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BASEL CONVENTION

Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal
Thirteenth meeting
Geneva, 24 April–5 May 2017
Agenda item 4 (e) (i)

Matters related to the implementation of the Convention: international cooperation, coordination and partnerships: Basel Convention Partnership Programme

Documents developed by the Partnership for Action on Computing Equipment

Note by the Secretariat

1. At its thirteenth meeting, the Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal considered, among other things, the revised section 3 and proposed additional changes to the guidance document on environmentally sound management of used and end-of-life computing equipment, and the revised concept for a follow-up partnership to the Partnership for Action on Computing Equipment (PACE), both prepared by the Working Group of the PACE taking into account comments made during the tenth meeting of the Open-ended Working Group.

2. Annex I to the present document sets out the guidance document on environmentally sound management of used and end-of-life computing equipment, with the revised section 3 and proposed additional changes to ensure consistency of the text throughout the guidance document, as adopted, on an interim basis, by the Conference of the Parties to the Basel Convention decision BC-13/12 on the PACE.

3. Annex II to the present document sets out the concept note on a follow-up partnership to the Partnership for Action on Computing Equipment that the Conference of the Parties took note of in decision BC-13/12 on the PACE.

4. Annex III to the present document sets out a report on project experiences and lessons learned based on the outcome of the pilot projects implemented by the PACE.

5. The present note, including its annexes, has not been formally edited.

Annex I

Guidance document on environmentally sound management of used and end-of-life computing equipment set out in document UNEP/CHW.11/6/Add.1/Rev.1 with revised section 3 and proposed additional changes to ensure consistency of the text throughout the guidance document as adopted, on an interim basis, by the Conference of the Parties to the Basel Convention decision BC-13/12

Basel Convention

Partnership for Action on Computing Equipment (PACE)

Guidance document on the environmentally sound management of used and end-of-life computing equipment

Approved by the PACE Working Group
Revised version: 02 May 2017

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In addition, special thanks are extended to the Co-Chairs of the PACE Working Group: Marco Buletti, Federal Office for the Environment, Switzerland; Oladele Osibanjo, Basel Convention Coordinating Centre for the African Region-Nigeria; Leila Devia, Basel Convention Regional Centre for the South American region, Argentina; and the chairs of the various project groups: Michael VanderPol, Environment Canada; Ross Bartley, Bureau of International Recycling; Andy Howarth, United Kingdom Department of Environment, Food and Rural Affairs; Willie Cade, PC Rebuilders and Recyclers; Isabelle Baudin, Switzerland; Joachim Wuttke, Federal Environment Agency, Germany; John Bullock; Renee St. Denis, Patricia Whiting, Sims Recycling Solutions;; Aisha Mahmood, John Adefemi Adegbite, Federal Ministry of Environment, Nigeria; Miguel Araujo, Basel Convention Regional Centre-Central America and Mexico; and Yorg Aerts, Public Waste Agency of Flanders Belgium.

By decision BC-10/20, the guidance document, excluding section 3, was adopted, by the Conference of the Parties to the Basel Convention at its tenth meeting, held in Cartagena, Colombia, from 17 to 21 October 2011. This guidance document, excluding sections 2 and 3, was revised based on changes made to individual guidelines, which have been reviewed to reflect the practical situation. By decision BC-11/15, this revised guidance document, excluding section 3, was adopted, by the Conference of the Parties to the Basel Convention at its eleventh meeting, held in Geneva, from 28 April to 10 May 2013. By decision BC-13/12, the revised section 3 and proposed additional changes to ensure consistency of the text throughout the guidance document were adopted, on an interim basis, by the Conference of the Parties to the Basel Convention at its thirteenth meeting, held in Geneva, from 24 April to 5 May 2017. The guidance document is not legally binding.

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Finally the PACE Working Group would like to express its deep sadness at the passing of Mr. John Myslicki. John contributed immensely to the work of PACE in general and for the preparation of this guidance document in particular. We have lost a friend and a colleague who always worked towards protecting the environment. His enthusiasm was and remains an inspiration for us to continue this work.

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1. Introduction

1.1 Purpose of the guidance document

1.1.1 The objective of the present document is to provide guidance on the environmentally sound management (ESM) of used and end-of-life computing equipment. The document emphasizes reuse and recycling, with the aim of avoiding the final disposal of such used and end-of life products in final-disposal facilities such as landfills or incinerators.

1.1.2 To this end, the present document provides general guidance pertaining to the environmentally sound management of used computing equipment that may not be waste and end-of-life computing equipment that is waste and addresses such matters as ESM criteria; transboundary movement procedures; testing, refurbishment and repair; and material recovery and recycling.

1.1.3 The document complements guidelines prepared by various project groups and approved by the PACE Working Group. It summarizes the information provided in the report prepared by the ad interim project group on environmentally sound management criteria recommendations and guidelines prepared by project groups 1.1 (environmentally sound testing, refurbishment and repair of used computing equipment) and 2.1 (environmentally sound material recovery and recycling of end-of-life computing equipment).

1.1.4 Together with the report on ESM criteria recommendations, individual project guidelines and procedures for transboundary movement, the document is intended to be used to raise awareness and further the implementation of best-practices associated with various stages of the ESM of used and end-of-life computing equipment. The information provided can be used to transfer current know-how on the refurbishment and repair of used computing equipment and best practices for material recovery and recycling. The document therefore provides a foundation for a training programme (e.g., in the form of workshops) aimed at helping to implement the recommendations and actions developed by the project groups established under PACE. The material found in the document can also be used by Basel Convention regional centres in developing training materials on the topics that it covers.

1.2 Contents

1.2.1 The document reproduces relevant general provisions of the Basel Convention and provides background information on computing equipment and PACE, executive summaries and recommendations from reports, guidelines and their relevant appendices pertaining to ESM criteria recommendations, procedures for transboundary movement, testing, refurbishment and repair and material recovery and recycling.

1.2.2 Throughout the document, references to Annex I, II, III or IV refer to the annexes to the Basel Convention.

1.3 General provisions of the Basel Convention

1.3.1 The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal was adopted on 22 March 1989 and entered into force on 5 May 1992. It emphasizes, among other principles, the environmentally sound management of hazardous wastes, which is defined as "taking all practicable steps to ensure that hazardous wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes". The Convention includes a number of specific objectives, which are obligations for parties, including the following:

(a) Reduction of transboundary movements of hazardous and other wastes subject to the Convention;

(b) Prevention and minimization of the generation of hazardous wastes;

(c) Active cooperation, subject to parties' national laws, regulations, and policies, in the use and transfer of cleaner technology and management systems related to the environmentally sound management of hazardous wastes and other wastes.

1.3.2 These objectives are supported by a regulatory system for the monitoring and control of hazardous wastes set forth in the Convention. Some key elements of the regulatory system are: prior notification and informed consent; prohibition of exports to countries that are not parties to the Convention; provisions governing the duty to reimport; and provisions governing the responsibilities of parties involved in transboundary movements. One obligation of the State of export is to provide advance notification to and obtain consent from importing and transit countries before any shipment of hazardous waste is initiated. It

should be recognized that all countries have the sovereign right to ban the entry or disposal of foreign hazardous wastes and any other wastes on their territory.

1.3.3 Countries of export and import are required to assure themselves that wastes destined for disposal (which includes recycling and final disposal) will be managed in an environmentally sound manner. No transboundary movement should be allowed to proceed if the exporting and importing countries believe that the wastes in question will not be managed in an environmentally sound manner. Lastly, each shipment of hazardous waste or other waste must be accompanied by a movement document from the point at which a transboundary movement begins to the point of disposal. Once consents have been obtained, wastes to be transported must be appropriately packaged and labelled, as required by international transport rules such as the United Nations Recommendations on the Transport of Dangerous Goods: Model Regulations.[i]

1.3.4 Article 11 of the Convention pertains to bilateral, multilateral and regional agreements or arrangements regarding the transboundary movement of wastes. Under Articles 4(5) and 11, parties to the Convention may not trade in hazardous wastes destined for disposal with non-parties unless there is an agreement or arrangement of the kind contemplated by Article 11. Under paragraph 1 of Article 11, Parties may enter into such agreements or arrangements with non-parties so long as those agreements or arrangements "do not derogate from the environmentally sound management of hazardous wastes as required by [the] Convention", and "stipulate provisions which are not less environmentally sound than those provided for by [the] Convention, in particular taking into account the interests of developing countries. Under paragraph 2 of the same article, the provisions of the Convention shall not affect transboundary movements which take place pursuant to such agreements provided that such agreements are compatible with the environmentally sound management of hazardous wastes and other wastes as required by the Convention.

1.3.5 Article 11 agreements or arrangements should therefore include: consistent scope of coverage; prior notification and consent; prohibition of shipments without consent; efforts to reduce transboundary movements; use of authorized facilities that operate in an environmentally sound manner; prohibition of exports to countries that have prohibited such imports; shipments only by authorized persons; alternate measures for stranded shipments; and the use of tracking documents (in accordance with the annex to decision II/10). A list of recognized Article 11 agreements and arrangements can be found on the Convention website at: http://www.basel.int/article11/multi.html.

1.4 Why computer equipment was selected for the second partnership under the Convention

1.4.1 Computing equipment was selected for the second partnership under the Convention because:

(a) People in all countries can relate to this high-visibility product;

(b) The technology has global application;

(c) Recovery of computing equipment is a highly topical issue;

(d) Mismanagement of used and end-of-life computing equipment may pose risks to public health, worker safety and the environment;

(e) There are a limited number of computing equipment manufacturers, as compared to all electrical and electronic products, facilitating consensus-based project management.

1.4.2 Over the past three decades, people worldwide have rapidly gained access to computer technology, representing important progress towards the achievement of the Millennium Development Goal[ii] of making available the benefits of new technologies, especially those related to information and communications. As markets continue to expand and more communities gain access to information technology, many countries, especially developing countries and countries with economies in transition, enjoy the benefits of these new technologies but also face new challenges in managing used and end-of-life computing equipment and other electronic products.

1.4.3 All stakeholders have a role in promoting the environmentally sound management of used and end-of-life computing equipment. The technology and skills needed to ensure the proper management of such equipment are available, including in respect of proper refurbishment and repair, which can provide employment and extend the use of valuable equipment, making it available to the people of less-developed countries. Furthermore, those products that cannot be reused can be directed to environmentally sound material recovery and recycling, either domestically or in other countries that can reclaim base and precious metals, adequately treat problematic substances and conserve resources and energy.

1.4.4 From the figure below it can be seen that personal computer (PC) sales have increased significantly in all regions from 2000 to 2010, a trend that is expected to continue at least until 2014. Total units sold globally (calculated by adding up sales from all regions for the years in question) increased from some 170 million in 2000 to around 370 million in 2010. It is projected that total sales globally in 2014 will reach an estimated 470 million units. Sales have more than doubled in the past 10 years, with the largest growth seen in Asia.

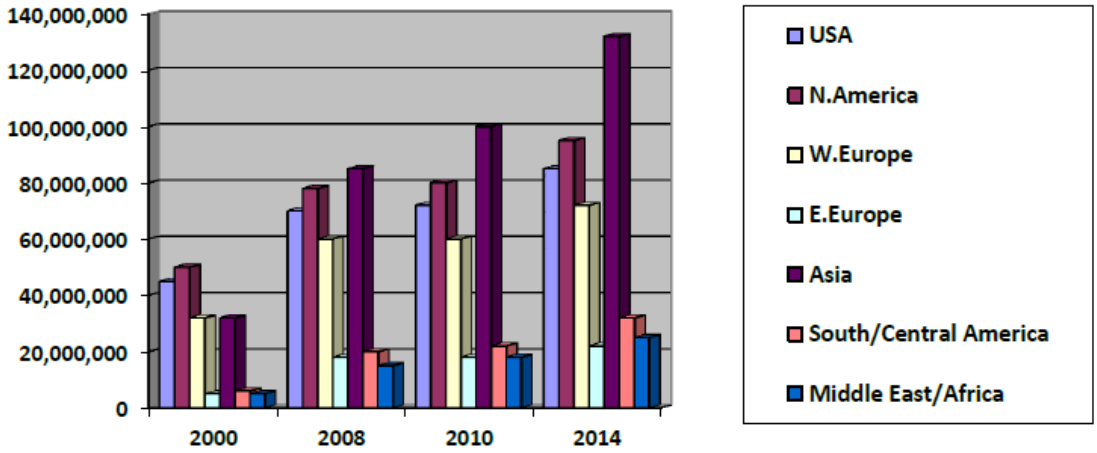


Figure: PC sales and projections by region [iii]

1.4.5 With this growth, it should be remembered that all PCs will eventually be replaced, sooner rather than later in many industrialized countries. PCs are often replaced before they become obsolete or cease working. The United Nations Environment Programme (UNEP) has found that PCs generally have a first-use span of less than four years before they are replaced by new ones because their owners want newer models with more or newer features. As a result of growth in PC sales, second-hand products are available for refurbishment and reuse, or recycling upon becoming electronic and electrical waste (e-waste) at the end of their lives. According to UNEP,[iv] some 20–50 million tons of e-waste are generated worldwide every year, comprising more than 5 per cent of all municipal solid waste. When the millions of computers purchased around the world every year become obsolete, those that are not managed in an environmentally sound manner leave behind lead, cadmium, mercury and other hazardous substances, which have an impact on the environment.

1.4.6 In addition, according to the United States Environmental Protection Agency,[iv] while it is not a large part of the waste stream, e-waste is growing faster than any other category of municipal waste. Overall, between 2005 and 2006, the total volume of municipal waste increased by only 1.2 per cent, compared to 8.6 per cent for e-waste. This shows that personal computers should not be neglected at the end of their lives. They can be refurbished, repaired and reused, or sent to environmentally sound material recovery and recycling facilities where various materials can be recovered and recycled to manufacture new products.

1.4.7 It should also be recognized that fast-growing markets for used and refurbished computing equipment exist in many developing countries, where such equipment is frequently shipped to meet this rising demand. At the same time, in many developing countries and countries with economies in transition there exists an informal sector for the collection, repair, refurbishment and re-use of used and end-of-life computing equipment and the recovery of materials such as copper and gold from e-waste. Material recovery operations in this informal sector are unfortunately not always safe and/or environmentally sound, with the result that highly risky operations expose people to hazardous substances. Furthermore, studies have shown that workers in the informal sector often lack the necessary education and training properly to manage the collection, refurbishment, repair and recovery of materials in an environmentally sound manner. Lastly, most developing countries lack the basic infrastructure and industrial capacity to recycle end-of-life computing equipment in an environmentally sound manner and must therefore rely on facilities outside their borders.

1.5 Partnership for Action on Computing Equipment

1.5.1 The Partnership for Action on Computing Equipment (PACE) was launched by the Conference of the Parties to the Basel Convention at its ninth meeting, in Bali, Indonesia, in June 2008. PACE is a

multi-stakeholder public-private partnership under the umbrella of the Basel Convention that provides a forum for representatives of PC manufacturers, recyclers, international organizations, associations, academic institutions, environmental groups and Governments to tackle the environmentally sound refurbishment, repair, material recovery, recycling and disposal of used and end-of-life computing equipment. PACE is intended to increase the environmentally sound management of used and end-of-life computing equipment, taking into account, among other things, social responsibility, the concept of sustainable development and information-sharing on life-cycle thinking.

1.5.2 For the purpose of PACE, computing equipment is defined as: PCs and associated displays, printers and peripherals; personal desktop computers, including their central processing units (CPUs) and all other parts contained in them; personal notebooks and laptop computers, including docking stations, CPUs and all other parts contained in the computers; computer monitors, including cathode ray tube, liquid crystal display and plasma monitors; computer keyboards, mice and cables; computer printers, including dot matrix, inkjet, laser and thermal printers and any computer printer with scanning or facsimile capabilities, or both.

1.5.3 Some examples of computing equipment follow:

(a) CPU and personal desktop computer;

(b) Monitor or display;

(c) Keyboard and mouse;

(d) Printer and scanner.

1.5.4 PACE aims to provide new and innovative approaches to emerging issues. It is also designed:

(a) To promote sustainable development in developing countries and countries with economies in transition through the continued use, refurbishment and repair of used computing equipment;

(b) To find incentives and methods for diverting end-of-life computing equipment from land disposal and burning to environmentally sound commercial material recovery or recycling operations;

(c) To develop guidelines for proper refurbishing, repair and material recovery or recycling, including criteria for testing, labelling of refurbished used equipment and certification of environmentally sound repair, refurbishing and recycling facilities;

(d) To end shipments of used and end-of-life computing equipment to countries, in particular developing countries and countries with economies in transition, whose laws prohibit the import of such equipment.

1.5.5 PACE activities include launching pilot demonstration projects to assist developing countries and countries with economies in transition in assessing and improving the management of used and end-of-life computing equipment, raising awareness of PACE and initiating training activities to achieve PACE and Basel Convention objectives.

1.5.6 The PACE Working Group, established by the Conference of the Parties in its decision IX/9, is the operating mechanism for PACE and serves as a forum for sharing information. Members of the Working Group include parties and signatories to the Basel Convention; intergovernmental and non-governmental organizations; Basel Convention regional and coordinating centres for capacity-building and technology transfer; and other stakeholders including: manufacturers, recyclers, refurbishers, industrial associations and academic institutions that have specific expertise and experience required for the activities of this group.

1.5.7 Following its establishment, the PACE Working Group discussed its tasks, developed its terms of reference and decided to set up five project groups and two subgroups to carry out its work programme, with the following objectives:

Ad interim project group on ESM criteria

The objectives of the ad interim project group were:

(a) To identify relevant existing international, country-specific, industry and other ESM guidance material that could be used to support other project groups established under the PACE Working Group;

(b) To propose recommendations[v] for ESM core criteria for use by PACE project groups in developing guidelines or launching pilot projects. Subsets of criteria for specific operations might also be developed by this project group where required.

Project group 1.1 on environmentally sound refurbishment and repair of used computing equipment

The objective of the project group was to develop tools (such as guidelines) and activities on environmentally sound refurbishment and repair, including criteria for testing, certification and labelling. The project group was to cooperate and coordinate with other PACE project groups working on ESM principles, recycling standards and pilot projects.

Project group 2.1 on environmentally sound material recovery and recycling of end-of-life computing equipment

The objective of the project group was identified as to recognize risks and benefits of collecting, reviewing and disseminating – through a guideline – information on practices for environmentally sound material recovery and recycling of computing equipment. The project group was to cooperate and coordinate with other PACE project groups working on ESM principles, refurbishment standards and pilot projects.

Project group 3.1 on collection and management of end-of-life computing equipment from informal sectors

The objective of the project group was to develop and promote pilot schemes for the environmentally sound management of used and end-of-life computing equipment aimed at the attainment of the Millennium Development Goals; to increase the amount of funds for pilot projects on the collection and management of used and end-of-life computing equipment; and to ensure the long-term financial sustainability of such projects.

Project group 4.1 on awareness-raising and training

The objective of the project group was to develop a list of awareness-raising and training products and to implement them to improve the promotion of PACE and reports and guidelines that have been developed under PACE.

Subgroup on transboundary movement of used and end-of-life computing equipment

The objective of the subgroup was to review rules that might apply to the transboundary movement of used and end-of-life computing equipment, taking into consideration the Guideline on the Transboundary Movement of Collected Mobile Phones developed under the Mobile Phone Partnership Initiative. Participants in this subgroup also recognized the need for continual coordination with the work mandated by the Conference of the Parties in decision IX/6 and BC-10/5 on the development of technical guidelines on transboundary movements of e-waste, in particular regarding the distinction between waste and non-waste.

Subgroup 3.1.1 on resource mobilization and financial sustainability

The objective of the subgroup was to increase the funds available for pilot projects on the collection and management of used and end-of-life computing equipment and to ensure the long-term financial sustainability of such projects.

2. ESM criteria recommendations[vi]

2.1 Summary

2.1.1 This section identifies recommendations for ESM criteria that were developed by the ad interim project group on ESM criteria. The group's report is available on the Convention website (http://www.basel.int/industry/compartnership/documents.html).

2.1.2 The purpose of the group's report is to identify recommendations for ESM criteria for use by other PACE project groups in devising guidelines for use by countries in implementing the principle of environmentally sound management for computing equipment and in PACE pilot projects in developing countries and countries with economies in transition. The report may also be used by national Governments and facilities as an information resource for general guidance on ESM. For the purpose of PACE and as defined in the glossary of terms set out in appendix I to the present document, ESM is "taking all practicable steps to ensure that used and/or end-of-life products and wastes are managed in a manner which will protect human health and the environment".

2.1.3 ESM criteria recommendations were modelled on existing relevant guidance of international organizations, national Governments, industry and non-governmental organizations to the fullest extent possible as a means of avoiding duplication and promoting compatibility with existing approaches. Compatibility with ESM criteria and core performance elements under the work of the Basel Convention and the Organization for Economic Cooperation and Development (OECD) was an important consideration in preparing the ESM criteria recommendations. Identifying the needs of developing countries and countries with economies in transition was another key aspect of this work. Such needs include best management practices at the facility level and, often, effective legal systems and infrastructure to protect workers, communities and the environment, which individual facilities must use and rely on to achieve ESM.

