | × | × |
| | Batteries | ★ | | | × | ✓ | ✓ | ✓ | × | × | × | × |
| | Ink/toner cartridges | | ★ | | ✓ | ✓ | ✓ | ✓ | ✓ | × | × | × |
| | Ink/toner | | ★ | | × | ✓ | ✓ | × | ✓ | × | × | × |
| | Phosphor powder | | | ★ | × | ✓ | ✓ | × | × | × | | × |
| | Ethylene glycol | | | ★ | × | ✓ | ✓ | × | × | × | | × |

Material recovery is always preferred over other disposition methods for all materials but only required where indicated with a '★'. Where the use of the material for energy recovery or other disposition methods is permitted, it is indicated with a '★'.

| | |
|---|---|
| Process/application not recommended | × |
| Process/application is permitted & subject to onsite audit | ✓ |
| Process/application is permitted & subject to document review and verification | |

[25] Electronics Product Stewardship Canada (EPSC). 2010. *Recycler Qualification Program for End-of-life Electronics Recycling*.

## Notes

## Notebook

Does your facility have in place many of the best practices you have been hearing about? Do you have any suggestions for implementing any of these best practices into your workplace?

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_____

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## Group Discussion

Think of your own facility. Does it have in place engineering controls that are in line with ESM and that you think are best practices? Share some of these good practices with other group members.

Also, think about whether there are any areas of your facility where you would like to hear about best practices from other facilities. Other group members may be able to offer some good ideas.

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# Best Practices to Prevent and Minimize Risks to EHS through Administrative Controls

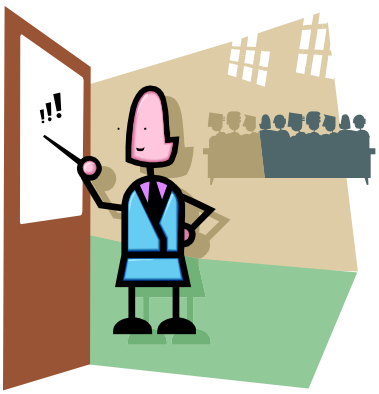
## 4.7 Best Practices to Prevent and Minimize Risks through Administrative Controls

### Introduction: Administrative Controls

**Administrative Controls**: policies and procedures that outline rules, responsibilities and methods for pollution control and health and safety. These also include increasing the knowledge regarding hazards in the workplace, and promoting awareness of how to minimize risks through proper training.

Facilities use many different types of management systems appropriate for their needs, size, and scale of operations. Some of the administrative controls identified as best practices by verification and certification bodies are presented in this section. Facilities may have these elements rolled up into an overarching environment, health and safety (EHS) management system, while others could opt to maintain separate programs.

The following page presents the best practices identified relating to administrative controls. These include policies and procedures relevant to all areas of an electronics recycling or refurbishment facility (receiving, testing, manual processing, mechanical processing, packaging and holding), health and safety committees or programs in the facility, and management system components that include administrative controls.



### 4.7.1 *Administrative Controls—Policies and Procedures at Recycling or Refurbishment Facilities*

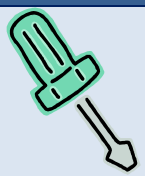
***Receiving/Sorting at Refurbishment and Recycling Facilities***

**Best Practice: Ensure that you know what is arriving at your facility, and ensure that it is properly sorted and labelled in the receiving area so that suitable controls are in place for incoming hazardous components. Follow documented processes for dealing with "non-conforming" equipment or materials that arrive (including a "Do Not Accept" list).**

- A facility should avoid accepting materials and equipment that it does not have the capability to manage and process in an environmentally sound manner. Personnel should be trained to either reject unwanted materials or redirect them to an appropriate facility that can handle the materials in an environmentally sound manner.[26]

- To ensure the safety of workers and the environment, it is important for your facility to have a process for dealing with "non-conforming" equipment or materials. This could include: how non-conforming equipment will be identified, reported (or returned) to the client or customer, or otherwise addressed at the receiving site. The procedures could include specific responsibilities for different levels of employees.[27]

**On the Floor**



- Review incoming products and product label specifications that **identify the hazards** associated with the product or its composition, such as manufacturer and brand-owner information (for example, incoming equipment might have material declaration sheets).

- If you work in the receiving area, know and use the policies for inspecting incoming products. This will help you to document, label, and sort equipment as it arrives. For example, boxes labelled as peripheral components (computer mice, cords, casings, etc.) should not include cathode ray tube monitors, which require specific engineering controls for hazardous materials, such as safe handling practices to avoid breakage.

- Make sure you know how to deal with unusual items that your facility may or may not be prepared to manage safely. If your facility has a process for dealing with "non-conforming" equipment or materials, make sure that you are familiar with it.

- If your facility does not have a policy/process for dealing with non-conforming equipment, recommend that a process be established.

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

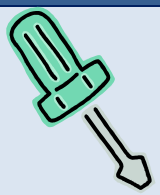
[27] Electronic Products Recycling Association (EPRA). 2012. *Electronics Reuse and Refurbishing Program*. Part B: Implementation Guide.

***Spill Response and Clean-up Procedures at Refurbishment and Recycling Facilities***

**Best Practice: Follow documented clean-up practices for accidental breakage of hazardous equipment in the receiving area.**

Your facility should have documented clean-up practices for any hazardous equipment, such as mercury-containing components (fluorescent tubes, backlighting for liquid crystal display screens, thermostats, and mercury-containing batteries), lead-containing components (cathode ray tubes [CRTs], tin-lead-based solders and connectors), leaking batteries or printer cartridges, and any other hazardous materials with which workers could come into contact. For example, a recommended best practice for clean-up procedures for accidental CRT breakage during receiving or testing is outlined below.[28] This should be posted in convenient areas, and be part of worker training.