2.1.4 It is recognized that ESM capacity varies greatly by country, often dependent upon political, social and economic considerations beyond the scope of PACE. As such, the development of new recommendations for national Governments would require broad consultation with and approval of organizations outside PACE. Consequently, ESM criteria recommendations for national Governments identified herein simply recap existing approved recommendations under the Basel Convention and OECD.

2.1.5 While not diminishing the importance of broad government and societal ESM criteria, efforts focused on identifying facility-specific recommendations, which include ensuring that facilities undertake the following measures:

(a) Top management commitment to a systematic approach: Demonstrate commitment of top management to integrating a systematic approach to achieving ESM in all aspects of facility operations, which often includes an environmental health and safety management system;

(b) Risk assessment: Identify 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;

(c) Risk prevention and minimization: Eliminate where possible and in all cases strive to minimize actual and potential hazards and risks to public and worker health and safety and the environment that are associated with activities, products and services;

(d) Legal requirements: Identify, gain access to and strive to fulfil applicable legal requirements, including those in respect of legislation, statutes and regulations; decrees and directives; permits, licenses and certificates of approval or other forms of authorization; orders issued by regulatory agencies; and/or judgments of courts or administrative tribunals. Facilities should also take into consideration customary or indigenous law and treaties, conventions and protocols;

(e) Awareness, competence and training: Ensure that employees have an appropriate level of awareness, competence and training with regard to the effective management of occupational risks;

(f) Record-keeping and performance measurement: Maintain records, monitor, track and evaluate facility performance in achieving ESM.

(g) Corrective action: Take appropriate action to tackle significant actual and/or potential risks to public and worker health and safety and the environment and correct identified deficiencies in achieving ESM;

(h) Transparency and verification: Put in place provisions to support transparency and verification for each of the above building blocks, subject to appropriate protection for confidential

business information. This can help facilities to provide public assurances that operations and activities are compatible with ESM. Such provisions may include participation in third-party audits and inspections.

2.1.6 Lastly, it was recommended that PACE project groups should take into consideration all recommendations set out in the report on ESM criteria recommendations during the design and implementation of their technical guidance and pilot projects.

2.2 Recommendations

2.2.1 Country-specific recommendations

2.2.1.1 Countries should review measures in place to implement their obligations under the Basel Convention and to support the implementation of applicable recommendations in the guidance document on the preparation of technical guidelines for the environmentally sound management of wastes subject to the Basel Convention.[vii]

2.2.1.2 OECD member countries should review measures in place to support the implementation of applicable recommendations in OECD Council Recommendation C(2004)100 on the environmentally sound management of waste (see annex B)[viii] and OECD technical guidance on the environmentally sound management of specific waste streams: used and scrap personal computers (ENV/EPOC/WPWPR(2001)3/FINAL).[ix]

2.2.1.3 Should domestic environmental management systems be employed as part of a national approach to ESM, special consideration should be given to developing an environmental management system (EMS) specifically tailored to small and medium-sized enterprises (SMEs). Whatever system is selected, it is recommended that the Government or large companies have a programme in place to provide support to SMEs in terms of information and know-how sharing.

2.2.1.4 Domestic policies and programmes implemented in accordance with PACE technical guidance should facilitate the ability to meet applicable international agreements and protocols and domestic legal requirements concerning the management of wastes.

2.2.2 Facility-specific recommendations

2.2.2.1 Facilities should ensure that measures are in place to demonstrate conformity with the following ESM criteria:

(a) Top management commitment to a systematic approach: Demonstrate commitment of top management to integrate a systematic approach towards achieving ESM in all aspects of facility operations, which often includes an environmental health and safety management system;

(b) Risk assessment: Identify 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;

(c) 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;

(d) Legal requirements: Identify access and strive to fulfil applicable legal requirements, including for example legislation, statutes and regulations; decrees and directives; permits, licenses and certificates of approval, or other forms of authorization; orders issued by regulatory agencies; and/or judgments of courts or administrative tribunals. Facilities should also take into consideration customary or indigenous law and treaties, conventions and protocols;

(e) Awareness, competency and training: Ensure that employees have an appropriate level of awareness, competency and training with respect to the effective management of occupational risks;

(f) Record-keeping and performance measurement: Maintain records, monitor, track, and evaluate facility performance at achieving ESM;

(g) Corrective action: Take appropriate action to address significant actual and/or potential risks to public and worker health and safety, and the environment, and correct identified deficiencies in achieving ESM;

(h) Transparency and verification: Provisions to support transparency and verification throughout each of the above building blocks, subject to appropriate protection for confidential business information, can help facilities to provide public assurances that operations and activities are compatible with ESM. Such provisions may include for example participating in third party audits and inspections.

2.2.2.2 Facilities should review measures in place to support applicable recommendations in the Basel Convention guidance document on the preparation of technical guidelines for the environmentally sound management of wastes subject to the Basel Convention.[x]

2.2.2.3 Facilities should review measures in place to support applicable recommendations in PACE guidance documents and other applicable guidance under the Basel Convention.

2.2.2.4 Facilities located in OECD member countries should also review measures in place to support applicable recommendations in OECD Council Recommendation C(2004)100 on the environmentally sound management of waste and OECD technical guidance on the environmentally sound management of specific waste streams: used and scrap personal computers (ENV/EPOC/WPWPR(2001)3/FINAL).

2.2.3 Recommendations for consideration when planning to undertake work pertaining to the management of used and end-of-life computing equipment[xi]

2.2.3.1 All recommendations in the present document should be taken into account.

2.2.3.2 Consideration should be given to the inclusion of a waste management hierarchy in the development of technical guidance documents and pilot projects. The hierarchy is proposed as follows, in descending order of preference: prevention; minimization; reuse; recycling, energy recovery; and disposal. Ideally, all feasible opportunities for waste management will be taken at higher levels of this hierarchy. This does not preclude possible consideration of additional issues linked to the various stages of product life cycles and impacts of facility operations such as the generation and potential release of hazardous wastes and opportunities to reduce and avoid greenhouse gas emissions.

2.2.3.3 The differences between hazardous and non-hazardous wastes and between dangerous and non-dangerous processes should be taken into account.

2.2.3.4 Refurbishing or recycling activities should not be discouraged, recognizing in particular the flexibility required for each country to increase the rate of environmentally sound recovery of low-risk waste.

2.2.3.5 Facility measures and specific actions should be identified. This would include any appropriate verification measures that operators in facilities might carry out for use in demonstrating conformity to each of the ESM criteria.

2.2.3.6 Consideration should be given to the development of tiered checklists of facility measures for each of the eight ESM criteria. A tiered checklist can support the continual improvement of ESM by enabling facilities to identify readily what types of measures they should have in place to graduate from lower to higher tiers of ESM.

2.2.3.7 Realistic options and potential resources available for integrating informal sector operations into local, regional and national programmes of developing countries and countries with economies in transition, with the ultimate goal of facilitating the transition of such operations into the formal sector, should be identified.

2.2.3.8 Self-sustainable and economically viable solutions to support the long-term implementation of PACE pilot project activities designed to collect, refurbish and recycle used and end-of-life computing equipment in a manner consistent with the ESM criteria should be identified.

2.2.3.9 Incentives and relief measures for facilities to support the PACE technical guidance should be developed.

2.2.3.10 The size of an enterprise, especially in respect of small and medium-sized enterprises, the type and amount of waste, the nature of operations and domestic legislation should be taken into account when developing technical guidance and pilot projects.

2.2.3.11 Procedures for achieving any certification/registration and reporting requirements may be simplified for SMEs in comparison with large facilities. Thus, for example, environment, health and safety reports could be made publicly available every three years (rather than annually, as required for large facilities). Such incentives and/or relief measures should not, however, compromise suitable and effective protection of public and worker health and safety or the environment as part of a facility's approach to achieving environmentally sound management. Consequently, it is not appropriate to allow less complicated or fewer facility audits for small and medium-sized enterprise facilities in non-OECD countries.

2.2.3.12 It should be taken into account that small and medium-sized enterprises whose operations present little or no risk need significantly more limited emergency plans.

2.3 For more detailed information on the ESM criteria recommendations and their annexes, see the document entitled "Environmentally Sound Management (ESM) Criteria Recommendations".[xii]

3. Transboundary movement of used and waste computing equipment

3.1 Summary

3.1.1 Regarding the transboundary movement of used and waste computing equipment, it is referred to the technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment, in particular regarding the distinction between waste and non-waste under the Basel Convention (document UNEP/CHW.12/5/Add.1/Rev.1) which were adopted on an interim basis, in decision BC-12/5, at the twelfth meeting of the Conference of the Parties to the Basel Convention. In addition, this section contains guidance specific to the transboundary movement of used and waste computing equipment.

3.2 Recommendations

3.2.1 Consistent with the PACE guidelines and report on ESM criteria, each importing country should take measures to establish appropriate infrastructure to ensure that waste computing equipment is collected and recycled in environmentally sound facilities, either within or outside the country.

3.2.2 Used computing equipment is sufficiently packaged if the packaging guidelines set out in appendix III are followed..

4 Testing, refurbishment and repair of used computing equipment[xiii]

4.1 Summary

4.1.1 This section provides information on the environmentally sound testing, refurbishment and repair of used computing equipment based on the guideline on environmentally sound testing, refurbishment and repair of used computing equipment,[xiv] which can be obtained from the Convention Secretariat. The guideline promotes greater reuse of such computing equipment and the environmentally sound management of any discarded computing equipment or components. A typical refurbishment and repair process is shown in appendix VII. Extending the life of computing equipment generally results in the best environmental outcome, reducing the demand for natural resources and increasing waste prevention. Refurbishing and repairing used computing equipment using environmentally sound management may require either a broad set of skills or device-specific expertise and operational controls to make the process efficient and to minimize impacts on human health and the environment. Given the complexity of the computing equipment market, the intention is to provide general guidelines that will be useful for years to come and to offer guidance for refurbishment facilities around the globe.

4.1.2 The guideline on environmentally sound testing, refurbishment and repair of used computing equipment is divided into four parts:

(a) Part 1 introduces the background, purpose and use of the guideline. It also sets out a list of ESM criteria that are relevant to the refurbishment or repair of used computing equipment;

(b) Part 2 provides guidance applicable to refurbishment facilities. It covers measures that refurbishment and repair facilities and facility managers may put in place better to ensure the environmentally sound management of used computing equipment, and addresses each of the ESM criteria from the PACE ad interim project group on ESM criteria;

(c) Part 3 provides additional guidance applicable to refurbishment and repair facilities further to support ESM. It includes a flow chart of the refurbishment process and guidance on the sorting of refurbishable and non-refurbishable equipment. It provides guidance on data security and destruction and on disassembly. One of the most important elements is guidance on the testing of used equipment prior to reuse to ensure functionality, including in respect of batteries. Lastly, it offers guidance on labelling and documentation, packaging and storage and handling of refurbished and repaired equipment;

(d) Part 4 includes guidance on the marketing, donation (principles for donors are listed in appendix VIII) and redeployment of refurbished and repaired computing equipment and components.

4.1.3 The information should also assist individuals, companies and agencies involved in collection schemes and transportation of used and refurbished computing equipment and consumers who use refurbished computing equipment. Any organization involved in buying or selling computing equipment for reuse should also find this information useful.

4.2 Recommendations

4.2.1 Recommendations relating to facility measures to support ESM

4.2.1.1 Top management of the facility should ensure that a systematic approach is in place to create an environmentally sound operation. This policy should be fully documented and implemented through a plan of action on ESM, which should provide for continual review and improvement. Care should be taken to communicate and document the organization's policies and operational controls on ESM to all staff, subcontractors and visitors.

4.2.1.2 Management should seek to identify hazards and risks to worker health and safety and the environment that are associated with refurbishment and repair activities, products and services.

4.2.1.3 Once top management has assessed the risks, they should seek to minimize or eliminate hazards and risks to worker health and safety and the environment that are associated with refurbishment and repair activities by establishing and maintaining a working environment that is safe and adequate for the welfare of all those engaged in such activities and putting in place high-quality awareness-raising and training systems.

4.2.1.4 Refurbishment and repair facilities should perform evaluations at regular intervals to identify all applicable laws, regulations and authorizations and should determine how they apply to the facility, so as to ensure compliance with all applicable requirements. Refurbishment and repair facilities should seek the best available guidance and training to understand and apply the laws.

4.2.1.5 Records of the inspections, testing and assessment of facility performance in respect of the environmentally sound refurbishment and repair of used computing equipment should be maintained and should be readily accessible to customers, auditors and regulators in compliance with applicable laws and in conformity with ESM.

4.2.1.6 Refurbishment and repair facilities dealing with products that are potentially hazardous to the health and safety of their workers and the environment should have documented procedures in place to ensure scheduled inspection and monitoring of hazards. In addition, there may be regulatory requirements that must be satisfied.

4.2.1.7 A certification of facility conformance with an accredited comprehensive environmental management system and electronics recycling standard is desirable, and will assist Governments and other interested persons in evaluating refurbishment and repair operations and facilities. If possible, this certification should be made by an independent certification body that is accredited to audit to the applicable standards (see appendix XI for additional information on certification schemes).

4.2.2 Recommendations relating to the refurbishment/repair process

4.2.2.1 Facility managers should establish a policy specifying what used computing equipment is accepted into their facility for refurbishment or repair based on their technical capacity.

4.2.2.2 Facilities that refurbish or repair used computing equipment should take steps to identify and sort used computing equipment that is to be refurbished or repaired from that which should undergo recycling and materials recovery.

4.2.2.3 Refurbishers should sell, transfer or transport only computing equipment that is evaluated to be refurbishable or that is appropriately tested to assess its functionality (appendix IV).

4.2.2.4 Refurbishment and repair facilities should store and handle used computing equipment before refurbishment in a manner that protects the computing equipment and reduces the potential for hazardous releases to the environment and injuries to workers.

4.2.2.5 Refurbishers should prevent the release of data stored on used computing equipment that they receive and process, and should seek to destroy such data through electronic means.

4.2.2.6 Refurbishment and repair facilities should ensure that proper labelling or documentation of refurbished or repaired equipment is undertaken. The labelling or documentation should cover, where appropriate and possible, the type of equipment, the model and serial numbers, the year manufactured, the refurbishment or repair date, possible evaluation and testing that was performed, and an overall confirmation that the refurbished or repaired equipment is fit for reuse.

4.2.2.7 Refurbishment facilities should use the Convention guidelines to ensure that downstream materials-recovery and recycling facilities operate in a manner protective of the environment and worker health and safety and compliant with the requirements of the Convention. Such recycling facilities should take into consideration chapter 5 of this guidance document, the PACE guideline on material recovery and recycling of end-of-life computing equipment and the International Labour Organization Guidelines on Occupational Safety and Health Management Systems.[xv]

4.2.2.8 Refurbishment facilities should ensure that all computing equipment, components (e.g., batteries, cathode ray tube devices, mercury-containing devices and circuit boards) and residuals destined for materials recovery, recycling and disposal are prepared for subsequent shipment and transported in full compliance with all applicable laws, including those pertaining to national implementation of the Convention (see chapter 3 of this guidance document) and other multilateral waste trade agreements.

4.2.3 Recommendations relating to the marketing and redeployment of refurbished or repaired computing equipment

4.2.3.1 Any organization that markets used computing equipment should ensure that such equipment continues to meet all applicable industry and government standards and requirements, including the original product's rated operational characteristics.

4.2.3.2 Documentation for used and refurbished or repaired equipment should certify the testing performed on the equipment to verify that it is in working condition and is fit for its intended end use (appendix VI).

5 Material recovery and recycling of end-of-life computing equipment[xvi]

5.1 Summary

5.1.1 This section provides information on the environmentally sound material recovery and recycling of end-of-life computing equipment based on the guideline on the subject,[xvii] which is available from the Convention Secretariat. The guideline provides guidance on best practices for environmentally sound material recovery and recycling of end-of-life computing equipment and pertains to the recycling of all components of computing equipment, which include personal computers and peripherals; central processing units (CPUs), both desktop and laptop; monitors: cathode ray tube and liquid crystal display flat screen technology; keyboards and mice; and printers and scanners. It also discusses the adequacy of current material recovery and recycling infrastructures and their capacity to handle the increasing volume of obsolete computing equipment being directed to material recovery and recycling facilities rather than to landfills, incinerators or other forms of final disposal.

5.1.2 The guideline on environmentally sound material recovery and recycling of end-of-life computing equipment is divided into 11 parts:

(a) Parts 1–4 provide an executive summary and introduction, identifies the type of material covered, and identifies a number of common materials found in computing equipment;

(b) Part 5 provides guidance on initial recycling facility practices, supported by a series of flow charts;

(c) Part 6 explains how materials should be safely stored and how they should be transported when shipped for further processing;

(d) Parts 7 and 8 discuss material recovery processes, plus management and disposal of different types of residues derived from recovery operations;

(e) Part 9 identifies legal requirements for material recovery and recycling facilities and steps to be taken to comply with applicable health, safety and environmental laws and regulations;

(f) Part 10 highlights commercial considerations pertaining to the establishment of economically and environmentally sound material recovery operations;

(g) Part 11 provides recommendations to national authorities regarding programmes and policies that may be implemented to ensure environmentally sound and economically efficient material recovery and recycling of end-of-life computing equipment.

5.1.3 In theory, every part of end-of-life computing equipment can find continued beneficial use through environmentally sound management (appendix IX), from direct reuse as a complete computer to a part of a slag-construction aggregate. In practice, however, there are economic limits to material recovery, and some process residues from all six material recovery steps will require final disposal, with careful attention to protection of the environment.

5.1.4 Computing equipment contains more than 60 types of constituent metals and other materials: primary constituents such as steel occur in large amounts; minor constituents such as silver occur in small amounts; and micro or trace constituents such as gold occur in very minute amounts. Of course, the exact materials differ for each manufacturer and piece of equipment, and change as technologies evolves. Facilities that recover material from end-of-life computing equipment must be prepared for new and old equipment, with new and old technology.

5.1.5 Some of these materials, such as steel, present little or no special hazard or concern. Others may present hazards when they are broken, crushed, shredded or melted, unless environmentally sound management practices are employed. In addition, other substances may be used or produced in recycling, and there are three main groups: of substances that may be released during material recovery and should be of concern: original constituents of computing equipment, such as lead and mercury; substances that may be added in some recovery processes, such as cyanide; and substances that may be formed by recycling processes, such as dioxins and measures should be taken to prevent the release of these substances.

5.1.6 To protect their workers and communities, material recovery facilities should take steps guided by environmentally sound management criteria. These criteria work together to guide and assist material recovery facilities in achieving environmentally sound management of computing equipment and recovery of materials. Facilities will need to obtain more detailed technical information than the guideline can provide to determine accurately the most appropriate and effective technology and practices, but

should find that the guideline provides an overview of many material recovery steps and how they work together.

5.1.7 When applying these environmentally sound management criteria, material recovery facilities should first collect end-of-life computing equipment, but only the kind that they are prepared, qualified and licensed to accept and process. Next, they should carefully remove and separate the most problematic constituents – those that contain hazardous substances that may contaminate other materials – such as mercury, batteries and CRTs, which usually need additional processing and/or environmentally sound final disposal. Material recovery from the remaining computing equipment then generally consists of a long series of steps and processes, some lasting a number of months, with each step adding value. All these processes may also result in the release of hazardous substances, and careful worker training and protection, in addition to community protection, are necessary parts of sound facility management. The general intent at each step is that complex materials should be sorted and separated according to specifications and quality demands of ESM downstream processors to optimize value and material recovery, including quality specifications determined between ESM facility buyers and sellers. At each step, a more concentrated output material becomes a more valuable input for another process, until a material is ready for the market as a new material. What is more, material recovery from computing equipment not only minimizes waste disposal but can also be much more environmentally sound than mining the same raw materials.

5.1.8 Material recovery facilities sometimes use manual labour in recovery processes and sometimes use mechanized and advanced sorting processes. Many facilities use both, depending on which is most efficient for a particular step. In developing countries and countries with economies in transition, where costs of manual labour are relatively low, the manual disassembly path is more often taken and generates employment opportunities. Even in developed countries, experience shows that manual disassembly and sorting with proper precautions is likely to be a beneficial complementary step to mechanical processing to maximize material recovery rates. Certain technological skills and, most importantly, knowledge of parts that may contain harmful substances (e.g., mercury-containing switches, PCB-containing and other capacitors and plastics containing brominated flame retardants) are essential in manual disassembly and the associated treatment and disposal. Worker training and education on the risks should be part of the initial induction that all employees receive before working on the disassembly of materials with on-going continual assessment and professional development. It can produce clean sorted materials and working components, such as electronic chips and wires or cables to be sent to other mechanized facilities for additional recovery of materials. These steps are not, however, without risk of exposure to hazardous substances, making health, safety and the environment important considerations.

5.1.9 Mechanized material recovery processes, using shredders, grinders and separation technology, are more likely to be high-speed and high-volume operations, with several shredding steps followed by modern, sophisticated identification and separation of plastics and metals by optical and X-ray technology, electromagnets (for ferrous metals) and eddy current (for copper and aluminium).

5.1.10 When concentrated streams of metals are produced they are usually further refined in metal-specific pyrometallurgical and/or hydrometallurgical processes. Scrap steel can be used in electric arc furnaces to produce new steel. Scrap aluminium can be used in secondary aluminium furnaces to produce new aluminium. Scrap copper, scrap precious metals and some other special non-ferrous metals are commonly recovered from computer circuit boards and other components or fractions through pyrometallurgical processing and/or by metal-specific hydrometallurgical refining. Informal recovery operations on circuit boards and other precious metal-bearing materials, such as acid leaching, are inefficient and expose workers, communities and the environment to cyanides, strong acids, hazardous gases and other dangers.

5.1.11 Some functional CRTs may be reused without change or may be used to produce televisions or other electronic displays. If they cannot be reused, clean and sorted CRT glass may be used in CRT manufacturing facilities to produce new CRT glass. New and different display technologies, however, have caused demand for recovered CRT glass to decline, and will continue to do so in the future. At the same time, the traditional material recovery options for used CRT glass, particularly in lead smelters, are gradually disappearing. The alternative use of CRT glass fractions (mixed glass, separated panel or funnel glass) or safe disposal in compliance with applicable environmental law is required. New manufacturing applications for used CRT glass are emerging. In these applications, the lead-containing funnel glass should be separated from the panel glass that may contain lead, to guarantee the safe use of the fractions in the recycling processes. The addition of front glass cullet in glass wool insulation and building material production are examples of such new recycling options. The use of front glass cullet as abrasives and reflective material are other recovery options that, however, do not lead to recycling. There are also other uses under development, but options for lead-containing funnel glass are very limited. Phosphor coatings should be removed in all cases and handled in an environmentally sound manner. Nevertheless, new applications should be scrutinized to ensure that leaded CRT glass is not used in applications where

hazardous materials, could leach into the environment or harm human health or the environment. If lead-containing funnel glass cannot be recycled or recovered, it should be otherwise disposed of in an environmentally sound manner.

5.1.12 Screens with liquid crystal displays (LCD) may contain mercury lamps as backlights, which should be carefully and manually removed before processing or managed in closed, highly mechanized systems (emerging technologies). The mercury lamps should be properly packaged and sent to specialized mercury recovery facilities. Atmospheric and environmental levels of mercury in work areas should be regularly monitored.

5.1.13 Plastics may be recycled if they are separated by type and are mostly free of metals and other contaminants; they should also be free of certain hazardous brominated flame retardants, unless they can be removed or can legally continue to be used as flame retardants. Plastics can be used in smelting operations as fuel and as reducing agents, if smelter emissions are well controlled, especially for dioxins and furans.

5.1.14 Batteries derived from computing equipment, which are now almost always based on lithium and nickel metal hydride chemistry, should be evaluated for continued use as batteries, if they meet criteria in the PACE guideline on environmentally sound testing. refurbishment and repair of used computing equipment for battery testing and minimum performance. If a battery is no longer useable, it should be processed only in specialized facilities that are authorized to safely manage hazardous characteristics such as corrosivity and toxicity. Electrical contacts on individual batteries should be physically covered or separated to prevent the risk of fire from unintentional electrical discharge or explosion during transportation and handling. The primary metals of interest are cobalt, nickel and copper, and lithium may also become a valuable target for recovery.

5.1.15 Residues from processing and pollution control systems that cannot be recovered efficiently are likely to contain metals and other substances of concern, which should be carefully managed, often as hazardous waste. These include baghouse filters and dust, sweepings, glass fines, phosphors, plastics and slags. Because these waste residues are likely to contain metals, plastics and halogens, disposal in an incinerator that has no efficient pollution control systems is unsuitable. Similarly, because process residues may leach hazardous constituents, disposal in an uncontrolled landfill is also unsuitable.

5.1.16 Many residues generated in the material recovery chain are intended for further recovery processes or for final disposal and will be classified as hazardous waste. It is therefore important that material recovery, energy recovery and disposal facilities used to process hazardous waste be properly authorized and licensed and comply with all applicable local, national, regional, multilateral and international laws. Such laws may include laws to implement the Basel Convention if transboundary movement is involved, as is often the case with end-of-life computing equipment.

5.2 Recommendations

5.2.1 Goals and objectives

5.2.1.1 Material recovery, energy recovery and disposal facilities should be properly authorized and licensed and should comply with all applicable laws – local, national, regional, multilateral and international. Such laws will include national laws implementing the Basel Convention whenever transboundary movement is undertaken, as is often the case with end-of-life computing equipment and residuals.

5.2.1.2 Parties and signatories to the Convention are encouraged to implement policies and/or programmes that promote environmentally and economically sound material recovery and recycling of end-of-life computing equipment.

5.2.1.3 Consistent with the Basel Declaration on Environmentally Sound Management, used computing equipment should be diverted from disposal practices, such as landfilling and incineration, by robust collection programmes, to the more environmentally sound practices of reuse, refurbishment, material recovery and recycling.

5.2.1.4 It is important that end-of-life computing equipment be collected effectively (which is usually not the case today, even in industrialized countries). Funding for collection should be provided where necessary.

5.2.1.5 Environmentally sound material recovery and recycling of end-of-life computing equipment requires setting up an effective recycling chain, comprising the steps of robust collection of used computing equipment, evaluation, testing/refurbishment/reuse if appropriate, preparation/dismantling of non-reusable computing equipment or parts, separation into material streams, final recovery of marketable raw materials and disposal of non-recyclable fractions and processing residues. Some hazardous fractions should be sent to facilities for destruction of the hazardous substances to ensure that they are taken out of use. All those involved in each step should understand and communicate with

persons involved in the entire chain. ESM recycling facilities should ensure that hazardous fractions and materials derived from processing computing equipment are sent to ESM facilities that are licensed and permitted to manage these materials**.**

5.2.1.6 A number of components and materials of concern, such as batteries and mercury lamps, may release hazardous substances when being processed for material recovery; such materials and components should be identified and carefully removed to avoid their entry into more intensive processing such as shredding.

5.2.1.7 Environmentally sound material recovery and recycling of computing equipment is not simple, and can cause exposure to hazardous substances if not handled correctly. It should be well understood, managed and performed consistent with the practices set out in this document to protect workers, communities and the environment. All steps should be taken to ensure that unsound computing equipment material recovery and recycling practices are avoided, such as those where proper worker and environmental protections are not implemented (e.g., informal backyard operations) and those where there is no attempt to maximize material recovery.

5.2.1.8 Priority should be accorded to material recovery processes that adhere to and increase the benefits of the waste management hierarchy: waste prevention, waste minimization, reuse, recycling, energy recovery and disposal. Such processes result in high-efficiency recovery from computing equipment; minimize loss and final disposal of valuable materials; and reduce the use of energy, generation of greenhouse gases and other negative environmental and health impacts.

5.2.2 Development of recycling infrastructure

5.2.2.1 The Basel Convention general obligations related to national self-sufficiency, proximity, least transboundary movement, and ESM, in addition to the need for economic efficiency, should be taken into account when choosing computing equipment material recovery and recycling facilities or operations and when developing domestic policies for environmentally sound material recovery and recycling. However, there are currently many countries that do not possess material recovery facilities that meet the criteria for environmentally sound management. In these cases, it may be preferable to export some components that may be hazardous or require specialized processes to achieve high material recovery rates. These materials (e.g. CRT glass, mercury lamps and switches, LCD screens, batteries, plastics containing brominated flame retardants or circuit boards) should be exported for treatment in an ESM facility, in compliance with the Basel Convention,.

5.2.2.2 Because conformance with this guideline may mean an increase in recycling costs, parties, industry, including producers, importers and other stakeholders should collaborate to ensure that there is adequate financing for computing equipment material recovery and recycling. As certification and auditing can be very expensive, the procedures needed for recovery and recycling facilities to achieve certification need to be affordable and achievable for facilities worldwide. The support of multilateral and regional development banks and bilateral donors would be highly valuable in setting up significant and attractive investment programmes in developing countries aimed at the development of recycling infrastructure compliant with ESM.

5.2.2.3 Parties should be prepared to grant timely consents and other approvals for legal exports or imports of waste computing equipment to environmentally sound managed facilities.

5.2.3 Facility-level guidelines

5.2.3.1 Top management should systematically plan and execute environmentally sound material recovery and recycling operations and facilities. Without the continuing commitment of top management, it is unlikely that a facility will consistently and increasingly perform in ways that minimize its impacts on human health and the environment. Facilities are encouraged to develop and use certified comprehensive systems of environmental, health and safety management to plan and monitor their environmental, health and safety practices. Such systems should include specific elements for environmentally sound material recovery and recycling in respect of used and end-of-life computing equipment (appendix X).

5.2.3.2 Certification of facility conformance with an accredited comprehensive management system is desirable and will assist Governments, material recovery facilities and other interested persons in evaluating and approving environmentally sound material recovery operations and facilities. If possible, such certification should be made by an independent and qualified auditor and an accredited certification body.

5.2.3.3 Facilities should develop procedures for identifying and complying with applicable legal requirements. Such requirements might be found in many places, such as national and local statutes and regulations, as well as in permits and licenses, and special professional expertise may be needed. Regulatory agencies, government publications and news releases, legal advisers, legal journals and commercial databases and industry associations may help to identify applicable legal requirements. Facilities should also take into consideration customary or indigenous law and international treaties, conventions and protocols.

5.2.3.4 Recycling facilities should dismantle and separate, through manual and mechanical processing, computing equipment that is not directed to reuse and should direct it to properly equipped material recovery facilities, to ensure that the loss of valuable material is minimized. Facilities should send potentially hazardous items and substances (such as batteries and items containing mercury) to processing, recovery or treatment facilities that are properly licensed to receive them and use technology designed to manage them safely and effectively. Facilities should not attempt to recover components or materials if they lack the proper capabilities.

5.2.3.5 Recycling facilities should, before beginning operations and systematically thereafter, identify hazards and assess occupational and environmental risks that exist or that could reasonably be expected to develop. This practice of hazard identification and risk assessment should be incorporated into the facility management system, and employees should have an appropriate level of awareness, competency and training with regard to the effective management of such hazards and occupational risks. Environmental, health and safety measures should then be adopted. Such measures could include the use of engineering controls (substitution, isolation, ventilation, dust control, emergency shut-off systems, fire suppression), administrative and work practice controls (regular, documented health and safety training, job rotation, safe work practices, medical surveillance, safety meetings) and personal protective equipment (respirators, protective eyewear, cut-resistant gloves). Such facilities should take into consideration the International Labour Organization Guidelines on Occupational Safety and Health Management Systems.[xviii]

5.2.3.6 Facilities that dismantle, process, smelt, refine or perform other steps in computing equipment material recovery and recycling should identify themselves to their relevant regulatory authorities. Permit issuing and inspecting authorities with jurisdiction should inspect and verify that these companies are complying with health, safety and environmentally sound management requirements.

5.2.3.7 Material recovery facilities that process electronic equipment should perform due diligence in the selection of downstream vendors to assure themselves that such downstream vendors (handlers and processors) are practising environmentally sound management. Due diligence should include verification of the existence of a documented management system encompassing hazard identification, risk assessment and corrective action, environmental permits, compliance with applicable legal requirements and other general principles included in the guideline.

5.2.3.8 Facilities should monitor, track and evaluate their performance and maintain records of their activities. Record-keeping and performance measurement enable facilities to make better-informed decisions as to whether they are achieving desired results and whether it is necessary to implement corrective actions. In some cases, record-keeping and performance measurement may be legally required.

5.2.4 Design for recycling

5.2.4.1 The material recovery and recycling phase of end-of-life computing equipment should be taken into account by manufacturers during product design by considering the issues of toxicity and recyclability.

5.2.4.2 A number of materials used in the manufacture of new computing equipment, such as: beryllium, mercury and brominated flame retardants, have been identified in this document as substances of particular concern during the processing of end-of-life computing equipment. Manufacturers can aid the recycling industry by providing more information on the hazardous substances in their products and how they can be safely dismantled, while also substituting in less hazardous substances that perform the same function. Manufacturers should also strive to use substances that reduce risks to human health and the environment throughout the product life cycle.

5.2.4.3 Computing equipment manufacturers should work together to improve the recyclability of plastics in computing equipment. Specifically, consideration should be given to greater consistency in material selection during the design stage for all computing equipment, which would allow plastics recyclers to eliminate sorting steps necessary to achieve compatibility of plastics types.

5.2.5 Future collaborative steps

5.2.5.1 Parties to the Convention are encouraged to extend the role of the Basel Convention regional centres to develop training and technology transfer regarding environmentally sound material recovery and recycling of end-of-life computing equipment, in order to assist developing countries and countries with economies in transition in implementing regulatory frameworks for the environmentally sound management of end-of-life computing equipment, including regulations on transboundary movements.

5.2.5.2 Audit checklists or similar tools should be developed to assist parties and others in performing inspections and due diligence audits based on the guideline.

Appendix I

Glossary of terms

Note: *These terms were developed for the purpose of the report on ESM criteria recommendations, individual project guidelines, and the overall guidance document developed under PACE, to assist readers to better understand these PACE documents*.

Assemblies: Multiple electronic components assembled in a device that is in itself used as a component.

Basel Convention: Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, adopted on 22 March 1989 and entered into force in 1992.

Cleaning: Removal of dirt, dust and stains and making of cosmetic repairs.

Component: Element with electrical or electronic functionality connected, together with other components and usually by soldering, to a printed circuit board to create an electric or electronic circuit with a particular function (for example an amplifier, radio receiver, or oscillator).

Computing equipment: Computing equipment includes personal computers (PCs) and associated displays; printers and peripherals; personal desktop computers, including the central processing unit and all other parts contained in such computers; personal notebooks and laptop computers, including any docking station, the central processing unit and all other parts contained in such computers; computer monitors, including cathode ray tube monitors, liquid crystal display monitors and plasma monitors; computer keyboards, mice and cables; computer printers, including dot matrix printers, inkjet printers, laser printers, thermal printers and any computer printers with scanning or facsimile capability.

Defective/Defect: Defective **computing equipment** is equipment that is delivered from the last manufacturer in the supply chain in a condition that is not as it was designed to be sold, or equipment that breaks or malfunctions due to a condition that was not intended as part of the equipment's design. Defective equipment does not include equipment that loses functional or cosmetic value as a result of normal wear and usage or consumer negligence.

Direct reuse: The using again, by a person other than its previous owner, of **computing equipment** and **components** that are not waste for the same purpose for which they were conceived without the necessity of **repair, refurbishment** or hardware **upgrading**.

Dismantling: Taking apart **computing equipment**, **components** or **assemblies** to separate materials and/or increase options for **reuse, refurbishment or recycling** and to maximize recovery value.

Disposal: Any operations specified in Annex IV to the Basel Convention (paragraph 4 of Article 2 of the Convention, and appendix II to this document).

End-of-life computing equipment: Computing equipment that is waste and no longer suitable for use and is intended for **dismantling** and recovery of spare parts or is destined for **material recovery** and **recycling** or final disposal. It includes off-specification or new **computing equipment** that has been sent for **material recovery** and **recycling** or final disposal.

Environmentally sound management (ESM): The taking of all practicable steps to ensure that wastes are managed in a manner that will protect human health and the environment against adverse effects which may result from such wastes.

Essential key function: The originally intended function(s) of a unit of equipment or **component** that will satisfactorily enable the equipment or component to be reused.

Evaluation: The initial assessment of used **computing equipment** to determine whether it is likely to be suitable for **refurbishment, repair, material recovery** or **recycling.**

Final disposal: Disposal operations specified in Annex IV A to the Basel Convention (appendix II, section A, to this document).

Fully functional/Full functionality: Computing equipment or **components** are **fully functional** when they have been tested and demonstrated to be capable of performing the **essential key functions** that they were designed to perform.

Hydrometallurgical processing: The uses of aqueous chemistry for the recovery of metals from ores, concentrates or recyclable wastes or products. Typically, hydrometallurgy consists of three steps:

i) Leaching of an intermediate product with acid, caustic, or a complex forming solvent, often combined with oxidation to dissolve the desired element(s) at ambient or elevated pressures and temperatures;

ii) Purification of the solution by:

(a) precipitation of insoluble compounds,

(b) cementation of unwanted metals (using another metal to precipitate the metal in solution); or

(c) solvent extraction;

iii) Precipitation of desired product, either as an insoluble compound or as a metal either by chemical or electrochemical methods.

Recycling reagents and treatment and disposal of effluents and residues are further important steps that occur throughout the process. Hydrometallurgical operations in authorized industrial-scale facilities are distinct from unauthorized and illegal environmentally harmful practices in the informal sector.

Incineration: A thermal treatment technology by which wastes, sludge or residues are burned or destroyed at temperatures ranging from 850° C to more than 1,100° C.

Labelling: The marking of **computing equipment, individually or in batches,** to designate its status according to the PACE guidelines.

Landfilling: The deposit of waste into land (i.e., underground), or onto land.

Material recovery: Relevant operations specified in Annex IV B to the Basel Convention (appendix II, section B, to this document).

Mechanical separation: Using machinery to separate **computing equipment** into various materials **or components**.

Potential for reuse (reusable): Computing equipment and its **components** that possess or are likely to possess the quality necessary to be directly reused or reused after they have been refurbished or repaired.

Pyrometallurgical processing: Thermal processing of metals and ores, sludges and residues including roasting, smelting and remelting with the aim of recovering metals as marketable products. Pyrometallurgical operations in authorized industrial scale facilities are distinct from unauthorized and illegal environmentally harmful practices in the informal sector.

Recycling: Relevant operations specified in Annex IV B to the Basel Convention (appendix II, section B, to this document).

Redeployment: Any action of new deployment or use by the owner of used **computing equipment** or its **components.**

Refurbishable: Computing equipment that can be refurbished, returning it to a working condition performing the essential functions it was designed for.

Refurbishment: Modification of **used computing equipment** to increase its performance and functionality or to meet applicable technical standards or regulatory requirements**,** including through such activities as **cleaning, data sanitization and software upgrading.**

Repair: Fixing specified faults in computing **equipment** and/or replacing defective components of computing equipment to bring the computing equipment into a fully functional condition**.**

Reuse: The using again, by a person other than its previous owner, of used **computing equipment** or a functional **component** from used **computing equipment** that is not waste for the same purpose for which it was conceived, possibly after **refurbishment, repair or hardware upgrading.**

Separation: The removal of specific **components** (e.g., batteries), constituents or materials from **computing equipment** by manual or mechanical means.

Small and medium-sized enterprises (SMEs): According to the European Commission, small and medium-sized enterprises are those businesses that employ fewer than 250 persons and have an annual turnover not exceeding 50 million euros or an annual balance sheet total not exceeding 43 million euros.

Testing: The testing of used **computing equipment** through an established protocol to determine whether it is suitable for **reuse**.

Transport of dangerous goods recommendations: United Nations recommendations on the transport of dangerous goods, which deal with classification, placarding, labelling, record keeping and other matters relating to the protection of public safety during the transport of such goods.

Treatment: Any physical, chemical or mechanical activity in a facility that processes computing **equipment,** including **dismantling**, removal of hazardous components, **material recovery, recycling** or preparation for **disposal**.

Upgrading: Modification of fully functional **computing equipment** by the addition of software or hardware to increase its performance and/or functionality.

Used computing equipment: Computing equipment that is or has been used, either by its first owner or otherwise. Used computing equipment may or may not be a waste, depending upon the waste definition and its characteristics, intended destination and fate.

Wastes: Substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law (paragraph 1 of Article 2 of the Basel Convention**).**

Working condition: See **fully functional.**

Appendix II

Basel Convention – Annex IV Disposal Operations

A. Operations which do not lead to the possibility of resource recovery, recycling, reclamation, direct reuse or alternative uses

Section A encompasses all such disposal operations which occur in practice.

D1	Deposit into or onto land, (e.g., landfill, etc.)
D2	Land treatment, (e.g., biodegradation of liquid or sludgy discards in soils, etc.)
D3	Deep injection, (e.g., injection of pumpable discards into wells, salt domes of naturally occurring repositories, etc.)
D4	Surface impoundment, (e.g., placement of liquid or sludge discards into pits, ponds or lagoons, etc.)
D5	Specially engineered landfill, (e.g., placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)
D6	Release into a water body except seas/oceans
D7	Release into seas/oceans including sea-bed insertion
D8	Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations in Section A
D9	Physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations in Section A, (e.g., evaporation, drying, calcination, neutralization, precipitation, etc.)
D10	Incineration on land
D11	Incineration at sea
D12	Permanent storage (e.g., emplacement of containers in a mine, etc.)
D13	Blending or mixing prior to submission to any of the operations in Section A
D14	Repackaging prior to submission to any of the operations in Section A
D15	Storage pending any of the operations in Section A

B. Operations which may lead to resource recovery, recycling reclamation, direct re-use or alternative uses

Section B encompasses all such operations with respect to materials legally defined as or considered to be hazardous wastes and which otherwise would have been destined for operations included in Section A.