**On the Floor**



*Recommended Best Practice and Procedure for Spill Response for Clean-up after CRT Breakage (note: you should follow your own facility's procedure if there is one in place):*

A CRT clean-up kit consists of a broom, small plastic liner bags, paper towels, dustpan, disposable dust mask, and disposable latex gloves. If a CRT breaks, the following steps should be taken:

- Inform the foreman and/or warehouse supervisor that there has been breakage.
- Put on personal protection equipment.
- Isolate the area prior to clean-up.
- Use hand-held broom and dustpan to gather and collect all glass particles from the breakage.
- Place the breakage into the plastic bag. NOTE: The bag should be in the plastic bucket when placing the CRT debris into it, just in case the bag has a hole.
- Spray the area with water and wipe up any residue with the paper towels in the clean-up kit.
- Throw the gloves, paper towels and mask into the garbage for disposal.
- Seal the bag, keeping it in the bucket.
- Bring the broken CRT glass in the bucket to a designated disposal area.
- Replace the clean-up kit if needed, or return the kit to the clean-up station.
- The warehouse supervisor should inform the manager when the collection container is full.
- Disposal should be in accordance with local legal requirements.

***Cathode Ray Tube (CRT) Breakage Clean-Up Procedures:***
E-Stewards clean up procedure #1, for accidental CRT breakage, available free at:
<http://e-stewards.org/standard-appendixes/appendix-c/clean-up-procedures/>
E-Stewards clean-up procedure #2, for accidental CRT breakage, available free at:
<http://e-stewards.org/standard-appendixes/appendix-c/clean-up-procedure-2/>

***Fluorescent Lamps Breakage Clean-Up Procedures, available at:***
Environment Canada, Mercury website. Link to Disposal and Clean up Guidelines:
<http://www.ec.gc.ca/mercure-mercury/>

[28] E-Stewards. 2012. *e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*. Appendix A: Guidance on the Interpretation and Application of the e-Stewards Standard.

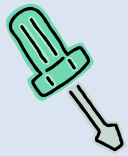
### *Testing at Refurbishment Facilities*

Functionality Testing

Workers should evaluate the potential suitability of used equipment for direct reuse, and test the items.[29] The tests to be conducted depend on the kind of equipment.[30]

**Best Practice: To determine the suitability of used equipment for reuse, workers should test the functionality of its key components. A visual inspection without testing functionality is unlikely to be sufficient. Results of testing should be recorded.**

**On the Floor**



- Test used equipment to evaluate its suitability for direct reuse.[31] The tests to conduct depend on the kind of equipment.[32]
- Record the results of any testing you do. The record should contain the following information:
  - name of the item and the producer,
  - identification number of the item, where applicable,
  - year of production (if available), and
  - name and address of the company responsible for testing, along with date of testing, types of tests performed and results.

Electrical Safety

**Best Practice: Always adhere to international electrical safety test guidelines when testing for electrical safety, such as the *Code of Practice for in-service inspection and testing of electrical equipment* by the Institution of Engineering and Technology.**

Used electronic products destined for refurbishment should be tested for electrical safety before they are connected to a power supply, as electrically unsafe equipment can cause death or serious injury from electric shocks and can also catch fire. The Institute of Engineering and Technology offers a useful Code of Practice for this purpose.[33]

[29] Electronic Products Recycling Association (EPRA). 2012. *Electronics Reuse and Refurbishing Program*. Part B: Implementation Guide.

[30] UNEP. Basel Convention. 2012. Open-ended Working Group of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Eighth meeting, Geneva, 25–28 September 2012. Agenda item 3 (b) (ii) a.

[31] Electronic Products Recycling Association (EPRA). 2012. *Electronics Reuse and Refurbishing Program Guide*.

[32] UNEP. Basel Convention. 2012. Open-ended Working Group of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Eighth meeting, Geneva, 25–28 September 2012. Agenda item 3 (b) (ii) a.

[33] Institute of Engineering and Technology. 2012. *Code of Practice for In-service Inspection and Testing of Electrical Equipment, 4th Edition.* Available at: http://electrical.theiet.org/books/e-books/cop-iitee.cfm.

***Disassembly at Refurbishment and Recycling Facilities***

Disassembly Procedures

**Best Practice: Follow documented procedures for manual removal, storage and treatment of any hazardous components or substances that are removed prior to processing, repair, or recycling.**

Documented procedures for the manual dismantling and removal, storage and treatment of any hazardous components and substances are important, including how to identify products and components that should be removed prior to subsequent processing activities. Workers should follow all procedures that outline the hazards associated with various types of used and end-of-life electronic products and the proper handling to prevent unintended releases of hazardous constituents through handling, breakage, etc.[34]

Legal Compliance for Removed Hazardous Components

**Best Practice: All hazardous components removed during repair should be packaged, stored and transported as hazardous in compliance with all local, stat/provincial, and federal/national regulations, as appropriate.**

There are specific legal compliance requirements for handling hazardous materials, for both repair and recycling operations. These will depend upon your jurisdiction, so you will need to become familiar with the requirements that apply to your facility.[35]

[34] Electronics Product Stewardship Canada (EPSC). 2010. *Recycler Qualification Program for End-of-life Electronics Recycling*.

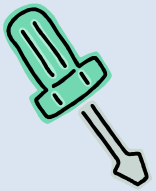
[35] Ibid.