R1	Use as a fuel (other than in direct incineration) or other means to generate energy
R2	Solvent reclamation/regeneration
R3	Recycling/reclamation of organic substances which are not used as solvents
R4	Recycling/reclamation of metals and metal compounds
R5	Recycling/reclamation of other inorganic materials
R6	Regeneration of acids or bases
R7	Recovery of components used for pollution abatement
R8	Recovery of components from catalysts
R9	Used oil re-refining or other reuses of previously used oil
R10	Land treatment resulting in benefit to agriculture or ecological improvement
R11	Uses of residual materials obtained from any of the operations numbered R1-R10
R12	Exchange of wastes for submission to any of the operations numbered R1-R11
R13	Accumulation of material intended for any operation in Section B

Appendix III

Packaging guidelines

1. For shipments,[xix] the following packaging guidelines should be followed to sufficiently pack used computing equipment:

- Each piece of computing equipment should be protected with cushioning material appropriate to preserve its asset value (e.g., bubble wrap, packaging foam).
    - **Laptops** and their chargers should be packed together in boxes reasonably fitted to them.
- **Batches of 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.
- Stacks of equipment should not exceed:
    - **Display devices** – four 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** – five layers stacked vertically;
    - **Printers** – five layers.
- **Batteries** should be packaged in a way that prevents contact with their terminals that could cause short circuits and fires;
- **LCD backlights** – Because they are fragile LCD backlights when removed should be individually packaged in rigid containers and sealed in foil-laminated bags to prevent breakage during transport. In general, removal and packaging of LCD backlights for reuse is a specialist activity that should be undertaken by professionals with detailed knowledge and experience in handling hazardous components.
- Each load should be properly secured to a pallet (e.g., with plastic shrink wrap).

2. Small individual items of computing equipment should be packed in boxes, properly encased with cushioning material and surrounded by sufficient fill to prevent movement. For multiple items within the same box, each part should be separated with appropriate intermediary packaging. Boxes should be suitable for the length and type of shipping being used. Where pallets are used, boxes should be secured to pallets using shrink wrap or other means.

Appendix IV
Functionality tests for used computing equipment

Computing equipment	Functionality tests	Test results
Central processing units (CPUs), including desktop PCs	**Power on self test (POST)**[1] Switching on the computer and successfully completing the boot-up process. This will confirm that the principal hardware is working, including power supply and hard drive. • A working monitor should be supplied for testing if none is present. • Ensure that cooling fans are functioning.	**Computer** should boot up successfully. **Computer** should respond to keyboard and mouse input. **Cooling fans** should operate normally.
Laptops/notebooks	**Power on self test (POST)**[2] Switching on the laptop and successfully completing the boot-up process. This will confirm that the principal hardware is working, including power supply and hard drive. • Test screen. • Test battery functionality. • Ensure that the display is fully functional. • Ensure that cooling fan(s) is(are) functional.	**Laptop** should boot up successfully. **Laptop** should respond to keyboard and mouse input. **Display** should turn on during boot up. Image should be clear and colours, contrast and brightness correct with no screen-burned images, scratches or cracks (see also below for display devices). **Laptop battery** should retain a minimum of 1 hour[3] of run time; alternatively the battery should be tested to determine that it has a full charge capacity in watt-hours of at least one hour (see appendix V, testing of laptop batteries).
Keyboards	Connect to computer and ensure that computer and keyboard successfully interface. Test keys for functionality.	Computer should respond to **keyboard** input. **Keyboard** should have no missing or non-functioning keys.
Mice	Assess mouse casing, cable and parts. Plug into desktop or laptop to assess functionality.	**Mouse** should have all parts present (e.g., the rollerball). Computer should respond to **mouse** input. Visible cursor on screen should not shudder.
Cables and power cords	Assess cable insulation and inspect plugs.	**Cabling and plugs** should be complete and free of damage, e.g., have no cracked insulation.

[1] The power on self test (POST) is automatically engaged when a PC or laptop is switched on. POST is a software-based system integral to all PCs and laptops. POST will check that the hardware systems of the computer are functioning, including the hard drive, computer ports, the motherboard and video cards. POST will deliver an audible beep or set of beeps to the refurbisher or operator should any of the hardware systems be faulty. Online guidance exists for better understanding of the beep codes (for example, see www.poweronselftest.com/ and www.computerhope.com/beep.htm).

[2] Ibid.

[3] One hour is the minimum charge that a battery should hold, although some laptop users may request more usable run-time. It should be noted that some end-users will also be able to make use of batteries with less capacity, for example a battery able to hold 40 minutes capacity, which could be adequate if the laptop is normally connected to a reliable electricity supply.

Computing equipment	Functionality tests	Test results
Display devices	Plug in display and test the picture quality for pixels, colour, contrast and brightness. Software-based diagnostic testing for display devices are readily available online,[4] and should be used. Visual inspection for screen burn (in the case of CRTs) or image persistence (in the case of flat screens) and scratches or other damage to screen or housing. Cabling should be inspected and present.	**Display devices:** the picture should not be fuzzy, have damaged pixels or be too dark. LCD backlights should all function. Colours, brightness, hue and straightness of lines should be considered. The software diagnostic test should be positive. Cabling should be free from damage.
Laser and inkjet printers	Print a test page with the printer in stand-alone mode or connected to a computer or local area network to assess connectivity. On inkjet printers, check that the ink heads are not clogged with dry ink.	**A printer** should successfully print a test page without jamming or producing smudged or incomplete copy.
Components (removed from equipment) including motherboards, other circuit boards, sound cards, graphics cards, hard drives, power supplies and cords/ cables	Components should be tested for functionality either before removal from the host computer or laptop or by insertion in a test bench computer using diagnostic software or a known working device, as applicable.	**Components** should be fully functional. **Power supplies and cords/ cables** should be complete and free of damage, e.g., have no cracked insulation.

[4] See, for example, www.softpedia.com/progDownload/Nokia-Monitor-Test-Download-464.html.

Appendix V

Testing methods for laptop batteries

Method 1: Demonstration

1. This is the most commonly used method and represents a simple test, able to be undertaken by all refurbishers. The system/battery combination is tested to ensure that it can hold an appropriate charge[5] to meet the minimum run-time charge. The laptop battery should be inserted into the laptop and then fully charged. The system[6] should be started with the screensaver disabled and allowed to run functions to demonstrate the capability of operating off the power grid. The time for the battery to drain fully is recorded.

Method 2: Self-managing the smart battery

2. This more sophisticated test requires some expertise and knowledge and applies to newer batteries. All new laptop batteries now incorporate smart battery technology that enables them to be assessed using a battery check programme provided by the manufacturer. For a laptop powered by a smart battery, the calculated method may be used to determine run-time. The power used[7] by the laptop should be determined in watts (W). The battery should be interrogated or tested to determine the full charge capacity (FCC)[8] in watt-hours (Wh). The run-time is determined by:

Run-time in hours (h) = FCC (Wh)/power used (W).

[5] "Hold an appropriate charge" means that a battery, when used in a particular system, is capable of powering the system for a time period that meets the needs of a target user. "Time period that meets the needs of a target user" is the end-user expected operational time for the mode of operation expected. One hour is the minimum charge that a battery should hold, although some laptop users may request more usable run-time. Users may also be able to make use of batteries with less capacity, for example when using a computer system predominantly connected to the grid, with the battery serving as a backup to allow the work product to be saved in the event of a power outage.

[6] A "system" is a laptop, notebook, netbook or other portable computer.

[7] The "power used" is the actual power used by the system when the system is operating.

[8] "Full Charge Capacity" is the energy storage capacity of a battery, measured in watt-hours (Wh). This value is obtained from the microcontroller, which is part of a smart battery, from design specifications, or through measurement using equipment capable of determining the full discharge capability of a battery.

Appendix VI

Declaration of testing and determination of full functionality of used computing equipment

Information to be provided on testing

Holder (responsible for testing): Name: Address: Tel.: E-mail**:**		

Declaration:

I, the legal holder of the used computing equipment listed below, hereby declare that the used computing equipment, listed below, was tested after it was removed from service, or after it was repaired/ refurbished, and is in good working condition and fully functional.[9]

Name: Date: Signature:

Type of equipment[10]	Model No.	Serial No. (if applicable)	Year of manufacture	Date of testing	Type of tests and comments

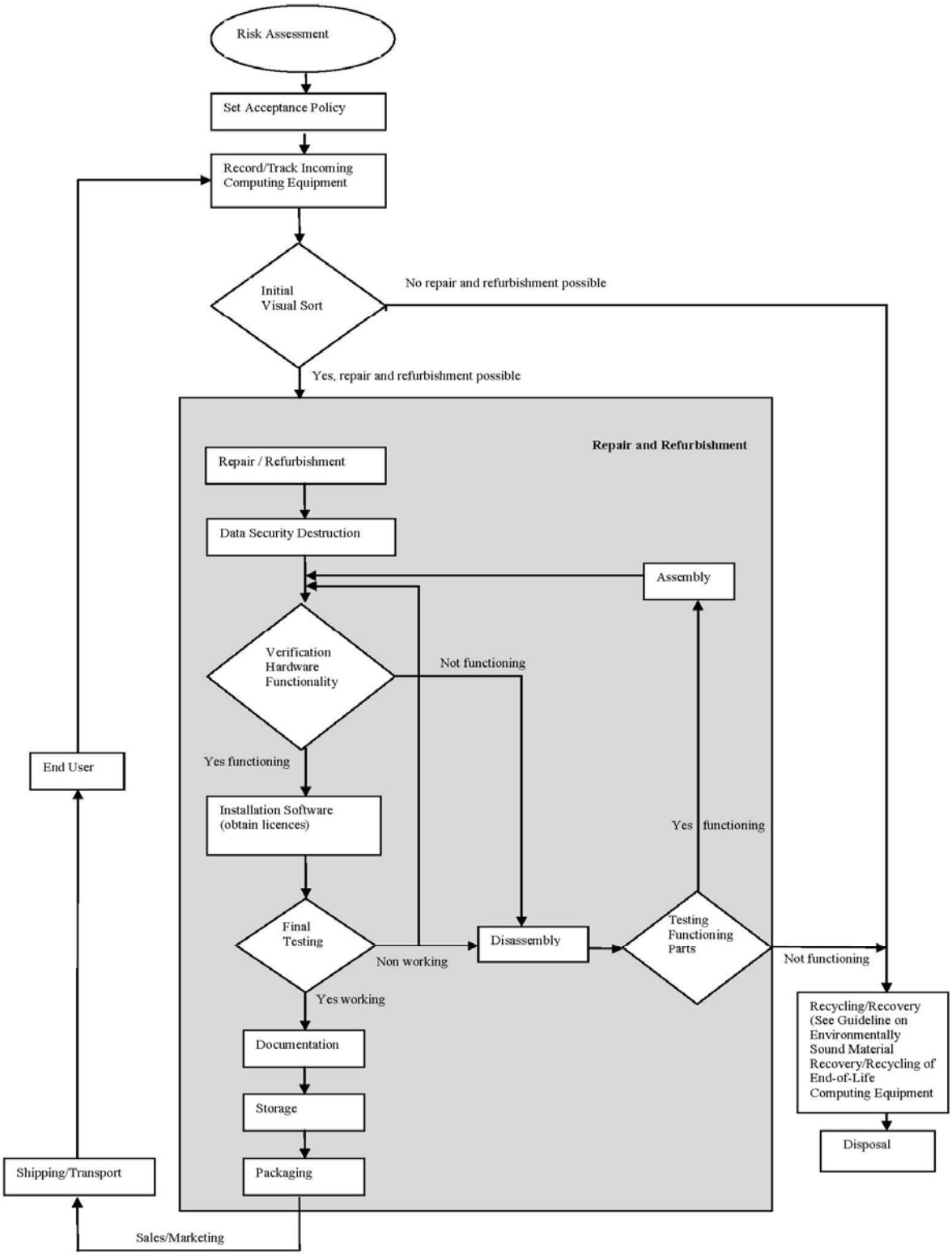
[9] **Fully functional/Full functionality: Computing equipment** or **components** are "fully functional" when they have been tested and demonstrated to be capable of performing the essential key functions that they were designed to perform.

Essential Key Function: The originally intended function(s) of a unit of equipment or component that will satisfactorily enable the equipment or component to be reused.

[10] List all equipment and identify types of whole equipment, such as PC, laptop, printer and scanner. Component parts, such as circuit boards, memory, hard drives, power supplies or batteries, can be sent in a batch without the details required in columns 2 and 3 but still will need to be tested.

Appendix VII

Flow Diagram of a Typical Environmentally Sound Refurbishment and Repair Process



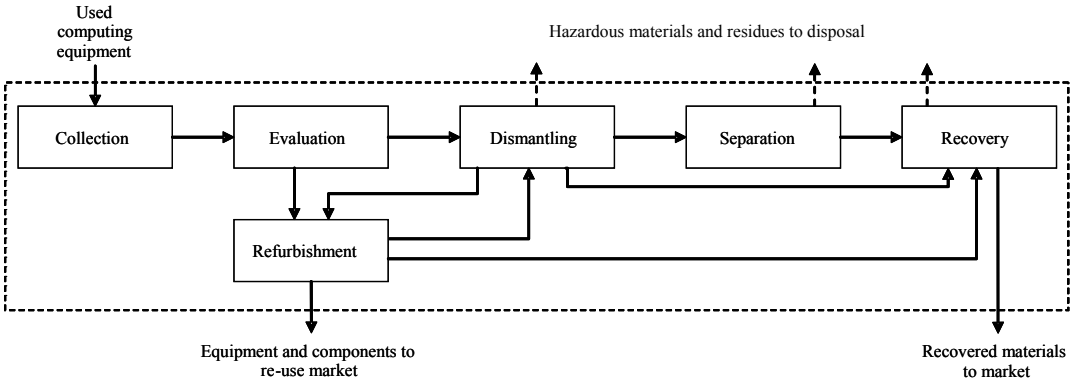
Appendix VIII

Principles for donors of functional used computing equipment

1. **Provide a useful product:** Donors will provide only equipment that is expected to have a significant lifespan and is functional under the expected conditions and needs in recipient countries and communities.
2. **Provide an appropriate product:** Donors will ensure that hardware and software is operable within the limitations and conditions of recipient countries and communities.
3. **Ensure and verify availability of technical support:** Donors will encourage the introduction of maintenance and technical support in recipient communities, either from the donor or in the recipient community.
4. **Test, certify and label functionality:** Donors should provide proof of testing for functionality.
5. **Ensure availability of training:** Donors may support recipients with training programmes.
6. **Ensure full transparency, contract and notification and consent before delivery**: Donors will ensure that recipient communities consent in writing to receiving equipment in accordance with the terms and conditions of the contract entered into between the donors and the receiving communities.
7. **Export controls:** Donors should export in accordance with applicable national and international controls (see also chapter 3 of the PACE guidance document).

Appendix IX

Flow Diagram of Environmentally Sound Management of Used Computing Equipment



Step one: **Collection:** This critical step can be challenging, but is critical. Computer equipment that is discarded in household trash may never reach the next steps, may be lost for further beneficial use or may be mismanaged. In some countries, informal scavengers may look at everything before it is finally discarded and used and end-of-life computer equipment often has enough value to be collected by them. These scavengers, and informal and second-hand markets, are important sources of electronic scrap. In other countries, greater efforts and expenditure are needed to collect computers, and it may be necessary to find ways to subsidize collection systems.[xx] Formal sector and governments should consider opportunities to engage, employ, and empower the informal sector and help transition them into formal systems, which are consistent with applicable legal and other requirements including provisions that support protection of human health, worker safety and the environment. Special collection events are often organized, or collection may take place regularly in retail stores or by mail-in collection. Charities sometimes collect computers for reuse. Collection of computers from large businesses provides an important opportunity due to both the large volumes of equipment available from one source, and the fact that a lot of this equipment is retired early and thus has significant value in the refurbishment.

Step two**: Evaluation**: Once collected, computing equipment should be evaluated to determine whether it is suitable for reuse after refurbishment or repair or for material recovery depending on its potential for reuse, facility capabilities, economics and other factors. Initial evaluation of each device can be done at the initial collection site or some other point before repair, refurbishment or dismantling. Evaluation of individual components, on the other hand, will occur within both refurbishment or repair and dismantling to determine which components are suitable for reuse after refurbishment repair or material recovery. Continued use of computing equipment preserves the high value added in original manufacture, conserves resources and energy needed to manufacture new computing equipment and makes relatively inexpensive computing technology available to those who cannot afford to purchase new computers. The methods of such evaluation are outside the scope of this guideline (see guideline produced by PACE Project Group 1.1), but an experienced, knowledgeable person can often decide swiftly – based on model, age, condition and appearance – whether computing equipment has potential market value in continuing use or should be scrapped for material recovery either straight to recovery or through the dismantling and separation steps first.

Step three: **Refurbishment or repair**: Computing equipment that can still be used as computing equipment after evaluation may need to be refurbished or repaired. This includes replacement of hardware and software as needed and cleaning, labelling and distribution, with the intent of bringing a useful computer or component back on the market for continuing use. Depending on the type of component or part, those that cannot be repaired or reused should be sent to either ESM dismantling or recovery. For refurbishment activities or standards, reference should be made to PACE Project Group 1.1 for its refurbishment guideline.

Step four: **Dismantling:** Computing equipment often needs to be opened to see if its components are still working and can still be used in computing equipment, or submitted to the material recovery processes. Dismantling should be performed manually if it is intended to keep a used or end-of-life computer in working condition. Computers are usually held together by screws and simple fasteners that can be easily removed,

although some parts are welded or soldered and are more difficult to separate. Dismantling can also be the beginning of material recovery. Manual dismantling can recover not only working components, but also clean materials for recovery, such as steel cases. This type of manual separation is distinguished here from automated separation which occurs in the next step. It may also involve powerful mechanical separation of parts and components, such as shredding, which may release substances as dust and vapours. It will be necessary to first manually remove components such as mercury lamps and batteries, etc., and their contained substances, some of which are hazardous, so they are not processed together with the whole device in the mechanical dismantling step so they are not released or mixed with other materials. In the case of the LCD it is well documented that mercury emission occurs, exposing the workers to high risk. Toner cartridges should also be removed unless recycling or shredding equipment has been specifically designed to handle environments where high dust concentrations in air might occur. Like many organic materials in powdered form, toner can form explosive dust-air mixtures when finely dispersed in air. Protection of worker health and safety and the environment is necessary in such conditions, including engineered control systems, personal protective equipment such as gloves and eye protection, and more complex measures such as respiratory masks.

Step five: **Separation:** Separation is the process of sorting materials into batches and consolidating them for specialized material recovery. Computing equipment that has been evaluated to have no continuing value through refurbishment and no remaining valuable working components will be taken apart, manually or mechanically, and separated into steel, plastics and circuit boards, among other things. Relatively high levels of worker and environmental protection are needed, depending on the separation process and the materials being processed. Some materials can be swiftly returned to markets (e.g., steel cases may readily be sold on the scrap steel market), while others may have to pass through several separation processes before they are adequately consolidated. At the end of separation, finding the appropriate ESM recovery facilities for separated waste streams is a critical part of ESM, as this final link will largely determine the ultimate material recovery achieved in the chain, as well as the magnitude of environmental impact.

Step six: **Recovery:** Recovery takes the separated batches of materials into more specialized processes, often in a series; circuit boards, for example, first go through copper recovery, followed by specialized refining of the residues to recover other metals, while engineered thermoplastics are subjected to size reduction and granulation processes. Recovery processes often involve high temperatures (e.g., smelting and other pyrometallurgical processes), or very strong chemicals (e.g., hydrometallurgical processing by acids or cyanide), or hazardous emissions and require very high levels of process technology, monitoring and worker and environmental protection.

Appendix X

Facility measures to support environmentally sound material recovery and recycling of end-of-life computing equipment

To protect workers and communities, material recovery facilities should take steps that are guided by the following ESM criteria:

1. Top management commitment to a systematic approach
2. Risk assessment
3. Risk prevention and minimization
4. Legal requirements
5. Awareness, competency and training
6. Record-keeping and performance measurement
7. Corrective action
8. Transparency and verification

1. *Top management commitment to a systematic approach*: A material recovery facility should have the clear commitment of top management to a systematic policy approach to achieving and continually improving environmentally sound management in all aspects of facility operations, including pollution prevention and environmental health and safety. Adequate financial and human resources should be made available. The policy should be documented, implemented and communicated to all personnel, as well as to contractors and visitors as appropriate. Policy performance should be reported and reviewed periodically by top management. In larger material recovery organizations, a specific management representative or representatives should be appointed to oversee implementation of the policy through the design, implementation and maintenance of a management system.

2. *Risk assessment*: Material recovery facilities conduct heavy industrial operations involving powerful machinery, very high temperatures and hazardous chemicals. While facilities vary according to their operations and locations, they all present multiple risks to worker health and safety and potential environmental impacts both within and beyond the facility's location. Material recovery facility management should seek to identify and document hazards and risks to worker health and safety and to the environment that are associated with their existing and planned material recovery activities, products and services. It is especially important to identify potential emergency situations and accidents and how to respond to them. Response procedures should be tested and reviewed periodically, especially after accidents or emergency situations have occurred. The hazards and risks of site decommissioning and closure should be identified in advance and decommissioning plans should be prepared, including remediation and financial mechanisms to secure long-term site management if necessary.

3. *Risk prevention and minimization*: Once material recovery facility management has assessed the hazards and risks of facility activities, products and services, it should systematically seek to minimize or eliminate them. This systematic approach should first address significant existing environmental and health and safety risks, in addition to non-compliance with applicable legal requirements. It should consider technological, operational and business changes, including improved procedures, improved equipment and alternative business practices. Beyond significant existing hazards and risks, material recovery facilities should seek continually to improve the design of the workplace, process, installations, machinery, operating procedures and work organization with the aim of eliminating or reducing Environmental Health and Safety (EHS) hazards and risks at their source. All these improvements should be documented and communicated to all personnel, as well as to contractors and visitors as appropriate. It is particularly important to have good communication with suppliers and buyers of recovered materials about the content and risks associated with those materials in the very specific circumstances of material recovery processing.

4. *Legal requirements*: Material recovery facilities dealing with used and end-of-life computing equipment are required to have all operating permits, licenses or other authorizations that apply to their operations, especially if the equipment is defined as waste under the law of the countries in which they operate, as is often the case. A facility should always be in compliance with such permits, licences and authorizations. A systematic approach to environmentally sound management includes regular evaluations to identify applicable laws, including amendments and new laws, and to determine how they apply to a facility and its operations. A systematic approach also includes periodic communication and a sound working relationship with the competent authorities. Because material recovery operations may involve transboundary movement of supplies, wastes and products, a material recovery facility should also take care to ensure compliance with

applicable international laws, including the Basel Convention, and to respect laws of other countries concerned.

5. *Awareness, competency and training*: Facility managers should ensure that all those engaged in material recovery operations are trained to carry out their responsibilities safely. This means that employees should not only be trained in how to carry out facility operations but also should have an appropriate level of awareness of hazards and risks, and should achieve competence with regard to the effective management of these hazards and risks, including how to respond to and deal with foreseeable emergencies or accidents. This should follow from the risk assessment and risk prevention and minimization steps described above. Worker competence also requires access to special tools associated with material recovery operations, test equipment, materials handling equipment and information such as material safety data sheets for all substances, in addition to training in understanding and using them. Where possible, photographs and diagrams should be added to written instructions used to train workers in material recovery operations.

6. *Record-keeping and performance measurement*: A systematic approach to environmentally sound management includes the creation and maintenance of documents that record the details of such management. When an operating procedure has been documented, it can be properly executed in a consistently safe manner, and regularly improved. Documents that record the training of employees can be reviewed to ensure that training is complete and appropriate to the tasks assigned to those employees. Inspection, testing and assessment of used computing equipment can be reviewed to ensure that efficient and environmentally sound management is taking place in accordance with facility and legal requirements. There is little or no activity at a material recovery facility that will not be improved by appropriate records of such activity, accompanied by periodic review with intent to improve.

7. *Corrective action*: A material recovery facility should take appropriate action to respond to risks to worker health and safety and the environment that it identifies in risk assessments or that are brought to its attention by others, such as competent authorities or third parties. Failings in achieving ESM should also be addressed. Preventive and corrective actions should be appropriate and proportionate, and should be documented. The need for corrective action should be presented to senior management, in addition to the results of such action.

8. *Transparency and verification*: Material recovery facilities deal with end-of-life computing equipment that may be hazardous to the health and safety of their workers and the environment. They should therefore have regular, scheduled inspections and monitoring of all hazards, following documented procedures. If possible, such inspections and monitoring should be conducted by persons not involved in environmental management within the facility operations or by third parties. Such documented inspection and monitoring procedures may be required by law, but should in any case constitute part of a systematic approach to environmentally sound management. A facility's environment, health and safety policy, and its inspection and monitoring schedule and results, should be available to the public and to customers and clients who perform due diligence investigations of facility activities and operations.

Appendix XI

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These documents were considered during the working period of the project groups. Some of these documents may have been revised, updated or substituted.

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Appendix XII

Endnotes

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[ii] http://www.un.org/millenniumgoals/

[iii] eTForecasts publishes market research reports for the PC and Internet industries.

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[v] "Electronic Waste Management in the United States", approach 1, table 3.1, EPA530-R-08-009 United States Environmental Protection Agency, July 2008

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[vi] PACE Interim Project Group, report on ESM criteria recommendations, March 2009

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[xvii] Ibid.

[xviii] http://www.ilo.org/global/publications/ilo-bookstore/order - online/books/WCMS_PUBL_9221116344_EN/lang--en/index.htm

[xix] These provisions are in addition to applicable requirements under the United Nations Recommendations on the Transport of Dangerous Goods (i.e., UN Orange Book): Model Regulations, 18th revised edition, 2013, or later version.

[xx] Examples of funding mechanisms:

- Advance disposal fees – paid by the consumer at sale, either in the form of a visible fee shown on the receipt as a separate item or an invisible fee included without specific mention in the total sale price.
- Levy on import – paid by the importer of a product at the point of entry into the country (either collected and managed by the industry or by the Government)
- Waste arisings – collection and recycling costs are paid for by the producer and importer at the time the product enters the waste stream. The costs can be calculated based on current or historic market share and may or may not include legacy and orphan wastes.
- End-user-pays – the end-user pays a fee for collection and recycling costs at the point of disposal.
- Rate-payer –collection and recycling costs are defrayed by all taxpayers through their rates payments.
- Short-term grant funding – grants can be awarded for short-term projects such as initial collection infrastructure and are available from a variety of sources, including private sector, trusts, Governments, lotteries, landfill taxes and others.

Annex II

Concept for a follow-up partnership to the PACE

Follow-up Partnership to PACE

December 12, 2016

Contents

I. Introduction

1. A creative and innovative partnership, the Partnership for Action on Computing Equipment (PACE) has successfully advanced in laying the ground for significant steps towards achieving the environmentally sound management (ESM) of used and waste computing equipment which is one of the largest growing waste streams in the world today.

2. The PACE, launched in 2008 by decision IX/9 of the Conference of the Parties to the Basel Convention (COP) as a follow-up of the Nairobi Declaration on the Environmentally Sound Management of Electrical and Electronic Waste from COP8, was developed as a multi-stakeholder public-private partnership. It was based on the positive experience of the Mobile Phone Partnership Initiative (MPPI) which developed guidelines on the environmentally sound management of used and end-of-life mobile phones. Membership of the PACE working group and participation as invited experts was open to Parties and signatories to the Basel Convention, intergovernmental organizations and all other stakeholders, including manufacturers, recyclers, refurbishers, academia, public interest non-governmental organizations and Basel Convention Regional and Coordinating Centres (BCRCs/BCCCs) which had specific expertise and experience required for the activities of this group to tackle environmentally sound refurbishment, repair, material recovery, recycling and disposal of used and waste computing equipment. PACE delivered high value products, such as guidance documents, pilot projects, regional awareness raising and training workshops and a productive platform for multi-stakeholder dialogue. According to decision BC-12/12, the PACE working group has been requested to complete some outstanding tasks from the 2014-2015 work programme up to 2017.

3. Although PACE has contributed substantially to finding solutions, the challenges of achieving ESM of used and waste computing equipment are neither solved nor diminishing; on the contrary, they continue to grow. There are also up-stream challenges, taking into consideration a life cycle approach. These challenges have similarities with wider waste electrical and electronic equipment (WEEE or e-waste) issues which are also on the rise.

4. There is an urgent need to bring action on the ground and to involve more industries, donors and other stakeholders into the implementation of concrete activities at regional and local level. It is suggested to establish a follow-up partnership to PACE with the aim to coordinate and strengthen the implementation of ESM for waste computing equipment as well as waste mobile phones and other e-waste, at the national and regional levels in developing countries and countries with economies in transition, taking into consideration a life cycle approach. The follow-up partnership could be supported by a working structure, similar to the one used by PACE and where necessary adapted to regional or local structures, but with a strong leadership involvement by the BCRCs and BCCCs and tapping into the capacities and experience of the centres and the already built PACE network.

5. As first step, it is proposed that a group of Basel Convention regional and coordinating centres[1] with support from interested stakeholders will take the lead and coordinate, subject to the availability of funding, the implementation of activities listed in the work programme contained in the appendix I below. Based on the work undertaken and as need is defined more specifically on national and regional level, the group will propose to further develop the concept for a follow-up partnership to PACE on regional and/or international level.

II. Partnership approach

A. Scope

6. The follow-up partnership should cover strengthening the ESM of used and waste electrical and electronic equipment, at regional and national levels. In addition, a life cycle approach should be taken into consideration, including issues related to used electrical and electronic equipment; in this respect, duplication of work under SAICM in relation to the emerging issue of hazardous substances within the life cycle of electrical and electronic products[2] should be avoided.

7. The current momentum of ESM advances, e.g. within the Expert Working Group on ESM of the Basel Convention, calls for initiatives that are oriented towards action and provide practical solutions. The enforcement coordination initiatives to prevent illegal traffic, e.g. the Environmental Network for Optimizing Regulatory Compliance on Illegal Traffic (ENFORCE), also opens the opportunity to redirect informal sector activities related to e-waste, while simultaneously advancing towards integrating informal operations and combating illegal transboundary movement of e-waste.

[1] Basel Convention regional and coordinating centres in Argentina, China, El Salvador, Indonesia, Nigeria, Slovakia, South Africa, Trinidad and Tobago.

[2] See http://www.saicm.org/index.php?option=com_content&view=article&id=455&Itemid=708.

8. PACE experience in promoting ESM of used and waste computing equipment and its multi-stakeholder platform will be tapped for advancing ESM on used and waste electrical and electronic equipment which is of relevance to the Basel Convention and to other conventions when looked at with a synergistic lens (e.g. Stockholm Convention in the case of brominated flame retardants, Montreal Protocol in the case of ozone depleting substances found in refrigerators, Minamata Convention in the case of mercury used in backlighting of screens). Moreover, in the case of developing countries and countries with economies in transition, considering economies of scale and the real risk of rapid expansion of crude material recovery practices, it could make sense to set up one e-waste ESM program which gradually grows on its coverage of post consumption items.

B. Objective

9. To strengthen the ESM of used and waste electrical and electronic equipment, at regional, national and local levels, taking into consideration a life cycle approach.

C. Target groups

10. The follow-up partnership will capitalize the opportunity for expanding the reach of the work developed under PACE while at the same time be able to capture topics that are highly relevant to Parties of the Basel Convention and of other related chemicals and waste conventions, as well as to national, central and local governments, and other related stakeholders like original equipment manufacturers (OEMs), international organizations, associations and chambers, recoverers, recyclers, Non-Governmental Organizations (NGOs) and academia where the value added of PACE can be tapped to support implementation, knowledge and information sharing and experience exchanges.

D. Stakeholders

11. The follow-up partnership focuses on developing a multi-stakeholder partnership, including OEMs, the International Telecommunication Union (ITU) and its counterparts at the regional and national levels, as well as bilateral and multilateral agencies, academia and NGOs, led by the BCRCs and BCCCs (see Appendix II below).

E. Working principles and structure

12. The follow-up partnership will focus on activities at the national and regional levels, which cannot be carried out alone by the Secretariat of the Basel Convention (SBC). Nonetheless, it is also clear that the partnership will continue to require an important global coordination role towards facilitating the strengthening of information and experience sharing and discussion on emerging issues within the wider e-waste agenda.

13. The follow-up partnership will make the best possible use of the ESM guidelines developed within the framework of the Basel Convention, in particular those developed by MPPI and PACE and the ESM Expert Working Group.

14. As first step to define more specifically activities of the follow-up partnership on national and regional level, a group of Basel Convention regional and coordinating centres[3] with support from interested stakeholders will take the lead and coordinate, subject to the availability of funding, the implementation of activities listed in the work programme contained in the appendix I below. A two-tier approach for the organizational structure is proposed:

(a) A global coordination group to facilitate information and experience exchange and discussion on emerging issues, led by the group of BCRCs/BCCCs and facilitated by the Secretariat of the Basel, Rotterdam and Stockholm Conventions;

(b) Regional coordination groups to facilitate the implementation at the regional, sub-regional or national level, under the responsibility of BCRCs/BCCCs.

15. The group of BCRCs/BCCCs will report to the Open-ended Working Group and the Conference of the Parties on the implementation of the activities and will propose to further develop the concept for the follow-up partnership on regional and/or international level, as need arises.

[3] Basel Convention regional and coordinating centres in Argentina, China, El Salvador, Indonesia, Nigeria, Slovakia, South Africa, Trinidad and Tobago.

III. Work programme for 2018–2019

16. A detailed work programme for 2018–2019 is included in Appendix I below. The work programme includes activities on information exchange, training, stakeholder dialogues, support of national activities, life-cycle approach and awards.

Appendix I: Work programme for 2018–2019

Activities	*Timeline*	*Expected Outputs*	*Responsible*	*Priority (to be set at regional and/or national level)*
Information exchange				
(a) Distribute the MPPI and PACE guidelines, as toolkit, at the regional and national levels, including their translation to national languages	1st quarter 2018	1. MPPI and PACE guidelines are translated into national languages 2. MPPI and PACE guidelines are distributed in all countries in the Asia/Pacific, Africa, Central and Eastern Europe (CEE), Latin America and Caribbean (LAC) regions	All BCRCs/BCCCs	
(b) Disseminate the document "Manual of steps to establish and implement ESM of used and waste computing equipment" and the report on "Strategies, actions and incentives to promote ESM of used and waste computing equipment" as supporting documents for projects at regional and national levels	1st quarter 2018	Documents and reports are distributed to relevant partners as supporting documents for regional and national projects at regional and national levels in the Asia/Pacific, Africa, CEE, LAC regions	All BCRCs/BCCCs	
(c) Set up an information sharing web portal which provides and disseminates up to date information on expertise and knowledge available and ongoing activities, business models and producer responsibilities systems to the ESM of waste mobile phones and computing equipment and other e-waste in different regions of the world, taking into account other relevant work on ESM, e.g. work carried out under the ESM expert group under the Basel convention and supplementing existing information systems of the Regional Centres, ENFORCE, the United Nations Environment Programme (UNEP) and other related networks	1st -2nd quarter 2018	Information sharing web portal is set up	BRS Secretariat	

Activities	*Timeline*	*Expected Outputs*	*Responsible*	*Priority (to be set at regional and/or national level)*
(d) Disseminate information on the establishment of national registers of obliged persons which is the basis for extended producer responsibility (EPR) applied to e-waste	1st – 4th quarter 2018	1. Information on establishment of national registers of obliged persons is collected and summarized; 2. Information on the establishment of national registers of obliged persons is disseminated	Coordinating group of BCRC/BCCC All BCRCs/BCCCs	
(e) Disseminate information on registered e-waste certification bodies in the different regions	3rd quarter 2018 – 4th quarter 2019	A system to disseminate information on registered e-waste certification bodies in the different regions is set up	1 BCRC in Asia/Pacific, 1 BCRC in CEIT, 1 BCRC/BCCC in Africa, 1 BCRC/BCCC in LAC	
Training				
(f) Develop a tool kit, a workshop and training programme based on the MPPI and PACE guidelines and experience from MPPI and PACE, and other e-waste relevant materials, including a possible e-learning course, webinars in coordination with related e-waste regional and national projects	1st – 3rd quarter 2018	1. 1 toolkit per region is developed 2. 1 training programme and other e-waste relevant materials, including a possible e-learning course, webinars are organized per region 3. 1 workshop per region is organized	1 BCRC in Asia/Pacific, 1 BCRC in CEIT, 1 BCRC/BCCC in Africa, 1 BCRC/BCCC in LAC	
(g) Organize national workshops or trainings in national language(s) as appropriate with participation of national stakeholders from governments, public or private sectors, NGOs and other national and international organizations, associations and chambers	4th quarter 2018 – 4th quarter 2019	Up to 4 national workshops or trainings per region are organized	All BCRCs/BCCCs	

Activities	*Timeline*	*Expected Outputs*	*Responsible*	*Priority (to be set at regional and/or national level)*
Stakeholder dialogues				
(h) Organize regional and national dialogues on ESM of e-waste, bringing together among others government representatives of environment, customs, health, labor, telecommunication, transport, economics and trade ministries, departments and agencies ; as well as related stakeholders from the private sector, academia and NGOs and other national and international organizations, associations and chambers	1st quarter 2019 – 4th quarter 2019	1. Each BCRC/BCCC has organized 1 regional dialogues on ESM of e-waste 2. Each BCRC/BCCC facilitates the organization of up to 4 national dialogues on ESM of e-waste	1. All BCRCs/BCCCs 2. All BCRCs/BCCCs in cooperation with national authorities	
(i) Facilitate donor round tables and contacts with funding institutions, foundations and investment partners in support of programmes, projects and initiatives on ESM of e-waste at regional and national levels	1st – 2nd quarter 2018; 1st – 2nd quarter 2019	1. Each BCRC/BCCC has organized 1 donor round table at regional level 2. Each BCRC/BCCC has facilitated the organization of up to 4 national round tables	All BCRCs/BCCCs in cooperation with national authorities and donors	
Support of national activities				
(j) Assist initiatives on the inclusion of ESM of e-waste as part of the national development plans (mainstreaming) and strategies, e.g. on the development of legal and enforcement systems for ESM of e-waste, the implementation of the electronic notification for the Prior Inform Consent (PIC) procedure, public procurement, building of systems of registered e-waste certification bodies, the infrastructure for collection systems, dismantling and refurbishment facilities and EPR schemes, development of partnerships of stakeholders based on the PACE model, promotion of public awareness programmes, activities and events.	4th quarter 2018 – 4th quarter 2019	Each BCRC/BCCC has established cooperation with up to 4 national projects and supported the inclusion of ESM of e-waste into the national development plans and strategies	All BCRCs/BCCCs in cooperation with national project partners	

Activities	*Timeline*	*Expected Outputs*	*Responsible*	*Priority (to be set at regional and/or national level)*
Life-cycle approach				
(k) Organize international, regional and/or national stakeholder workshops on the life cycle of EEE (while seeking synergies with the work under SAICM), bringing together concerned stakeholders from the private sector, such as designing, producing and recycling industries, consumer organizations, academia and NGOs and other national and international organizations, associations and chambers, as well as among others government representatives of environment, but also energy, health, labor, telecommunication, transport, economics and trade ministries, departments and agencies;	1st quarter 2019	1 international workshop + 1 follow-up workshop are organized	Specific project group of the partnership	
Awards				
(l) Establish an international, a regional and/or national award on ESM of used and waste EEE, taking into consideration a life cycle approach, including material extraction, design, production, use, reuse, refurbishment, repair, recycling, material recovery	1st quarter 2019	1 international, 1 regional and/or 1 national award is/are established.	Coordinating group of BCRC/BCCC	

Appendix II: Basel Convention Regional and Coordinating Centres (BCRCs/BCCCs)

1. The Basel Convention benefits from a network of fourteen Regional and Coordinating Centres for Capacity Building and Technology Transfer (BCRCs/BCCCs). The Basel Convention has set up a regional network of autonomous institutions which operates under the authority of the Conference of the Parties, the decision-making organ of the Convention, composed of all the countries party to the Convention.

2. The BCRCs/BCCCs are established under two types of agreement: by being hosted in an inter-governmental institution or by vesting a national institution with a regional role to support countries within a region in their implementation of the Convention.

3. The BCRCs/BCCCs deliver training, dissemination of information, consulting, awareness raising activities and technology transfer on matters relevant to the implementation of the Basel Convention and to the ESM of hazardous and other wastes in the countries they serve. The specific activities are training workshops, seminars, pilot projects on the management of priority waste streams, the production of information material and guidelines.

4. The Centres are located in the following regions:

Africa and West Asia:	Egypt Nigeria Senegal South Africa
Asia and Pacific:	China Indonesia Islamic Republic of Iran South Pacific Regional Environment Programme (Samoa)
Central and Eastern Europe:	Russian Federation Slovak Republic
Latin America and the Caribbean:	Argentina El Salvador Trinidad and Tobago Uruguay

5. Each Centre services several countries in its respective region and has a Steering Committee which is composed of members of the Centre's host country and of the countries served by the Centre.

6. BCRCs/BCCCs website: http://www.basel.int/Partners/RegionalCentres/Overview/tabid/2334/Default.aspx

Annex III

Report on project experiences and lessons learned based on the outcome of the pilot projects

Report on project experiences and lessons learned

13 March 2017

Contents

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Under the Partnership for Action on Computing Equipment (PACE), one of the project groups, Project Group 3.1 was established with the objective to implement pilot projects among others to test the guidelines developed by the partnership. The PACE Working Group would like to express its appreciation for the efforts of the PACE Project Group 3.1 in the preparation of this document. Members of Project Group 3.1 are identified on page 4 and 5 of this document.