### *Packaging at Refurbishment and Recycling Facilities*

**Best Practice: Refurbishment and recycling operations should ensure that packaging minimizes potential risks to human health and the environment during movement, and risks for breakage are minimized. Reuse and refurbishment facilities should ensure that electronic products are properly packaged when destined for reuse. Recycling facilities should ensure that hazardous waste or residual materials are properly sealed in containers destined for further material recovery or disposal. Basel Convention guidelines for packaging should be followed.**

#### On the Floor

Where applicable, ensure that the following packaging guidelines[36] are met:



- Each piece of equipment should be protected with cushioning material appropriate to preserving asset value (e.g., bubble-wrap, packaging foam).
- Laptops and their chargers should be packed together in boxes (vertically).
- Cables, keyboards and mice should be packed in separate boxes.
- Stacked layers of computing equipment should be separated by appropriate intermediate packaging to preserve asset value (e.g., cardboard, bubble-wrap, packaging foam) and shrink-wrap should be used to secure shipments to pallets.
- Stacking of equipment should be no more than as follows:
  - Display devices—4 layers only, unless 17" (43.2 cm) or larger, in which case 2 layers; flat-panel displays should be stacked vertically.
  - Desktop PCs—15 layers.
  - Laptops—5 layers stacked vertically.
  - Printers—5 layers.
  - Batteries—should be packaged in a way to avoid contact with their terminals, to avoid short circuits and fires.
- LCD backlights—Due to their fragile nature, where removed, LCD backlights should be individually packaged in a rigid container that prevents breakage during the transport and should also be sealed in a foil, laminated bag in case of any breakage during the transport. In general, removing and packaging LCD backlights for reuse is a specialist activity to be undertaken by professionals with detailed knowledge and experience in handling these hazardous components.
- Each load should be properly secured to the pallet (e.g., with plastic shrink-wrap).
- Small, individual items of equipment should be packed in a box, properly encased with cushioning material, and with sufficient fill to prevent movement. When multiple items are packed in the same box, each should be separated by appropriate packaging. Where pallets are used, boxes should be secured to pallets using shrink-wrap or other means.

[36] UNEP. Basel Convention. 2011. *Guideline on Environmentally Sound Testing, Refurbishment & Repair of Used Computing Equipment*. Partnership for Action on Computing Equipment (PACE) Project 1.1.

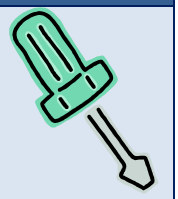
### *Labeling at Refurbishment and Recycling Facilities*

Refurbishment and recycling facilities may receive used electronic products, components and materials that cannot be reused or processed. These may include hazardous components such as faulty mercury lamps, batteries, capacitors and printed circuit boards, and should be managed onsite in a manner that protects human health and the environment and preserves their condition and value for subsequent material recovery and recycling, or proper treatment and/or final disposal if appropriate.

Following processing, refurbishment and recycling facilities should have provisions in place to arrange for processing, treatment and/or final disposal of residual waste streams at authorized facilities that possess the necessary infrastructure and capacity to manage these materials in an environmentally sound manner.

**Best Practice: Packaging, storage and shipping containers should be labelled in a clear, legible, visible and durable manner, and meet applicable legal requirements. Labels should convey essential information, to facilitate proper handling, transport and storage, enable shipment tracking, and support safe and timely emergency and spill responding.**

**On the Floor**



Labels should be clearly legible and visible, to facilitate identification by receiving facilities, regulatory authorities and inspectors, emergency responders, or the public.[37] Labels must meet all applicable legal requirements, and include, for example, the following information, where appropriate:

- original generator information (e.g., name, address),
- physical state (e.g., solid, liquid, gas) and hazard properties,
- identification, shipment manifest and/or facility tracking numbers,
- accumulation or packaging date,
- Workplace Hazardous Material Information System (WHMIS) symbols, if applicable,[38]
- for reusable equipment, proof of testing to confirm that used products are in good working condition and are fit for reuse, and
- description of container contents—for material destined for recycling or disposal, detailed description of contents and hazardous designation, if applicable.

[37] UNEP. Basel Convention. 2012. Open-ended Working Group of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Eighth meeting, Geneva, 25–28 September 2012. Agenda item 3 (b) (ii) a.

[38] Health Canada. WHMIS, http://www.hc-sc.gc.ca/ewh-semt/occup-travail/whmis-simdut/index-eng.php.

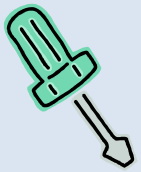
***Holding at Refurbishment and Recycling Facilities***

**Best Practice: Ensure all material is securely stored in a manner that meets all applicable legal requirements, including maximum allowable time periods for material retention and storage. Materials also should be protected from atmospheric and weather effects (e.g., heat, cold, moisture, dust, etc.), and accidental spills and breakage.**

Sometimes material must be stored onsite until enough has been accumulated to justify processing and/or transport.

**On the Floor**

All materials and components should be stored in a way that:[39,40]



- meets applicable requirements of regulatory agencies, including regulations, permits, standards, guidelines and codes of practice,
- protects them from the atmospheric and weather effects (e.g., using weatherproof covering and a rain catchment system),
- protects against accidental spills or breakage (e.g., using an impermeable surface with a sealed drainage system and sealed sump pump pits[41]),
- is secure from unauthorized entrance or access,
- includes clearly labelled storage areas,
- includes labels on materials, with the date they were placed into storage, and
- safeguards workers.

**Best Practice: Keep inventories of stored hazardous substances, to ensure conformity with regulatory requirements (including maximum retention and storage times) and to support implementation of facility contingency and emergency response plans.**

Inventories should note the type, quantity and location of material, and should be accessible in the event of emergency, particularly where electronic files are used.[42]

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39 UNEP. Basel Convention. 2011. *Guideline on Environmentally Sound Testing, Refurbishment & Repair of Used Computing Equipment*. Partnership for Action on Computing Equipment (PACE) Project 1.1.

40 Basel Action Network. 2009. *Performance Requirements Excerpted From the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.