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Abbreviations

BCRC	Basel Convention Regional Centre
COP	Conference of the Parties to the Basel Convention
EC	European Commission
EPR	Extended Producer Responsibility
ESM	Environmentally sound management
E-waste	Waste Electrical & Electronic Equipment
NGO	Non-governmental organization
MoU	Memorandum of Understanding
OEM	Original equipment manufacturer
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

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I. Executive summary

1. The objective of the report on project experiences and lessons learned is to review the pilot projects and activities implemented by the Partnership for Action on Computing Equipment (PACE) in terms of their overall impacts; to assess the challenges encountered by the project teams as they developed and implemented the pilots and activities geared towards used and end-of-life computing equipment; to discern whether and how the PACE guidelines were used; to assess the impacts of the pilots on the ground and to determine the long-term sustainability elements or necessary follow-up activities. It is hoped that the lessons learned from executing these pilots and activities will inform future pilot activities regarding used-and-end-of-life computing equipment.

2. The PACE was initiated in 2008 by Decision IX/9 of the ninth meeting of the Conference of the Parties to the Basel Convention to tackle environmentally sound refurbishment, repair, material recovery, recycling and disposal of used and end-of-life computing equipment and agreed with the mission, scope, working principles and activities of the partnership.

3. The PACE activities initiated by the COP decision included, among other things, the development of the guidance document on environmentally sound management of used and end-of-life computing equipment, guidelines on the environmentally sound testing, refurbishment and repair of used computing equipment and on the environmentally sound material recovery and recycling of end-of-life computing equipment as well as the development and promotion of pilot schemes for environmentally sound management of used and end-of-life computing equipment towards the achievement of the Millennium Development Goals.

4. Four survey pilots were selected from 35 proposals based upon weighted criteria. Subsequent to surveys carried out on collection and management of used and end-of-life computing equipment that were completed in Burkina Faso, El Salvador, Jordan and Serbia, three pilot projects were initiated following a selection process established by the PACE. Additionally, four pilot activities on specific aspects of collection and management of end-of-life computing equipment were approved. The first activity was implemented by the Basel Convention Regional Centre (BCRC) Trinidad and Tobago in Suriname, the second activity was implemented by BCRC El Salvador in the Central American region, the third activity was implemented in South Africa, Namibia and Lesotho by BCRC South Africa and the fourth activity was implemented in Moldova by BCRC Slovakia.

5. To support the development of this report, an external evaluation of the three projects and four activities was conducted by Zoï Environment Network, who analyzed all the project and activity proposals, their final reports and conducted interviews with the project proponents.

6. The main findings are the followings:

(a) Innovation: The PACE pilot projects can be considered as pioneering in addressing the issues of e-waste in the partner countries, due to the propagation of guidelines, legislation and e-waste policy and implementation of concrete activities towards implementation of the guidelines in countries previously not exposed to the issues of e-waste;

(b) Leverage: Most of the PACE pilot projects were able to leverage considerable support both in funding (synergies with other development assistance projects, governments, national green funds) and through partnerships, in particular with the private sector;

(c) Awareness-raising: The guidelines and the PACE projects and activities had a high impact in creating awareness and in contributing to legislation and technical solutions where these previously did not exist;

(d) Private sector engagement: In most of the pilot projects, private sector participation was substantial, and opened highly interesting avenues and commitments for e-waste management;

(e) Use of the guidelines: The projects produced versions of the guidelines in French, Spanish, Serbian and Romanian language. The translation of the guidelines promoted awareness in contributing to legislation and technical solutions where these previously did not exist;

(f) Specific actions: Concrete and tangible e-waste efforts, such as the installation of collection points, events at schools and training in technology, have greatly enhanced the visibility of the issue and triggered action. Such activities also helped gain insights into what actually does and does not work. On the other hand, the purpose of a global partnership should not be to establish collection points or disseminate waste bins, unless these activities are linked to a wider national or regional programme ensuring sustainability in one way or another.

7. The Report on project experiences and lessons learned seeks to analyze g the different projects and activities by summarizing the projects' management schemes, implementation and outcomes in terms of achieving the Environmentally Sound Management (ESM) of e-waste. Most of the projects were implemented by the BCRCs involving national focal points in the countries.

8. With regard to the ESM of e-waste, the projects covered a wide range of activities: from regional awareness-raising and partnerships; to support of the development of national legislation; to the engagement and capacity-building of the private sector; and finally to local activities on awareness-raising, education and waste collection.

9. None of the projects and activities addressed directly the issue of the informal sector which is to a large extend involved in waste handling in most of the developing countries and which was one of the target groups clearly spelled in the call for proposals. This can be explained by the fact that e-waste management is a complex and multi factorial process that has to consider the role of both the informal and the formal sector. The PACE pilot projects and activities worked through the BCRCs and national Basel Convention contact points to find ways of factoring in, and actively involving, the informal sector in the national approaches to ESM of e-waste.

10. Five projects and activities, have delivered the expected outputs. The project in Jordan had to scale down its workplan due to lack of expected co-financing. The activity in the Southern African region is still ongoing. Most of the pilots leveraged additional resources and almost all of the PACE-initiated activities continued after the end of the pilots in one way or another, ranging from the development of regional strategies; sustainable partnerships with the private sector; the development and adoption of national legislation including Extended Producer Responsibility (EPR);rapid growth in systematic e-waste collection; and in general, increased awareness of the issues posed by end-of-life computing equipment, also in remote parts of the countries. It should be noted, however, even though enormous progress was made in all the regions with regard for example to policy frameworks, legislation, strategy and EPR during the period of the PACE partnership, quantifying the direct impact of the PACE is rather difficult.

(a) Based on the review of the implementation of the pilot projects and activities, of their outputs and of the feedbacks and experiences from the project proponents, the main lessons learned can be summarized as follow:
Implementation: The involvement of the BCRCs and national focal points was successful in terms of identification of the needs in the countries, implementation of the projects and mobilization of experts. In several cases, unexpected situations in countries affected the planned project implementation, such as changes within national administration due to new government in place. However, almost all the projects could achieve their goals when the implementation timeline was extended. The role and responsibilities of the regional centres' and their impact on country activities was not uniform across regions, some countries have indicated that they would prefer to work directly with the Secretariat in Geneva. In any case, e-waste is an issue to be dealt with at different levels from national to global and in this respect, the BCRCs are an invaluable asset for project delivery;

(b) Use of the guidelines: Through the projects and activities, the guidelines have been widely used and useful to have concrete directions for work in the countries and regions readily available. Moreover they have also widely been used for raising awareness;

(c) Efficiency of the pilot projects and activities: The feedback from the regions and countries was very positive on how a lot can be achieved with modest funding. The PACE projects and activities were able to raise awareness, to create leverage of additional resources and to trigger follow-up actions and projects. It also shows the current importance of e-waste management in developing countries and countries with economies in transition. The partnership approach strongly assisted all involved stakeholders, mainly governments and the private sector, in a much better understanding of the whole problem, different positions and helped closing gaps in one's knowledge.

11. Based on the evaluation of the projects and activities and the lessons learned, it is recommended for future pilot activities and partnerships regarding used and end-of-life computing equipment:

(a) To continue to involve the BCRCs in the implementation of e-waste projects at the national and regional level;

(b) To have a clear call for proposals with reasonable and achievable objectives coherent with the available budget and a detailed table of criteria for the evaluation of the proposals to ensure the proposals are realistic and in line with the objective of the partnership;

(c) To define a scope reflecting the needs of the countries;

(d) To address informal sector, one should involve local non-governmental organizations that have direct access to and work with local communities;

(e) To involve the national authorities and the private sector at an early stage of the project development to ensure its implication and the sustainability of the project;

(f) To rather facilitate awareness raising and triggering activities on national level, than directly establishing collection points or disseminating waste bins, unless these activities are linked to a wider national or regional programme ensuring sustainability in one way or another;

(g) To develop concise, visual "advocacy kits" for further dissemination at an early stage.

II. Introduction

13. The Partnership for Action on Computing Equipment (PACE) was launched on 2008 at the ninth meeting of the Conference of the Parties to the Basel Convention (COP IX), which took place in Indonesia in June 2008. The PACE is a multi-stakeholder partnership that provides a forum for representatives of personal computer manufacturers, recyclers, international organizations, academia, environmental groups and governments to tackle the environmentally sound management (ESM), refurbishment, recycling and disposal of used and end-of-life computing equipment. The Partnership was intended to increase the ESM of used and end-of-life computing equipment, taking into account social responsibility and the concept of sustainable development, and promoting the sharing of information on life cycle thinking.

14. The Partnership aimed to provide new and innovative approaches for addressing emerging issues. It also aimed to:

(a) Promote sustainable development for the continued use, refurbishment and repair of used personal computers in developing countries and countries with economies in transition;

(b) Find incentives and methods to divert end-of-use personal computers from land disposal and burning into environmentally sound commercial material recovery/recycling operations;

(c) Develop technical guidelines for proper repair, refurbishing and material recovery/recycling, including criteria for testing, labelling of refurbished used equipment and certification of environmentally sound repair, refurbishing and recycling facilities;

(d) End shipments of end-of-life computing equipment to countries, in particular developing countries and countries with economies in transition; which are illegal to import under their domestic laws.

15. Two project groups were created to develop the guidelines, which were field tested and approved at COP 11 in 2013:

(a) The guideline on environmentally sound testing, refurbishment and repair of used computing equipment sets out to promote re-use in a manner that is consistent with the Basel Convention, and benefits the environment, without compromising either product integrity or public health and safety. The guideline is aimed at supporting capacity building and the transfer of know-how to developing countries and countries with economies in transition so they can build infrastructure to manage electronic waste generated in-country, and to enable informal refurbishment operations to improve their operation for the protection of their workers and the environment.

(b) The guideline on environmentally sound material recovery and recycling of end-of-life computing equipment aims at describe the chain of steps that should be taken in order to ensure environmentally sound management in material recovery facilities that recycle electronics, and to encourage operators at each step to know about, work with, and take their responsibility for human health, safety and the environment, so that the entire value chain works in both an economically and environmentally sustainable manner.

16. In addition, a third Project Group was established with the objective to identify and select pilot projects, mechanisms and tools, to divert end-of-life computing equipment from environmentally unsound landfill, open-pit burning and harmful recycling operations to environmentally sound and efficient recycling operations locally and globally in a manner that is sustainable and mindful of improving the health and welfare of the informal sector. The pilot projects were also intended to test the ESM Guidelines produced by the PACE.

17. The major activities of the Pilot Project group included the selection of four countries where national e-waste surveys were carried out building upon, where possible, work already being done or underway in other programs. From the national surveys, three pilot countries were selected for the development of environmentally, economically and socially sustainable means to collect and further process electronic wastes in cooperation with and to the benefit of informal sectors and small repair, refurbishment enterprises

including supporting educational programs. When additional funding became available additional activities were carried out in four other regions to further study specific tasks on national and regional policy development, awareness raising and involvement of the private sector.

18. This report summarizes the process of the identification and organization of PACE pilot project and activities, the experiences and lessons learnt from the implementation of the projects and activities, and some conclusions and recommendations. Appendix 1 provides the list of criteria for selection of activities. The summary of projects and activities in section IV is based on the compiled final progress reports from the pilot projects and activities (Appendix 2) and detailed project documents which are available on the PACE website.[1] Appendix 3 sets out the report of the evaluation of PACE pilot projects carried out by an independent consultant.

III. Background

19. In 2009, the PACE initiated a call for country nominations, for special study on the management of end-of-life computing equipment. Based on the funds available, the PACE financed and organized in cooperation with national partners four national e-waste surveys in Jordan, Burkina Faso, El Salvador and Serbia to assess the current situation in four different regions regarding the legal background, stakeholder involved, material flows and potential social, environmental and economic impacts of the e-waste management in pilot countries in different regions. Three projects were selected out of a pool of 35 proposals, based upon weighted criteria, and implemented in **Burkina Faso**, **Jordan** and **Serbia** with budgets of up to USD 100,000 each.

20. Additionally, when more funding became available, a call for proposals was opened for four activities with a budget of up to USD 25,000 each on the basis of a table of criteria (see Appendix 1). The four selected activities in the **Central American region**, **Moldova**, **Suriname** and the **Southern African region** were submitted and implemented by BCRC-Slovakia, BCRC-El Salvador, BCRC-Trinidad and Tobago and BCRC-South Africa respectively.

IV. Summary of projects and activities

A. Objectives and components

21. Three projects and four activities have been implemented from 2012 to 2017. As of February 2017, five projects and activities have implemented their activities and delivered their expected outcomes. However, the project in Jordan and the activity in the Southern African region had to scale down their workplan due to lack of expected co-financing.

22. The approach followed by the projects and activities was very different depending on the needs and situation within each country. One of the projects developed feasibility studies and plans for putting in place a collection system in pilot areas, while others have put in place concrete actions for a collection system. Country assessments were supported by three activities due to the necessity to have updated data on e-waste management within the countries. Training activities were also a component or objective of three projects and activities. The aspect of developing a national legislation on e-waste management and awareness raising and education activities were included in two projects. Finally, two workshops were organized to update national guidelines and share experiences on e-waste management. All details on the activities and project outcomes can be found in Appendix 2.

B. Project management

23. All projects and activities have been implemented through BCRCs with the exception of Jordan, which was implemented by the Ministry of Environment through UNDP-Jordan. Half of the BCRCs implemented the projects themselves and the other half implemented the projects through a local partner, namely an academic institution or Ministry of Environment. All the projects followed the UN rules in terms of implementation and reporting.

24. The three projects in Burkina Faso, Jordan and Serbia had a Steering Committee composed of different national experts to give strategic direction and support the project manager. The four activities in the Central American region, Moldova, Suriname and the Southern African region were managed directly by the BCRCs in cooperation with the national partners.

[1] http://www.basel.int/Implementation/TechnicalAssistance/Partnerships/PACE/Pilotprojects/tabid/5381/Default.aspx

C. Priority setting and project follow-up

25. The call for proposals for pilot projects and activities were broad with the objective to find and pilot mechanisms and tools that can assist countries to divert end-of-life computing equipment from environmentally unsound landfill, open-pit burning and harmful recycling operations to environmentally sound and efficient recycling operations in a manner that is sustainable and mindful of improving the health and welfare of the informal sector. In that context, all projects and activities reflected the individual needs of the countries focusing on different aspects of e-waste management. The difference between projects and activities was that the projects were financed at a higher level than activities and were more ambitious task-wise. (See section III. above).

26. Even though the scope of the call for proposals was about used and end-of-life computing equipment to reflect the PACE mandate, all the projects and activities covered not only used and end-of-life computing equipment but e-waste in general.

27. The pilots focused mainly on e-waste collection as collection and the informal sector was the emphasis of the mission of the pilot project group. Nevertheless, all activities related to collection were very different from one another depending on the context in the pilot countries. They were implemented as planned but one activity faced an issue when it came to contract a local partner from private sector for collection activity. The local partner changed its strategy for profitability reasons, which created a delay and a situation, as it was the only solution envisaged to take care of collection operations.

28. A number of project proponents indicated that activities initiated and/or strengthened by the PACE will continue beyond the end of the support provided by the partnership, therefore the PACE pilot activities resulted in the longer-term sustainability of the ESM of e-waste on the country level.

29. Not all project proponents submitted recommendations on e-waste management. However, all projects and activities that produced an assessment or collected data on e-waste formulated recommendations. For more detailed information, please refer to Appendix 2 and section V below.

V. Lessons learned

30. The chapter on lessons learned is based on findings and lessons learned of the evaluation report, which was developed by an external expert, who conducted interviews of the project proponents. Its objective was to study the overall impacts the PACE activities, how the PACE guidelines have been used and what are the long-term sustainability elements or follow-up activities.

31. The external evaluation provided lessons learned which could be directly used and integrated as well as findings, which are analysed in this chapter. The whole evaluation report is presented in Appendix 3.

A. E-waste management at national level

32. In reviewing the projects and activities submitted to the PACE on the basis of the needs of the countries, the proposals covered the following steps of ESM of e-waste: assessment/data collection, legislation, collection models or putting in place collection systems. Considering that all the countries are at a different level of development, infrastructures and policies specific to e-waste management, it appears that most of these countries or areas focused on early stage activities for putting in place an ESM of e-waste. None of the selected proposals were about refurbishment, repair, material recovery and recycling, or business models of e-waste management. Finally, according to the call for proposals, the pilot projects and activities should have focused on computing equipment, instead of e-waste. However, the PACE projects and activities were used as an entry point to address the ESM of e-waste in general and reflect the need of the countries.

33. None of the proposals directly addressed the informal sector which is to a large extend involved in waste handling in most of the developing countries and which was one of the target groups clearly spelled in the call for proposals. This can be explained by the fact that e-waste management and the development and initiation of e-waste projects is a complex and multi factorial process that has to consider the role of both the informal and the formal sector. The PACE pilot projects and activities worked through the BCRCs and Basel Convention contact points to find ways of factoring in, and actively involving, the informal sector in the national approaches to ESM of e-waste. For example, one of the projects initiated a system rewarding consumers with a charger or a hands-free kit when they bring back their old mobile phone. They noticed that some actors of the informal sector started collecting rather than repairing mobiles. However, we don't have enough data, neither at a larger scale nor on a longer period to evaluate its sustainability.

34. Regarding legislation and policy frameworks, two projects had activities to assess and improve existing legislations in their countries. However, with policy frameworks and legislation being the essential elements for addressing e-waste, partnerships like PACE can be expected to get the most traction in this area.

But then, these legislative and policy processes take longer to unfold than the scope of a typical PACE pilot project. Thus, quantifying the direct impact of the PACE in this area is rather difficult. Still, during the period of the PACE partnership, enormous progress was made in all the regions with regard to policy frameworks, legislation, strategy and extended producer responsibility. These catalytic efforts need to be continued, in one way or another, to achieve sustainability. Existing legislation needs to be analyzed for potential impacts on the generation and handling of e-waste (the importing of second-hand electronic goods, for example). This should, however, not be seen as a reason to prolong the PACE pilot projects, since their main intention is to stimulate innovation and catalyze change.[2]

35. Specific actions implemented by projects and activities were mainly about collection, concrete and tangible e-waste efforts, such as the installation of collection points, events at schools and training in technology, have greatly enhanced the visibility of the issue and triggered action. Such activities also help to gain insights into what actually does and does not work. On the other hand, the purpose of a global partnership, whose existence is limited duration should not be to establish collection points or disseminate waste bins, unless these activities are linked to a wider national or regional programme ensuring sustainability in one way or another. Moreover, these activities are complicated to implement with economical components. For example, one of the projects on collection faced competition with the informal sector who is buying e-waste, while the project proponent was raising awareness to get e-waste for free. This issue was temporarily addressed by contacting the ministry of environment to get e-waste from national administration for free.

36. In addition to the four country assessments that had been conducted by UNDP at the early stage of the PACE and which led to the PACE projects, the two PACE activities in Suriname and Moldova focused on assessments and were developed in close collaboration with national authorities. The choice of this topic can be explained by the fact that dealing effectively with e-waste in a country requires relatively precise estimates of volumes, and information for decision-makers and the public needs to be based on simple, understandable facts and figures. The design of appropriate collection facilities, and investments in assembly and refurbishment depend on good information, as well as plans for full metal recovery whether in-country, in-region or through appropriate export. Some of the PACE projects have contributed to this effort.[1] Assessments and precise data are needed for national authorities, as well as for the private sector to set up or have an efficient system of e-waste's ESM in place.

B. Use of the PACE guidelines

37. One of the purposes of the evaluation was to examine the use of the guidelines developed under the PACE to support the pilot projects. Based on the interviews that were conducted and reflected in the evaluation report[1], the guidelines had a broad impact. They created awareness, contributed to legislation and technical solutions, and provided directions for their work in the countries and regions.

38. Producing the guidelines in local languages was an essential first step of many projects and activities. By doing so, it helped the target audiences – in the case of the PACE this covers a very wide range of stakeholders from government officials (local, national, regional), private enterprises as well as a more general public audience engaged in waste collection 'on the ground' - understand the guidelines. Some of the pilot projects produced excellent spin-off products that have contributed considerably to the spread of the concepts and guidelines.[1] The translation of the guidelines has already been taken into account in the drafting of the Follow up Partnership to PACE document[3]. Nevertheless, another element that could be integrated in the Follow up Partnership to PACE could be to develop concise, visual 'advocacy kits' using cartoons, animated movies or other media for further dissemination and awareness raising at an early stage of introduction of a comprehensive system for ESM of e-waste.

39. The guidelines, which were translated into English, French, Spanish, Serbian and Romanian, served as a reference in most of the projects and activities. They supported the development of project proposals, served as references and models for national guidelines and as models for the implementation of project activities. Finally, they have been key tools for awareness raising activities, which were carried out by the BCRCs.

40. Despite the use of the guidelines through the different PACE projects and activities, no feedback on the understanding or on the clarity of the guidelines was provided. This may be explained by the fact that the guidelines have been mostly used as awareness raising tools or served as references and models as indicated above, rather than being analyzed, compared or questioned.

[2] Evaluation report, Annex C.

[3] UNEP/CHW.13/INF/31, Annex II.

C. Implementation of projects: organizational aspects

41. The BCRCs played a central role by implementing most of the projects and activities. This project structure is efficient in terms of identifying the regional needs and mobilizing expertise and project implementation. The BCRCs also play an important role for the sustainability of activities. One drawback of this project structure maybe the longer project pathways that may be responsible for some of the project delays. In addition, the role and responsibilities of the regional centres and their impact on country activities was not uniform across regions, some countries have indicated they would prefer to work directly with the Secretariat in Geneva. In any case, national e-waste management is interlinked with regional and global waste management issues and in this respect, the BCRCs are an invaluable asset for project delivery.[2]

42. The implementation of the projects varied. The implementation through a national partner, being a ministry, an academic institution or a non-governmental organization (NGO) was often due to the fact that they had drafted the project or the activity proposal. Therefore, the proposals reflected a need in the country articulated by a proponent with good knowledge of the local or national situation.

43. As indicated previously, almost all projects and activities faced problems in implementing activities in the agreed timeframe. The reasons are multiple and different from project to project. In several cases, funds transfer from UNEP to the partners took longer than expected due changes of the UN administrative and financial programme in 2015 which generated delays. Once the funds were transferred to the implementing BCRCs, in most cases, they had to transfer the installments to the country thereafter. Therefore, it created a long chain taking a lot of time. However, extending the timeframe of the projects could be done on a cost neutral basis and allowed the project proponents to complete the implementation of all planned activities. The revised schedule of activities was developed by the project proponent and/or the BCRC and submitted to the Secretariat.

44. Further, unexpected situations in relation with project's partners occurred. In one case, a change within national administration resulting from new governments had limited consequences. The project was kept on hold until the new hierarchical chain was fully operational again and the project could be pursued in good cooperation with the new administration with activities undertaken on new agreed timelines on a cost neutral basis. In two other cases, the withdrawal of partners from public and private sectors delayed dramatically the projects due to the difficulties to find alternative partners. In these two cases, the external partners had not been involved in the development of the project proposals and were brought in at a later stage. All actors should be clearly identified and involved when the proposal is developed.

45. Concerning the collection activities implemented on the ground, two out of the three projects, namely in Burkina Faso and in Jordan, supported already existing collecting programmes. The only one which started from scratch, in South Africa, Namibia and Lesotho faced many problems and delays, mainly in finding sustainable and reliable partners from the private sector or from municipalities for the collection of e-waste. To avoid facing such problems, one of the criteria for the evaluation of the proposals was the ability of the PACE pilots and activities to leverage, as well as to contribute to existing projects or programmes. With regard to leverage, it is interesting to note that most of the projects and activities were able to leverage considerable support both in funding (synergies with other development assistance projects, governments, national green funds) and through partnerships, particularly with small and medium enterprises with a business interest in e-waste recycling at the local level, . This is encouraging and a strong factor for sustainability. It is also the result of an aspect that was highly emphasized while selecting the project and activity proposals requesting commitment and contributions which counted as 45% of the total points in the selection of the proposals (Appendix 1).

46. The involvement of the private sector was included in the evaluation table for the selection of the proposals. In most of the pilot projects, private sector participation was highlighted, and opened highly interesting avenues and commitments for e-waste management. Here the multinational producers and their representatives in the countries (importers, national associations), as well as the local private sector engaged in waste collection and recycling, all play crucial roles. Extended Producer Responsibility (EPR) has become part of the legislation of many countries, and, Corporate Social Responsibility standards have become commonplace for many industries. The direct impact of the PACE on the developments in the countries is difficult to quantify, but many interlocutors mentioned their work with the private sector as innovative and effective.[1] Even though the involvement of the private sector didn't substantiate in all projects and activities, the PACE projects and activities, by bringing seed funds and involving the national authorities, created an enabling environment to bring in the private sector, which is an integral part of the ESM of e-waste. The partnership approach strongly assisted all involved stakeholders, mainly governments and the private sector, in a much better understanding of the whole problem, different positions and helped closing gaps in one's knowledge.

VI. Conclusions and recommendations

47. The BCRCs played a key role in identifying local experts, in implementing the projects and activities through national focal points, and for the paving the ground for the sustainability of the activities. E-waste is an issue to be dealt with at different levels from regional to global, and in this respect, the BCRCs are an invaluable asset for project delivery. It is recommended to continue to involve the BCRCs in the implementation of e-waste projects at the national and regional level.

48. The PACE projects and activities have been a mixed basket of activities covering a wide range of different steps of the ESM of e-waste – from regional awareness-raising and partnerships; to support for the development of national legislation; to the engagement and capacity-building of the private sector; and finally, to local activities on awareness-raising, education and physical waste collection. While such a comprehensive and integrated approach can be a powerful vehicle to spread innovation, there was a risk of spreading resources too thin and leaving a lot of work undone. In this context, leveraging additional resources with various other initiatives and actors was key. In this respect, the evaluation report concluded that the PACE has done an excellent job. One factor for this success was good timing: Given the consumer electronic boom, the PACE was surfing on the e-waste wave. Another factor, that was included as a criterion for selecting project proposals, was the specific emphasis on ensuring the involvement of local actors. It is recommended to have a clear call for proposals with reasonable and achievable objectives coherent with the available budget and a detailed table of criteria for the evaluation of the proposals to ensure the proposals are realistic and in line with the objective of the partnership.

49. The PACE projects and activities addressed e-waste aspects, instead of focusing on computing equipment as requested in the call for proposals. According to the proposal, it was clear that e-waste should be tackle as a hole. Focusing only on computing equipment was not adapted in these countries.

50. None of the pilot projects and activities has targeted the informal sector even if it was one of the objectives of the call for proposals. The informal sector was not easy to address through the official channels, moreover when it comes from the international level, like PACE was operating. E-waste issue has to be addressed in its hole and the informal sector is part of the puzzle. It can be expected that when addressing the other aspects like legislation, collection and awareness raising, it can indirectly have an influence on the informal sector. To address this issue, it is recommended to involve local non-governmental organizations that have direct access to and work with local communities.

51. Almost all of the PACE activities have found continuation in one way or another, ranging from the development of regional strategies; sustainable partnerships with the private sector; development and adoption of national legislation including EPR, rapid growth in systematic e-waste collection; and, in general, increased awareness about the issue, even in remote parts of the countries. Therefore, despite limited funding, the PACE projects and activities brought the PACE guidelines to action. It is recommended to involve the national authorities and the private sector at an early stage of the project development to ensure its implication and the sustainability of the project.

52. The PACE projects and activities included concrete and tangible e-waste efforts, such as the installation of collection points, which have greatly enhanced the visibility of the issue and triggered action. However, it is recommended that a partnership should rather facilitate awareness raising and triggering activities on national level, than directly establishing collection points or disseminating waste bins, unless these activities are linked to a wider national or regional programme ensuring sustainability in one way or another.

53. The evaluation report confirmed that the PACE guidelines were used, translated and had a high impact on creating awareness and in contributing to legislation and technical solutions in the countries where these previously did not exist. In addition to having the guidelines translated, it was also recommended to use cartoons, animated movies or other media to make the guidelines more accessible. Some of the pilot projects produced excellent spin-off products that have contributed considerably to the spread of the concepts and guidelines. Future, partnerships may want to develop concise, visual “advocacy kits” for further dissemination at an early stage.

54. Quantifying the direct impact of the PACE projects and activities is difficult. On the short term, the feedbacks from the project proponents are positive, mainly because the pilots created awareness raising and triggered some follow-up activities. However, another evaluation would be needed at a later stage to assess the real impact and sustainability of the projects and activities.

Appendix 1

Activities proposals: Criteria for selection

Activity name:
Country:

Criteria	Points	Your Score
1. Is the amount of used and end-of-life computing equipment arising in the country from any source seen as a significant?	*10*	
2. Is used and end-of-life computing equipment/waste believed to be causing health and safety or environmental impacts?	*10*	
3. Would the country serve as a model for other countries in the same region, be representative of the entire and unique region?	*10*	
4. Is there room for significant improvement in the formal or informal e-waste collection and management systems in the country?	*10*	
5. Is there significant room for improvement needed in educating stakeholders including government officials, customs, etc.?	*5*	
6. Is the Activity proposal part of a national e-waste management strategy	10	
7. Is there significant national government interest and commitment toward this project (e.g., will government officials be part of the project team?)	*15*	
8. Is there significant interest and likely assistance available from the Basel Convention Regional Center (BCRC) in the region (e.g., a likely "champion" that will ensure project viability and sustainability)?	*10*	
9. Is there significant interest from NGOs, OEMs, or businesses?	*5*	
10. Is there any guaranty on the co-funding (e.g., a MoU or a declaration of intension) from other donors? (UN, EC, OEMs, etc) and/or from the government in the country?	*15*	
TOTAL SCORE	***100***	

Appendix 2

Compiled Final Progress Reports

A. Jordan

1. Background information

1.1 Project title: Pilot project on the environmentally sound management of used and end-of life computing equipment in Jordan

1.2 Project starting date: June 2013

1.3 Project completion date: Oct. 2015

1.4 Overall objective(s) of the project: Improve collection and materials recovery practices in an environmentally sound manner in Jordan

1.5 Total budget (US$): USD 93,000

1.6 Partners and leveraged resources:

The Jordanian Ministry of Environment, with UNDP support, is leading the implementation of this component. As part of its co-funding, the ministry has assigned one of its staff as a project manager to this project, this person is responsible of delivery of anticipated outputs and follow up day-to-day related work. The Ministry provides the necessary administrative support to the project, by means of offering offices, meeting rooms, computers, internet, printing, etc.

2. Project status

2.1 Information on the delivery of the project		
Activities / Outputs *(as listed in the project document)*	**Status** *(complete / ongoing)*	**Results/Impact** *(measured against the performance indicators stated in the project document)*
Output 1: Policy and legislations		
Conducting a baseline study to assess the current legislation that is indirectly and directly related to e-waste management.	Completed	Initial baseline study has been carried out. Included in the technical report, attached.
Propose a mechanism through which the national hazardous waste dumping site of SWAQA is activated as a treatment and disposal site for all types of hazardous waste including e-waste and establish a monitoring mechanism for the site.	Completed	Delivered Included in the technical report, attached.
Formulate a national technical specification including a testing mechanism and a policy for importing used computers, into the country.	Completed	The existing national legislations cover importing the used electronic and electrical equipment. However, through the new proposed legislation, it is suggested that the MoEnv does a validation role before getting these equipment entering the country.
Formulate a national policy that defines the responsibilities and obligations of all stakeholders.	Completed	A national policy framework has been developed, consulted with and agreed by the ministry of environment.
Share knowledge and experience garnered through the project in cooperation with BCRC-Egypt at the regional level.	Nothing done yet in this regard	Pending guidance (contact details) to establish communication with BCRC-Egypt.
Propose draft legislation for E-waste.	Completed	Legislation has been finalized after extensive consultation with all relevant stakeholders. Once endorsed by the minister, the legislation will be published in the official gazette and a launching ceremony will be held.

Output 3: Technology and Skills		
Develop collection (and possible recycling) technology and infrastructure suited to the e-waste volume generated and assess the local operational costs.	Completed	• 200 containers for e-waste collection of the computers and its accessories, cell phones, bulbs and batteries were distributed among the governorates of the Kingdom. The distribution included schools, trade centers, municipalities and environmental directorates. • Meetings were held with recycling companies for collaboration in the collection process and potential recycling. This type of consultation with private sector is expected to take time, and should be continued in drafting the new legislations and policies. The project managed to open a discussion platform with private sector, and relevant companies are now aware of the project and its agenda with regard to changing the legislations particularly. • Collection of e-waste has been initiated. It starts from collection points all over the country and ultimately goes to swaqa dump site. • Extra 220 plastic containers) 100 pcs 240L, 100Pcs 120L, 20pcs 770L distributed in all directorates of environment in the governorates) and many other places such as schools, GAM and environmental police.
Output 5: Awareness and education Develop and implement a national awareness and education campaign addressing all Jordanians with focus on: • Knowledge Points dealing with information and electronic devices • students at both universities and schools • national enforcement authorities consumers (with respect to the existing take-back e-waste collection system).	On going beyond the end of the project	• A comprehensive plan for awareness has been finalized and implemented throughout year 2014 started at schools, 100% of containers were distributed to schools for e-waste collection, and lectures were given by the ministry officials to raise awareness about the improper disposal and processing of e-waste that will cause serious health and pollution problems, also the scrap components of the e-waste contain contaminants such as lead, cadmium, mercury,…etc. • Number of publications were printed, and few other are being prepared, the brochure has been designed and first set of brochure was printed out and disseminated. • Press conference for launching the project was held at the Ministry of Environment. • The Minister of Environment has been hosted on TV on the most popular show in Jordan, so called YesaadSabahak(يسعد صباحك). The aim of that interview was to shed light on e-waste issues in Jordan and the ministry's plan in treating e-waste and changing the legislations. • Containers distribution event for the schools was held at the Ministry and covered in press.
Develop a mechanism for implementation of "take back" program for e-waste	On going beyond the end of the project	• An online database for E-Waste management has been developed and under validation by the Ministry of Environment officials. • An MoU was signed between the ministry of environment and orange company for the take back solution for cell phones as a pilot project. • Questionnaire was prepared and distributed to all governorates for data collection. • A preliminary situational analysis study is done to Amman in collaboration with Jo-Cycle Company.

All activities have been implemented according to the workplan though awareness sessions, collection process as well as E-Waste take-back programs will continue beyond the end of the project to ensure the sustainability of the project`s activities.

B. Burkina Faso

1. Background information

1.1 Project title: Pilot project management of Waste Electrical and Electronic Equipment (WEEE) in Ouagadougou and Bobo-Dioulasso

1.2 Project reference: CRCBS-AF/BURKINA FASO/2015/001

1.3 Project executing agency (if any): BCRC-Senegal

1.4 Project responsible officer: General Direction of the Preservation of the Environment and Sustainable Development / Ministry of the Environment and Sustainable Development

1.5 Project starting date: June 2015

1.6 Project completion date: May 2016

1.7 Reporting period: From: June to December 2016

1.8 Project objective:

- To promote sanitation through the consistent and concerted development and implementation of sub-sector actions
- To significantly improve populations' sanitation practices and behaviors
- To create conditions conducive to increased and sustainable funding of the sanitation sector

2. Project status: Information on the delivery of the project

Pilot project management of WEEE in Ouagadougou and Bobo-Dioulasso						
	Activities / Output	**Dates**	**Status**	**Outcome/Output**	**Compliance with workplan**	**Remarks**
1	To raise awareness and train importers, resellers, consumers and recyclers of e-waste in Ouagadougou.	19 to 20 January 2016	Completed	40 stakeholders trained.	Yes	
	To raise awareness and train importers, sellers, consumers and recyclers of e-waste in Bobo - Dioulasso.	13 to 14 July2016	Completed	44 stakeholders trained in Bobo-Dioulasso.	Yes	Strong actors' commitment to the pilot project.
3	To rent a warehouse to store e-waste for the NGO « les Ateliers De Bocage » in Ouagadougou and Bobo Dioulasso.	October 2015 to December 2016	Completed	Contract with the association « Action Défi Victoire » (ADV) signed.	No	Procurement of the warehouse delayed the signing of the contract.
4	To collecte e-waste in Ouagadougou and Bobo-Dioulasso.	October 2015 to December 2016	Completed	• Contract for collection signed with «Association Burkinabé pour la Promotion des emplois Verts». • 44,685 tons of e-waste collected.	Yes	• Collection of e-waste has stopped for this project. • Difficulties encountered due to some stakeholders buying e-waste from consumers.
	To transportation collected e-waste in Ouagadougou and Bobo-Dioulasso.	October 2015 to December 2016	Completed	• E-waste transportation contract signed with	Yes	Collection and transportation are concurrent.

				TEFA-OMEGA SERVICE. • 44,685 tons of e-waste transported.		
	To dismantle, segregate and recover what can be locally processed.	October 2015 to December 2016	Completed	• Contract on collection signed with « Association Burkinabé pour la Promotion des emplois Verts ». • 44,685 ton of e-waste dismantled.	Yes	Conditioning and transfer of the waste to foreign countries have not been considered within the project budget.

4. Project Delivery

4.1 Summary of the Problems Encountered in Project Delivery (if any)
We are facing competition, with some informal sector stakeholders buying WEEE for artisanal dismantling, while we are conducting awareness to collect waste free of charge, which complicates the collection across Ouagadougou and Bobo-Dioulasso.
4.2 Actions Taken or Required to Solve the Problems (identified in section 4.1 above)
These actions include the following: • The Minister of Environment wrote to the Minister of Economy, Finance and Development regarding the identification and removal of waste electric and electronic equipment from Government institutions for their environmentally sound management. • The Minister of Environment wrote to parastatal companies regarding the identification and removal of waste electric and electronic equipment from Government institutions for their environmentally sound management. The correspondence was positively welcomed, impacting the project for the better, especially during the extension phase, as evidenced by the quantity of WEEE collected in the last semester of 2016 (about 30 tons).

C. Serbia

Partners Name:

- The Basel Convention Regional Centre for Training and Technology Transfer for Central Europe in Bratislava
- Mr. Predrag Jovanic, National Team Leader, Serbia

Expected Accomplishment(s):

- Improved legislative framework
- Proposal for the feasibility study
- Proposal for sustainable and profitable e-waste collection model
- Proposal for the establishment of independent institution for the monitoring and control of e-waste management

Output(s):

- Draft legislation and/or regulatory measures including in particular collection system and recycling requirements and a financial system
- Proposal for a model for sustainable and profitable e-waste collection
- Analysis of e-waste potential market in Serbia
- Feasibility study of e-waste 3R potential in Serbia
- Report on the implementation and the activities of the monitoring and control body
- Public website with relevant information
- Trained state administration

Title of the approved PRC project: Capacity building for e-waste management in Serbia

SSFA starting date: 01/01/2014

1. Activity delivery status

Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of Activity (completed or not completed
Legal component	Draft legislation and/or regulation, concerning in particular collection system and recycling requirements and setting out a financial system, as well as successful organization and conduct of a workshop	Draft law	1.7.2015	Completed
Establish the model for sustainable and profitable e-waste collection and recycling	Report on the results of the national e-waste survey	Report	7.1.2015	Competed
	Proposal of a model for sustainable and profitable e-waste collection	Report	27.1.2016	Competed
	Organization and conduct of a Workshop on e-waste collection system	Report	Nov/Dec. 2015	Competed
	Report on the implementation of the e-waste collection system	Report	14.3.2016	Competed
	Successful organization of training for e-waste collectors	Report	Nov. 2015	Competed
Proposal to establish regional e-waste material treatment facilities	Analysis of e-waste potential market in Serbia	Report	11.12.2015	Completed
	Feasibility study of e –waste 3R potential in Serbia	Report	6.12.2015	Completed
	Organization and conduct of a Workshop			Completed
Proposal to establish independent monitoring and control body	Report with analysis of current situation on monitoring and control body for e-waste management	Report	4.8.2015	Completed
	Proposal report for monitoring and control body	Report	February 2015	Completed
	Organization and conduct of a Workshop	Report	March 2015	Completed
	Report on the implementation and the activities of the monitoring and control body	Report	July 2014	Completed
Public notification and education		www.e-otpad.rs	Oct.2014	Completed
Training state administration		Report	2016	Completed

D. Suriname

1. Project title: Assessment of Waste Electrical and Electronic Equipment for the Republic of Suriname

Executive summary

This report documents the outcomes of an assessment executed by the Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean (BCRC-Caribbean) on the waste electrical and electronic equipment (WEEE) waste stream in the Republic of Suriname. This study attempted to identify the local stakeholders involved in WEEE generation and management, the relationships between these stakeholders and the contribution that these stakeholders make to the overall e-waste generation and management in Suriname. It also sought to highlight current management practices to deal with WEEE as well as the extent of stakeholder knowledge and data management with regards to this waste stream within the local context.

The study was a continuation of the BCRC-Caribbean's WEEE assessments following similar work conducted in Trinidad and Tobago. The present assessment sought to work within the broad scope of WEEE items categorised under the original European Union WEEE Framework Directive (2002/96/EC), which characterised the waste stream and its precursor electrical and electronic equipment (EEE).

At present, WEEE generated in Suriname is largely mismanaged as a result of a non-harmonised system to handle these wastes and the lack of facilities to adequately treat such wastes. This scenario has led to a large and increasingly complex hazardous waste stream in Suriname being indiscriminately disposed of in the country's landfills and public spaces, and adding significantly to the issue of air, water and land pollution by POPs and other contaminants nationwide. Furthermore, the situation has led to the wastage of resources that have the potential to be recycled, recovered and re-used.

In the execution of this assessment, import and export data for EEE were analysed and interviews were conducted with distributors and consumers of EEE, waste collectors, and recyclers of WEEE, and the respective agencies involved. The data collected was analysed, summarised and assessed in order to examine the flows and management of these pieces of equipment. It was found that gaps in knowledge and practices exist across different sectors and that there are significant weaknesses in this respect as it relates to EEE consumption and WEEE generation.