41 UNEP. 2007. *E-waste Volume II: E-Waste Management Manual*. International Environmental Technology Centre.

42 Electronics Product Stewardship Canada (EPSC). 2010. *Recycler Qualification Program for End-of-life Electronics Recycling*.

### *4.7.2 Administrative Controls—Injury and Illness Prevention Program*

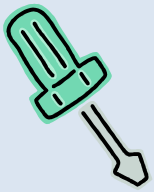
**Best Practice: Carefully follow your workplace's injury and illness prevention program (IIPP) (or equivalent/similar program).**

An injury and illness prevention program (IIPP), on its own or within a broader EHS management system, has the following attributes:

- An IIPP is a documented program to routinely identify and address hazards during normal business practices. The IIPP demonstrates management commitment to health and safety. It assigns responsibilities for hazard identification and correction, ensures regular workplace inspections, outlines required health and safety training, and encourages prompt employee reporting of environment, health and safety concerns.
- An IIPP is typically administered by a health and safety committee.

**On the Floor**

The following are best practices for employees to follow as part of an IIPP:



- observe health- and safety-related signs, posters, warning signals and directions,
- review the building emergency plan and assembly area,
- learn about the potential hazards of assigned tasks and work areas,
- take part in appropriate health and safety training,
- follow all safe operating procedures and precautions, and read operating manuals for equipment,
- use proper personal protective equipment,
- regularly inspect personal protective equipment (PPE) for correct fit and function,
- warn co-workers about defective equipment or new hazards in the workplace not yet rectified,
- report unsafe conditions immediately to a supervisor, and stop work if an imminent hazard is presented, and
- participate in workplace safety inspections.

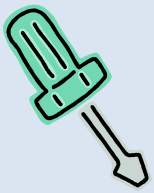
### *4.7.3 Administrative Controls—Health and Safety Committee*

**Best Practice: Contribute to and follow the guidance of the health and safety committee, to ensure that the elements of an IIPP are implemented and functioning properly.**

- A health and safety committee ensures that the elements of an IIPP are implemented and functioning properly.
- The committee should include representatives from both management and workers. Membership may rotate periodically. The committee should meet at least quarterly.
- The committee may have responsibility to: maintain and update the IIPP; assess compliance with applicable environment, health and safety regulations and policies; evaluate reports of unsafe conditions; and coordinate any necessary corrective actions.
- Unsafe conditions that cannot be immediately corrected by an employee or his/her supervisor should be reported to the safety coordinator or any safety committee member and documented.
- Management retains authority to implement corrective actions; however, timely correction of workplace hazards should be tracked by the committee, which will receive and review reports of unsafe conditions, workplace inspection reports, or injury reports.

**On the Floor**

The following are responsibilities of a health and safety committee:[43]



- establish a formal process to investigate, resolve, and follow up on health and safety complaints filed by workers;
- review the results of periodic, scheduled workplace inspections, to identify needed safety procedures or programs and to track specific corrective actions;
- review supervisors' investigations of accidents and injuries to ensure that all causes have been identified and corrected;
- where appropriate, submit suggestions to management for the prevention of future incidents;
- review alleged unsafe and hazardous conditions brought to the attention of any committee member, determine necessary corrective actions, and assign responsible parties and correction deadlines;
- investigate accidents and/or alleged hazards, to assist in establishing corrective actions;
- submit recommendations to assist management in the evaluation of employee safety suggestions;
- encourage two-way communication among workers and supervisors or management, without fear of reprisal; and
- inspect emergency response kits and first-aid kits to ensure that they are readily accessible at all times and adequately stocked, especially following an incident.

[43] Basel Action Network. 2009. *Performance Requirements Excerpted From the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.

### *4.7.4 Administrative Controls—Environment, Health and Safety Management System Components*

As you learned in Module 1, 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 are presented below, with further detail following.

1. **Policy**. An EHS policy includes objectives, targets, and programs. This policy should be established by top management, and should include commitments to compliance, prevention of pollution, and continual improvement of the EHS system.

2. **Planning**. The organization should: i) identify the environmental aspects of its activities, products, and services, including those that could have a significant impact on the environment and can be controlled or influenced (see Module 3 for more information on hazard identification); ii) identify all applicable environmental regulations; and iii) develop objectives and targets for its EHS management system.

3. **Implementation and operation**. A company should implement and organize processes to control and improve the products and services that are critical for environmental and worker health and safety. This includes development, documentation and use of important environment, health and safety controls and procedures, and employee training.

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 year to ensure that it remains suitable, adequate and effective. Management review should also be conducted in a timely manner following the implementation of corrective actions that are introduced to address ESM problems and deficiencies.

Many best practices related to EHS components above are profiled elsewhere in the training. However, two aspects that are part of implementation and operation of an EHS management system that have not yet been discussed in any of the worker training modules are:

- ✓ the importance of **documented procedures** and how they should be followed, and
- ✓ the importance of **employee training.**

These are discussed on the following pages.

## Administrative Controls – EHS – **Documented Procedures**

**Best Practice: Understand documented procedures that apply to your work, and follow them.**

You should become familiar with and follow procedures outlined by your managers. Some of the recommended procedures for a facility to have are included in Box 1.

### Box 1: Procedures that Should be Documented by Management and Followed by Workers

- Procedure to document the overall written EHS management system, including goals and objectives. Many of the following procedures could be documented within an overall EHS system.
- Procedure to identify aspects of the company's activities that could affect the surrounding local environment (this could possibly be a documented requirement for a risk assessment).
- Procedure to identify important worker health and safety aspects of the company's activities.
- Procedure to identify applicable legal and other requirements.
- Procedure to identify training and awareness goals and objectives, and a training plan for workers.
- Procedure for internal and external communication across the various levels within the company.
- Document control procedure for document approvals, reviewing and updating documents, and to ensure that the current versions of important documents are identified, available, and legible.
- Procedure for operational controls, to outline control of situations where loss of control could lead to deviation from the policy, objectives and targets.
- Procedure for emergency preparedness and response.
- Procedure for control of records for the identification, storage, protection, retrieval, retention and disposal of records.
- Procedure for monitoring and measurement, to monitor on a regular basis the key characteristics of the company's operations, including internal auditing procedures.
- Procedure for evaluation of compliance with the applicable legal requirements.
- Procedure to monitor regulatory change.
- Procedure for nonconformity, corrective action and preventive action for dealing with nonconformities and for taking corrective and preventive actions.
- A plan and procedures for closing the facility and for its after-care.
- Procedures for selecting a downstream processor.

An example of a documented procedure for emergency response is provided on the following page.[44] Similar procedures should exist for all items in Box 1.

[44] *Adapted from*: 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*.

## Administrative Controls – EHS – **Documented Procedures**

### Exhibit 3: Documented Emergency Response Procedure

**Purpose:**

- to plan and prepare for a potential EHS emergency that may pose an immediate and significant threat to human health and/or the environment,
- to outline how workers should respond to such a situation if such an event is imminent or occurs, and
- to identify existing programs and provide guidance to support these activities.

**Scope:**

- This procedure encompasses all activities and processes at the company.
- The procedure applies to the actions of all employees at the plant, and to the services and products provided by vendors and subcontractors while operating at the facility.

**Definitions:**

- Emergency incident or emergency situation: Environmental releases that require an emergency response.
- Emergency response: Actions taken by personnel outside of the immediate work area, to address an EHS accident.

**Responsibilities:**

- Emergency response coordination shall be in accordance with the applicable emergency response plan.
- The emergency response plan should cover both short-term and long-term remedial activities.
- The management representative will in case of an emergency act as emergency coordinator.
- All plant employees are responsible for identifying potential conditions, practices or activities that could lead to an emergency situation and for communicating this observation to their operations manager or the management representative: Employees shall immediately notify the operation's controller of any emergency condition or pending emergency condition.
- All emergency response activities are to be conducted within boundaries of training levels, appropriate procedures and governmental regulations.

**Emergency Planning Procedures:**

- regularly updating the emergency response plan,
- adequately training employees regarding emergency response and practice drills,
- reviewing events and accidents at the company and other similar facilities within the industrial sector,
- conducting health and safety and environmental compliance audits to identify areas for corrective and preventative action or improvement,
- coordinating with local governmental agencies, and local communities,
- documenting procedures within the emergency response plan,
- documenting procedures within the emergency spill response manual,
- documenting procedures within the chemical release emergency procedure,
- documenting procedures within the chemical hazard evaluation system,
- documenting procedures within the security and inspection program,
- documenting procedures within the malfunction and abatement plan, and
- documenting procedures for the continuous emissions monitoring system shutdown, breakdown or malfunction reporting.

**Emergency Response Equipment:**

- Emergency response equipment that may be required, in the event of a spill or potential release, is located within the facility. These locations are identified in the emergency spill response manuals.
- This equipment shall be periodically inspected to ensure that it is stocked, accessible, and appropriate to the response plans and needs.

## Notebook

Have you read and are you knowledgeable about any of these procedures at your facility? Who would you ask if you wanted to learn more about the documented procedures in force there?

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***Administrative Controls—Environment, Health and Safety (EHS) System—Implementation***

Worker Training

**REMINDER: ESM Criteria #5**
**Awareness, Competency and Training:**
Ensure employees have an appropriate level of awareness, competency and training with respect to the effective management of occupational risks.

**Best Practice: Participate in all training programs offered by management. Make sure to actively document all trainings taken (in a training record, a list, etc.).**

It is important for workers to participate in training that is designed to enhance employee awareness and competency regarding measures to minimize potential occupational risks and hazards. In some cases, it is often appropriate for specialized training courses to be offered to employees in specific work areas where the scope and magnitude of risk may be more severe.

The training program should be comprehensive, for new hires, and should include periodic refresher courses for all workers (for example, annually). The training should be given to workers in a language and format they can understand. Training content should include:[45]

- awareness of hazards in the workplace, and safe management and handling of hazards,
- spill prevention and spill response in an emergency, including spill reporting,
- engineering controls used by the facility and how they should be operated and maintained during normal use,
- equipment safety,
- use and care of personal protection equipment,
- fire safety—fire prevention techniques, fire extinguisher use, and evacuation training,
- disaster response and medical response training and first aid,
- injury and illness prevention program training (if applicable), and
- environment, health and safety management system training (if applicable).

All health and safety training programs should be provided at no cost to workers, conducted during normal working hours, presented by a knowledgeable supervisor or by contracted experts, offered in a language and format understandable to you, and documented.[46]

[45] Basel Action Network. 2009. *Performance Requirements Excerpted From the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.
[46] Ibid.

## Administrative Controls – EHS – **Training**

**Best Practice: Participate in training whenever you will encounter anything new. Supervisors should be trained about the specific hazards that workers under their immediate supervision may be exposed to.**

This training will help a supervisor understand and enforce proper protective measures. As a best practice, all supervisors should also ensure that the personnel they supervise receive appropriate training on the specific hazards of work they perform and how to protect against those hazards.

Training is particularly important for new workers and whenever a new hazard is introduced into the workplace. This may include new equipment, hazardous materials, or new procedures to deal with a hazardous material. Health and safety training is also required when workers are given new job assignments on which they have not yet been trained and whenever a supervisor is made aware of a new or previously unrecognized hazard.

Specific topics which may be appropriate are:[47]

- hazards relating to electronics recycling and refurbishing processes, such as hazardous materials present and released during each process,
- the use of important personal protective equipment, and
- care of the back, body mechanics, and proper lifting techniques.

### Notes

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[47] ibid.

## Notebook

What training have you received and is it enough for you to do your job? Do you have any training suggestions that you could offer to your health and safety committee, representative, manager, or supervisor?

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# Best Practices to Prevent and Minimize Risks to EHS through the use of PPE

## 4.8 Best Practices to Prevent and Minimize Risks through the Use of Personal Protective Procedures and Equipment

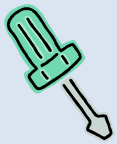
**Personal Protective Equipment**: It is important to protect health and safety of workers by requiring them use PPE to minimize their exposure to hazardous constituents. This control includes wearing protective equipment, as well as personal protective procedures.

### *4.8.1 Personal Protective Procedures*

**Best Practice: Ensure that good hygiene practices are documented and practiced by all staff in all areas of your facility.**

**On the Floor**

The following personal protective procedures should be followed:[48]



- Clean chemical and other spills using procedures and PPE in accordance with material safety data sheets, facility emergency response protocols, and applicable legal requirements (including spill reporting). Dust and particulate matter should be regularly removed from surfaces, using wet cleaning methods as opposed to dry cleaning methods, to maintain a clean working environment and avoid further distribution of contaminants.

- Do not eat, drink or smoke or allow any of these activities at work stations.
- Employees in the CRT processing area should remove contaminated clothing and wash their face and hands before they enter the common break room or eating area. Employees should wash their face and hands before they eat, drink, smoke or apply cosmetics.

- Employees in processing areas should wear smocks, coveralls or other suitable protective work clothing over their personal clothing to prevent them from becoming contaminated. Protective clothing should be professionally laundered by a service capable of handling industrial contamination.

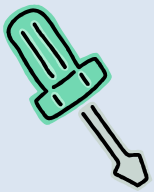
- A regular cleaning schedule should be adhered to.

[48] Katers, J., Jim Barry, & Neil Peters-Michaud. 2003. Occupational Risks Associated with Electronics Demanufacturing and CRT Glass Processing Operations and the Impact of Mitigation Activities on Employee Safety and Health. Presentation at the Institute of Electrical and Electronics Engineers (IEEE) International Symposium: Electronics and the Environment.

## Administrative Controls – **Personal Protective Procedures**

**Best Practice: Work clothing and personal protective equipment can become contaminated with hazardous substances. They should be cleaned and laundered at or by the facility. Do not take them home.**

### On the Floor



- Remove contaminated clothing promptly after you have completed your work and before break time and departure.
- Keep contaminated clothing in closed containers.
- Make sure that clothing is laundered before it is re-worn. In industrial facilities this often means having workers place used protective work clothing into a designated laundry bin, from which it is collected and appropriately laundered by the company prior to reuse.
- Wash before eating or drinking. Similarly, no food or drinks should be allowed in a work area where hazardous products are present.
- Do not wear work clothing or other personal protective equipment home.
- Supervisors should make sure that workers follow these practices.

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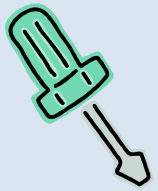
### *4.8.2 Personal Protective Equipment (PPE)*

**Best Practice: Follow the proper use and care of PPE. PPE should be properly fitted to the individual where appropriate. Employees should be well trained in the use of PPE applicable to their jobs. Before entering processing areas that may pose hazards, wear appropriate PPE, including protection for eyes, head, hands, skin, feet, hearing, and respiratory tract.**

**On the Floor**

Before entering areas that may pose hazards (e.g., cutting, grinding, shedding, heavy lifting, elevated noise levels, fumes and vapours), ensure that you are wearing appropriate personal protective equipment, such as:[49,50]



- ❒ approved eye protection (e.g., safety glasses, visors and goggles);
- ❒ approved hand protection (e.g., chemical gloves or work gloves);
- ❒ approved body protection (e.g., conventional or disposable overalls, smocks, aprons, coveralls, and high-visibility clothing);
- ❒ approved foot protection (e.g., safety work boots and shoes);
- ❒ approved respiratory protection (e.g., disposable filtering face piece or respirator, half- or full-face respirators; air-fed helmets and breathing apparatus);
- ❒ approved hearing protection (e.g., ear plugs, ear muffs); and
- ❒ approved head protection (e.g., hard hats, helmets and bump caps).





The personal protective equipment should be properly rated, and fit-tested to individual needs where important to do so, and it should be provided by the management of the company.[51]

[49] Canadian Centre for Occupational Health and Safety. Website, <http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/lead/personal_lead.html>.

[50] International Precious Metals Institute (IPMI). 2003. *Environmentally Sound Management for Used Mobile Telephones*. IPMI guidance paper. Online at: http://ipmi.org/pdf/IPMI_Guidance_Used_Mobile_Phones.pdf.

[51] Electronics Product Stewardship Canada (EPSC). 2010. *Recycler Qualification Program for End-of-life Electronics Recycling*.

### *Exposure Monitoring Effectiveness of Personal Protective Equipment*

**Best Practice: Know about the benefits of exposure monitoring, and participate in all exposure monitoring offered by your manager.**

- If your facility uses power machinery to shred, cut, grind or shear electronic products, then it should perform semi-annual exposure monitoring of workers for mercury, lead, beryllium, cadmium, and bromated flame retardants.[52]
- In such a case, your organization should have a medical surveillance program in place (e.g., biomonitoring through the use of routine blood work or other tests), offering to all workers a confidential service to monitor levels of contaminants in their bodies.
- Workers should be entitled to a second medical opinion, at the expense of the organization, for a reasonable and comparable cost. This will allow for identification of key hazard areas and implementation of new occupational safety procedures.[53]

**Notes**

[52] E-Stewards 2012. *e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*. Appendix A: Guidance on the Interpretation and Application of the e-Stewards Standard.

[53] Basel Action Network. 2009. *Performance Requirements Excerpted From the e-Stewards Standard for Responsible Recycling and Reuse of Electronic Equipment*, and Appendix A: Guidance Document. UNEP.

## Group Discussion

Think of your own facility. Does it have in place any practices for personal protective equipment that are in line with ESM and that you think are best practices? Share some of these good practices with other group members.

Also, think about whether you want to hear about best practices on any issue relating to the use of personal protective equipment from other facilities. Other group members may be able to offer some good ideas.

## 4.9 Summary—Key Take-away Messages

**<u>Why</u> Implement Risk Prevention and Minimization?**

Efforts to minimize risks to the environment and to worker health and safety are important to:

- ✓ reduce worker and community illnesses,
- ✓ reduce worker accidents,
- ✓ raise awareness in the facility about hazards and how to prevent risks—this will contribute to safer work practices—and
- ✓ improve workers' skills through regular training.

**<u>How</u> to Implement Risk Prevention and Minimization?**

Companies could adopt many of the ESM practices outlined in this module, such as a commitment to:

- ✓ control a hazard at the source (including controls during manual processing, emission controls during mechanical processing, and emission monitoring in processing areas);
- ✓ use of procedures and training to increase awareness and understanding of and competency in how to minimize hazards from company operations to the environment and worker health and safety; and
- ✓ use of personal protective equipment to ensure worker health and safety in all designated areas of electronic product refurbishment and recycling facilities. Personal protective equipment might include eye and ear protection, hand and body protection, respiratory protection, and head protection. If this equipment is not worn properly and consistently, workers and their families could become very ill.





## 4.10 Post-questionnaire

1. Did you learn what you wanted to about risk minimization and prevention (see Pre-questionnaire, Question #1)? If not, what questions do you still have that have not been answered?

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2. What best practices, ideas or suggestions came out of this module and from other participants that you will take back to your facility and your job?

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3. Are there any ideas that you would like to offer your manager, supervisor or health and safety committee regarding risk minimization and prevention at your facility?

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## Notebook

Please check off which of the following risk prevention and minimization measures outlined in this module you can apply to your work.[54]

### Risk Assessment: Putting the Training into Practice

| How Can You Apply Risk Prevention and Minimization to Your Work? | Key Items to Apply to Your Job |
|---|---|
| **Engineering Controls:**<br><br>Can you bring any of the module's best practices to your work for the following processes:<br><br>❒ Receiving, testing and sorting<br><br>❒ Manual processing<br><br>❒ Mechanical processing<br><br>❒ Packaging, labelling, holding<br><br>❒ Hazardous materials management | •<br><br>•<br><br>• |
| **Administrative Controls:**<br><br>Can you bring any of the module's best practices to your work for the following processes:<br><br>❒ Injury and illness prevention program or an equivalent type program<br><br>❒ Health and safety committee<br><br>❒ Following important procedures<br><br>❒ Employee training | •<br><br>•<br><br>• |
| **Personal Protective Equipment (PPE) and Procedures:**<br><br>Can you bring any of the module's best practices to your work, relating to: | •<br><br>• |

[54] UNEP. Basel Convention. 2011 (Revised). *Environmentally Sound Management (ESM) Criteria Recommendations*. Partnership for Action on Computing Equipment (PACE).

| How Can You Apply Risk Prevention and Minimization to Your Work? | Key Items to Apply to Your Job |
|---|---|
| ❒ Good hygiene practices<br>❒ The proper use and care of PPE<br>❒ Contaminated clothing<br>❒ Monitoring of worker exposure to hazardous substances<br>❒ The use of appropriate health and safety precautions | • <br>• |

## 4.11 Additional Resources

### Environment, Health and Safety Management

- **Canadian Centre for Occupational Health and Safety**, website: http://www.ccohs.ca/. Available online: downloadable posters on health and safety, and WHMIS fact sheets.
- **US Department of Labor. Occupational Safety and Health Administration**, website: http://www.osha.gov/. Available online: written programs and examples to meet the state regulations; hazardous materials training and other training materials; resources for small businesses, etc.
- **US Department of Labor. Occupational Safety and Health Administration. Forms for Recording Work-Related Injuries and Illnesses**, at: <http://www.osha.gov/recordkeeping/new-osha300form1-1-04.pdf>.
- **US Department of Labor. Occupational Safety and Health Administration. Chemical Hazard Communication Plan.** OSHA 3084 (1998), at: http://www.osha.gov/Publications/osha3084.pdf
- **US Centers for Disease Control and Prevention. Engineering Controls**, website: <http://www.cdc.gov/niosh/topics/engcontrols/>.
- **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***. Available free at: <http://www.epa.gov/osw/conserve/materials/ecycling/conference/resource/guide-esm.pdf>.
- **OECD. 2003.** ***How to Apply Environmentally Sound Management to Small and Medium Size Enterprises in the Waste Recovery Sector*****.** Available free at: <http://search.oecd.org/officialdocuments/displaydocumentpdf/?doclanguage=en&cote=env/epoc/WGWPR/RD(2002)5/FINAL>.
- **OECD. 2004.** ***Guidance Manual for the Implementation of the OECD Recommendation C(2004)100 on Environmentally Sound Management (ESM) of Waste***. Available free at: <http://www.oecd.org/env/resourceproductivityandwaste/39559085.pdf>.
- **OECD. 2003.** ***Technical Guidance For The Environmentally Sound Management of Specific Waste Streams: Used and Scrap Personal Computers*** (ENV/EPOC/WGWPR(2001)3/FINAL), at: <http://ban.org/library/OECDGuidelineWEEE.pdf>.
- **Canadian Standards Association**. **2011.** ***Occupational Health and Safety Management***. CAN/CSA-Z1000-06 SMART CD-ROM (R2011). Available for a fee at the CSA website: <http://shop.csa.ca/?gclid=CLe1o6_u0bUCFckx4AodKzwAIw>. The CSA Z1000-06 Smart CD-ROM is an electronic version of the Occupational Health and Safety Management Standard. It is organized according to a popular management system of "plan-do-check-act" methodology that easily guides the user through each phase for easy implementation of the CSA Z1000-06 Standard.
- **UNEP. Basel Convention. 2004.** ***Technical Guidelines on the Environmentally Sound Recycling/Reclamation of Metals and Metal Compounds (R4)***, at: <http://www.basel.int/DNNAdmin/AllNews/tabid/2290/ctl/ArticleView/mid/7518/articleId/189/Technical-guidelines-on-the-environmentally-sound-recyclingreclamation-of-metals-and-metal-compounds-R4.aspx>.

- **US Department of Labor. Occupational Safety and Health Administration (OSHA). Safety and Health Management Systems e-tool.** Website: http://www.osha.gov/SLTC/etools/safetyhealth/index.html

- **Five Winds International, LP.** ***Toxic and Hazardous Materials in Electronics***, at: <http://www.fivewinds.com/_uploads/documents/g60vcj6y.pdf>.

- **Microsoft Refurbishment Programs. Safety in the receiving area**. In online slide deck available free at: <http://www.techsoup.org/learningcenter/hardware/1.%20Warehouse%20Operations.pdf>.

- **Microsoft Refurbishment Programs. Dismantling and repair process**. In online slide deck, available free at: <http://www.techsoup.org/learningcenter/hardware/7.%20Demanufacturing.pdf>.


## Emergency Planning


- **Canadian Standards Association**. **2009.** ***Emergency Planning for Industry Major Industrial Emergencies.*** CAN/CSA-Z731-03 (R2009). **Emergency Preparedness and Response**. Available for a fee at: <http://shop.csa.ca/en/canada/injury-prevention/cancsa-z731-03-r2009/invt/27019912003/>.

- **Transport Canada (TC), the US Department of Transportation (DOT), the Secretariat of Transport and Communications of Mexico (SCT). 2012**. ***2012 Emergency Response Guidebook***. This guidebook will assist responders in making initial decisions upon arriving at the scene of a dangerous goods incident. It should not be considered as a substitute for emergency response training, knowledge or sound judgment. The *2012 Emergency Response Guidebook* (ERG2012) does not address all possible circumstances that may be associated with a dangerous goods incident. It is primarily designed for use at a dangerous goods incident occurring on a highway or railroad. The ERG2012 was developed jointly by Transport Canada (TC), the US Department of Transportation (DOT), the Secretariat of Transport and Communications of Mexico (SCT) and with the collaboration of Ciquime (*Centro de Información Química para Emergencias*) of Argentina, for use by fire fighters, police, and other emergency services personnel who may be the first to arrive at the scene of a transportation incident involving dangerous goods. The ERG2012 is primarily a guide to aid first responders in quickly identifying the specific or generic hazards of the material(s) involved in the incident, and protecting themselves and the general public during the initial response phase of the incident. Available documentation and videos free at: <http://www.tc.gc.ca/eng/canutec/guide-menu-227.htm>.

- **United States Environmental Protection Agency (EPA)**. ***Basic Awareness Factsheet for Small Business—Clean Air Act Section 112(r): Prevention of Accidental Releases***. Online at: http://www.epa.gov/oem/docs/chem/sb-final.pdf>.

## Risk Prevention and Minimization Guidelines and Practices

- **E-Stewards. Basel Action Network. E-Stewards Guidance Document.** Available free at: <http://e-stewards.org/wp-content/uploads/2009/10/e-StewardsStandardGuidanceDocument.pdf>. Appendix A: The Guidance Document is provided to aid in interpretation of the e-Stewards certification requirements as well as to provide guidance in how to meet the requirements in the Standard, including many leading practices provided by industry.

- **E-Stewards. Basel Action Network. Identification, Reporting, and Disposal of Potentially Non-Conforming Equipment.** Available free at: <http://e-stewards.org/standard-appendixes/appendix-c/identification-reporting-and-disposal-of-potentially-non-conforming-equipment/>.

- **US Department of Labor. Occupational Safety and Health Administration**. **Lead Smelting.** Available free at: <http://www.osha.gov/SLTC/etools/leadsmelter/index.html>.

- **E-Stewards. Basel Action Network. Toners and Inks.** Available at: <http://e-stewards.org/standard-appendixes/appendix-c/toners-and-inks/>.

- **E-Stewards. Basel Action Network**. **Cathode Ray Tube (CRT) Breakage Clean-Up, Sample #1: Clean-up Procedure for Accidental CRT Breakage.** Available free at: <http://e-stewards.org/standard-appendixes/appendix-c/clean-up-procedures/>.

- **E-Stewards Basel Action Network**. **Cathode Ray Tube (CRT) Breakage Clean-Up, Sample #2: Clean-up Procedure for Accidental CRT Breakage.** Available free at: <http://e-stewards.org/standard-appendixes/appendix-c/clean-up-procedure-2/>.

- **Environment Canada**. **Mercury. Disposal and Clean-up Guidelines**. Available at: <http://www.ec.gc.ca/mercure-mercury/>.

- **California Department of Industrial Relations. Injury and Illness Protection Program E-Tool**. Available at: <http://www.dir.ca.gov/dosh/etools/09-031/index.htm>.