The collection of WEEE is being done primarily on an as-needed basis or to facilitate the sale of metal components for revenue by private individuals and organisations. However, such collection is not necessarily being done with the end point of the environmentally sound management of the waste stream being taken into consideration. Furthermore, the existing practices for salvaging metals of value to local dealers and others operating in the country do not necessarily amount to the wise re-use or recovery of these resources within the local system. Therefore, there is a need to ensure that more sustainable collection efforts as well as the sensitisation of the WEEE issue and the development of ESM practices among local stakeholders, including in the area of collection and storage, are fostered.

Based on the findings of this assessment, the BCRC-Caribbean developed a series of recommendations which, if addressed, can significantly aid in the achievement of the environmentally sound management of WEEE in Suriname. Some of these recommendations, presented in order of priority, include the following:

- The establishment of a national WEEE management coordinating body comprising of membership from the various stakeholder groups with roles throughout the life cycle management of EEE.
- Roll-out of a well-developed awareness and public education campaign. The campaign can initially target key stakeholders involved in the life cycle management of EEE and WEEE followed by a broader public awareness campaign.
- The development of appropriate regulations and standards either stand alone or under any enacted national environmental or waste management legislation.
- The establishment of formal collection systems to support the timely and sound collection of WEEE from commercial entities and households. This can include the development of formalised take-back programmes among retail and distribution stakeholders.
- Development of a national data capture and management system for imported EEE products and flows in the country, with a view towards supporting monitoring and enforcement and decision-making.

- Capacity development of the informal collectors, salvagers and scrap dealers to improve existing practices and ensure the ESM of valuable, non-valuable and hazardous components of WEEE.
- The establishment a dismantling facility in the country to formally bridge the gap between the generators and downstream dealers and users of metals.
- The consideration of further development recovery operations to support the recovery of precious metals from WEEE supported by existing skills and experience in the population due to participation in the local gold mining industry.

These recommendations in addition to the findings of this study can provide a foundation from which a national strategy for WEEE can be developed and implemented in order to achieve the ESM of WEEE in Suriname. Furthermore, they can assist in the enhancement of the existing operations and practices to ensure that realization of the resident potential in business development for the valuable fractions of WEEE are achieved and beneficial to the local economy.

E. Central American Region

1. Identification:

Partner's Name: The ***Centro Regional del Convenio de Basilea para Centroamérica y México***/ the Basel Convention Regional Centre for the Central American sub-region including Mexico

Expected Accomplishment(s): assistance provided to participating countries of the region and to El Salvador to enable them to raise awareness on the environmentally sound management of waste electronic and electrical equipment

Output(s): organization and conduct of 2 (two) Workshops, review and validation of draft Guidelines for ESM of WEEE

Title of the approved PRC project: "Workshops for sharing regional advances in guidelines for the collection, temporary storage, transportation, testing, repair and refurbishment, disassembly, recycling and export of WEEE, as well as the Revision and validation of draft WEEE Guidelines",

SSFA starting date: 2-3-2016

Completion date: January 15, 2017

2. Activity delivery status

Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of Activity (completed or not completed	If activity not completed, please describe the reason why and indicate mitigation actions that were taken
Activity 1 – Hire the project Coordinator	1.1 An add was published on the Webpage of BCRC-CAM www.siva.int/crcbcam sharing the opening of the temporary position as Project Coordinator, with its TOR. 1.2 One application was received from Manuel Martinez, which was reviewed and the candidate was interviewed. 1.3 Manuel Martinez was selected by BCRC-CAM as Project Coordinator as his qualifications were verified to be consistent with the TOR.	Transparent selection of the Project Coordinator.	February 15, 2016	Completed	

Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of Activity (completed or not completed	If activity not completed, please describe the reason why and indicate mitigation actions that were taken
Activity 2 – Facilitate the sharing of Latin America and PACE experiences in the formulation of Guidelines for ESM of WEEE	2.1 Organize a regional workshop in Guatemala to exchange Latin America and PACE experiences in the formulation of Guidelines for ESM of WEEE with participation via Skype of experiences in Colombia and Mexico. 2.2 Prepare reports of regional workshop and publish it in BCRC-CAM Website.	2.1 Workshop organized with a successful exchange of Latin American and PACE experiences. 2.2 Report of the workshop approved by participants and published in BCRC-CAM Website.	February 23, 2016	Completed	
Activity 3 – Review and Validation of draft Guidelines for ESM of WEEE for El Salvador	3.1 Preparation of revised draft Guidelines for ESM of WEEE incorporating information from workshop on exchange of experiences. 3.2 Consultation workshop to review Revised Draft of Guidelines for ESM of WEEE. 3.3 Preparation of workshop report including recommendation s for adjustments to Guidelines for ESM of WEEE. 3.4 (NOT ORIGINALLY INCLUDED IN THE PROJECT BUT IMPLEMENTED AND HIGHLY RELEVANT TO PACE WORK). Validation of PACE Guidelines for ESM of Used and End-of-Life Computing Equipment in a facility in Guatemala (E-waste de Guatemala) and in El Salvador (ZARTEX).	3.1 National Workshop organized in El Salvador. 3.2 Revised Draft of Guidelines for ESM of WEEE. 3.3 Final draft of Guidelines for ESM of WEEE presented to Environmental Commission of the Salvadoran Cabinet.	October 19, 2016	Completed	Please note that Salvadoran Guidelines for ESM of WEEE were considered excellent by both the Guatemalan and Salvadoran workshops, even acknowledged as being the best in Latin America. Therefore there was not need to prepare adjustments. These guidelines are considered a living document which will be updated regularly as needed. The Salvadoran Workshop was used to open a dialogue between public and private sector interested stakeholders to the point that its participants were identified by government officials as key members of the new to be announced public-private sector Salvadoran roundtable for WEEE. This was facilitated by the presentation of the Colombian experience on ESM of WEEE at the National Salvadoran Workshop, by Carlos Hernandez, the Colombian Director of the WEEE Project in Colombia, who for 5 years coordinated a public-private sector dialogue which was key in achieving significant advances on ESM of WEEE

Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of Activity (completed or not completed	If activity not completed, please describe the reason why and indicate mitigation actions that were taken
					in Colombia and is now a model for Latin America. During the Salvadoran workshop a presentation was made on the validation of PACE Guidelines in a facility in Guatemala (E-waste de Guatemala) and in El Salvador (ZARTEX).

3. List of attached documents

Report of the Regional Workshop organized in Guatemala, fully translated into English, which includes a summary of each presentation made at the regional workshop and main comments made, workshop conclusions, the participants list and a link to all presentations made at the workshop.

Report of the National Workshop organized in El Salvador fully translated into English, which includes a summary of each presentation made at the national workshop and main comments made, workshop conclusions, the participants list and a link to all presentations made at the workshop.

F. Moldova

Identification:

Partners Name:

- The Basel Convention Regional Centre for Training and Technology Transfer for Central Europe in Bratislava
- Environmental Pollution Prevention Office within the Ministry of Environment of the Republic of Moldova

Expected Accomplishment(s):

- To collect the data necessary for estimation of waste electrical and electronic equipment (WEEE) arisen in pilot area with the aim of setting up the WEEE collection targets by the country in order to further promote implementation of the relevant obligations pertaining to the Basel Convention and to the EU Directives
- To organize a public information and education campaign, with particular focus on non-profit associations and education sector managers regarding the WEEE management issues and reduction of risks associated with unsound management of WEEE (including end-of-life computing equipment)

Output(s):

- Data for WEEE collection targets are collected
- Relevant applicable legal obligations pertaining to the Basel Convention and the EU Directives are promoted
- Protection of the population is improved
- Improvement of waste generation's prevention
- Increased awareness of educators & civil society organizations
- Educational materials and dissemination of activities results
- Capacity building processes are developed
- Trainings are organized
- Narrative and expenditure interim and final reports submitted to UNEP/SBC

Title of the approved PRC project: "Reduction of risks associated with end-of-life computing equipment in Moldova through raising public awareness and strengthening national capacities"

SSFA starting date: 14 May 2015

Completion date: 30 March 2016 (based on no cost extension letter nr CZA 5812/2015, SEN-0526-2015 dated 22.12.2015)

Summary of Status:

The results of the project have fully contributed to the achievement of the SSFA's main objective, and namely to is to contribute to the achievement of environmentally sound management of WEEE-waste within Moldova. The project has been implemented as the joint initiative of the EPPO in partnership with the Basel Convention Regional Centre Slovakia. It has been evaluated by both partners the good cooperation level within the entire project implementation period.

With regards to achievement of the specific accomplishments, the project experts and implementation partners have obtained the following:

- To collect the data necessary for estimation of waste electrical and electronic equipment (WEEE) arisen in pilot area with the aim of setting up the WEEE collection targets by the country in order to further promote implementation of the relevant obligations pertaining to the Basel Convention and to the EU Directives

  WEEE and particularly end of life computing equipment in Moldova is one the fastest growing waste streams in Moldova. Previous experience of EPPO and BCRC on elaboration of the Draft WEEE regulation has allowed to estimate of the EEE introduced annually at the local market for the last 10 years, thus clearly this stream is increasing. Bearing in mind the EU –Moldova association agreement provisions, and the commitment to promote the WEEE regulation, that is harmonized with the EU Directive, it is a priority for Moldova to improve the environmental management of WEEE and to initiate proper collection, treatment and recycling of electronics at the end of their life. The project aimed to conduct an analysis and provide recommendations on the feasibility and practicability of setting targets for one or more specific WEEE categories identified in draft WEEE regulation. In order to reach this target, firstly a context analysis is conducted, based on the results reached at the project pilot zone on the quantities of several major categories. Also, since the country lacks the WEEE treatment facilities, the WEEE is taken to other countries based on Basel Notification procedure, so the project implementation allowed again to check at which extend the national reporting for the Basel Convention can be improved for this particular categories of waste.

- To organize a public information and education campaign, with particular focus on non-profit associations and education sector managers regarding the WEEE management issues and reduction of risks associated with unsound management of WEEE (including end-of-life computing equipment)

  All the steps that were conducted by EPPO in order to organize the campaign with regards to selected WEEE categories and particularly end of life computing equipment among the educational institutions within the project pilot area has been improved, based on the impact evaluation exercises. It is also important to mention, that the experience of project pilot zone was presented and promoted at project final event and can be further replicated among other project districts.

  All project components have been completed, based on action plan. The initial duration of the project has been extended with 3 months, because of the need to prepare and organize the final project event and that took place on February 11st, 2016 in Chisinau, Republic of Moldova.

Major project outputs that were accomplished include:

- Information and data with regards to WEEE collection targets needed for promotion of the legal framework on WEEE at national level developed
- Selection of the project target zone – Cahul
- Questionnaire for the survey developed, piloted
- Survey conducted and report developed and presented to main stakeholders
- Educational materials and public awareness materials developed, printed and disseminated among professional and general public
- Training of Trainers for the representatives of the educational institutions, NGOs and public authorities organized
- WEEE collection campaign concept developed and consulted with all the regional authorities
- WEEE collection campaign conducted, results of the collection made public

- Quantities of collected WEEE have been exported to Romania for recycling by MoldRec
- Project final event prepared and organized on February 11, 2016
- Progress and final narrative and expenditure reports presented to BCRC

As such even of short duration the project initiative proved to be very significant for both national and local levels. Besides supporting the ministry of environment with collection of practical data, that is relevant to national context and shall further be used to setting the targets on WEEE collection, the project had an impact upon the selected pilot zone, by raising public awareness and reducing the adverse impact upon environment.

Educational materials were useful at content and adapted to needs and interactivity for the children and general population. The whole educational materials were elaborated jointly with BCRC expert and done in compliance with the PACE visibility rules. The electronic version of the flyers will be posted at partners' web page and provided for further consideration to PACE working group.

The project final event, conducted on February 11, 2016 was organized to present the results of the collection campaign conducted on 2-4 December 2015. In addition, the event allowed highlighting the main findings and conclusions of the collection campaign and sharing of the lessons learned.

Activity delivery status

Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of Activity (completed or not completed
Project Management	BCRC and EPPO within the MoEnv have concluded MoU for overall project management.	MoU on project implementation.	29 April 2015	Completed
Activity 1 – Organizing and conducting survey regarding the presence of end-of-life equipment among the educational institutions within the project pilot zone.	Contracting of the qualified company to conduct survey.	ToRs survey developed Contract signed and action plan developed.	25 June 2015	Completed
	Elaboration of the questionnaire.	Questionnaire drafted by EPPO has been consulted with BCRC international expert, finalized and translated into Romanian language.	June 2015	Completed
	Training of volunteers for filling of the questionnaire.	CRAION Contact Cahul has organized training for filling in the questionnaire.	25 June 2015 10 Sept 2015	Completed
	Analysis and dissemination of the results.	The survey has been developed, consulted with SEA and presented at national final event.	30 October 2015	Completed
	Elaboration of recommendations based on research results.	Survey findings have been used for development of the collection campaign concept.	30 October 2015	Completed
	Increasing of public knowledge through awareness-raising.	Throughout entire project implementation, has conducted at national level (environmental and educational authorities) and at pilot zone level Cahul intensive information and knowledge sharing has been done by EPPO and partners, involving not	Competed	Completed

Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of Activity (completed or not completed
		only selected professionals, but also large population.		
A2.1 Organizing ToT training for school managers within the project pilot zone regarding the WEEE management with the focus on reduction of risks for children and population in relation with unsound WEEE management	Elaboration of the thematic flyers (leaflets).	End of life computing equipment and WEEE related information packages has been developed and multiplied for ToT participants, general.	31 Oct 2015	Completed
	Elaboration of training set of materials.	The set of 6 thematic presentations has been developed by EPPO and Viera Simcovic, BCRC.	31 Oct 2015	Completed
	Selection of Participants for Training.	CRAION Contact Cahul has selected the ToT participants on open invitation and competition bases. The list of institutions has been shared with EPPO and BCRC for consultation.	31 Oct 2015	Completed
	Conducting of the training.	On November 5-6, 2015 the ToT has been conducted in Cahul district. The preparatory meetings (2X) have been organized by EPPO and CRAION Contact CAHUL on Nov 2 and Nov 4th, 2015.	5-6 Nov 2015	Completed
	Report on training is elaborated and widely disseminated.	The ToT report and conclusions has been drafted and disseminated among participants and stakeholders. Media coverage has been as well secured.	30 Nov 2015	Completed
A2.2 Organizing a practical WEEE collection event within the project target zone and public information campaign.	Selection of the pilot zone.	As representative pilot zone – district Cahul has been selected for the campaign.	Aug 2015	Completed
	Cooperation with the waste collector company.	EPPO has selected MoldREC company as WEEE authorizes company to be a partner for campaign.	Sept 2015	Completed
	Practical event arrangements.	EPPO with MoldREC and CRAION conducted preparatory activities for the campaign. Campaign has been conducted during period 02-04 December 2015.	Nov-Dec 2015	Completed
	-Mass media coverage of event.	EPPO has secured the mediatization of campaign through	Dec 2015	Completed

Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of Activity (completed or not completed
		MoEnv/EPPO Web page, MoldREC and CRAION-Contact Cahul web page and various mass media links.		
Project final event		EPPO and partners have organized and conducted project final event on February 11, 2016.	February 2016	Completed

G. South Africa in collaboration with Lesotho and Namibia

Progress Report

1. **Identification:**

Partners Name: AFRICA INSTITUTE
Expected Accomplishment(s): Piloting the E waste collection system in 3 cities in 3 African countries
Output(s): A well-established coordination system linking formal and informal sectors
Title of the approved PRC project: Demonstration of ESM of E Waste in Three African countries
SSFA starting date: May 2015
Reporting period: December 2015 to December 2016

2. **Summary of Status:**

The E waste collection Pilot is being implemented in three areas, in three neighbouring countries. In Namibia, there is a shipping company that started the collection of E waste as a corporate social responsibility, while taking advantage of their shipping infrastructure to move the waste to recyclers in South Africa.

Unfortunately, their collection has subsided because the management of the company felt that the venture should be able to recover its own costs but instead it was costing the company more. As a result, there were plans to cut it all out of the company operations. It became a part time activity where receptacles that have been placed in schools and waste transfer stations were irregularly collected, while the dismantling personnel were re-assigned to other hauling activities.

In June 2016 it became apparent that the company management was determined to close down the operation. Ina meeting held during this month (June, 2016) it was resolved that the Department of Environment in Namibia would meet with the management of the company to request them to allow the pilot to run using their infrastructure. An agreement was reached, an account opened and an invoice requested from the company.

The electronic waste is still being dropped in the receptacles in schools and transfer stations, however the collection remains irregular, the waste is no longer dismantled and is simply piling in the storage area. There is a need to identify a new player in the space, but there were no companies interested as the Transworld cargo had been doing it.

In Lesotho, three containers were procured to be placed in strategic positions in town, where the public could drop off unwanted electronic and electrical equipment. The containers are in the process of being branded. Several radio programs have been done towards awareness raising. It is expected that as soon as the containers are placed, the campaigns will start again.

In South Africa, the municipality is not being helpful towards the project. As a result the pilot will be out sourced to a consultant that will document the process that is being undertaken by private sectors players that are collecting E waste.

1 Activity delivery Status

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Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of Activity (complete/ on-going/ delayed)	Comments - brief description of implementing challenges, strategy/actions which have been adopted to address these challenges and planned actions to mitigate any identified risks
Activity 1 – setting up the coordination system	Introductory meeting held with City of Tshwane in Pretoria. Inception meeting held in Lesotho and coordination system established. Engagements with Namibian authorities.	Project coordination system	October 2015	Completed successfully in Lesotho and Namibia	There was a slow response rate from the countries, which delayed the setup and therefore the commencement of the activities in the countries. The Namibian company had made decision to close down the e waste operation, and this became a real challenge to resuscitate
Activity 2	Procurement of receptacles for Lesotho	3 containers	May 2016	3 Containers bought and transported to Maseru	The challenge remains that of accessing the placement sites. It was anticipated that the city council would easily assist. One mall has however accepted that the containers may be placed there.
Activity 3	Signature of MOU with Namibian company	Signed MOU and Invoice	August 2016	MOU signed with Government and private company	Despite the signature, the funds request were never sent because of problems in the country.
Activity 4	Branding of the containers in Lesotho	Branded containers	June to Dec 2016	Quotations received with artwork. One sided branding ordered	Good looking artwork developed and is being printed.
Activity 5	Radio Programmes	Radio slots	Jan to	Weekly radio	Awareness increasing

2

			June 2016	programs held for a month then stopped.	and public needs the drop off containers. Even though most inquiries were about the buyback system, which is popular in the metal scrap.

Appendix 3

Evaluation of PACE pilot projects

Evaluation of PACE pilot projects

Otto Simonett, Director of Zoï Environment Network

1. Background

This external review of PACE pilot projects entailed the analysis of the available background materials, followed by telephone interviews with the regional organizations responsible for project implementation and some country focal points (see below the list of interviewees and interview dates). The evaluation focused on broader project outcomes rather than on the details of how the projects were implemented or the budgets spent. The interviewees were asked following questions:

- What overall impacts did the PACE activities have "on the ground"?
- How have the PACE guidelines and activities influenced policymaking and the management of end-of-life computing equipment?
- What are the long-term sustainability elements or follow-up activities?
- Are there specific lessons learned?

The analysis comes in two sections: (1) Review of the methodological approach, providing a bird's eye view of the PACE globally, and (2) lessons learned, capturing some of the feedback received from the regions and the countries. While the headlines are valid for the global PACE project portfolio, the lessons learned cover some region- and country-specific issues related to legislation, government support, awareness, and the willingness of the private sector and the general public to participate. The review deliberately avoids highlighting specific countries and regions on the rationale that generic findings provide the highest value.

2. Methodological approach

INNOVATION: The PACE partnership and the PACE pilot projects can be considered- in conjunction with other punctual initiatives - as pioneering in addressing the issues of e-waste worldwide, particularly in developing countries, due to the development and propagation of guidelines, legislation and policy globally (partnership), and implementing concrete projects towards implementation of the guidelines in countries previously not exposed to the issues of e-waste (pilot projects). The guidelines had a high impact in creating awareness and in contributing to legislation and technical solutions where these previously did not exist. All the persons interviewed noted how important it was to have concrete directions for their work in the countries and regions readily available. Also, they made use of the guidelines for raising awareness. This clearly shows the potential for innovation and new methodology to spread through international networks (concretely, the Basel Convention Regional Centres). The timing was crucial: when PACE started, e-waste was on the verge of becoming overwhelming.

LEVERAGE: The feedback from the regions and countries was very positive on how a lot can be achieved with modest funding. Most of the PACE pilot projects were able to leverage considerable support both in funding (synergies with other development assistance projects, governments, national green funds) and through partnerships,. Compared to the moderate size of the PACE projects this leverage was (and continues to be) quite substantial. This development also coincides with the e-waste issue catching the world's attention, in particular through the rapid growth of mobile telephone and internet use worldwide.

AWARENESS-RAISING: Both governments and the private sector (ranging from multinational telephone and IT companies to the local waste industry) made good progress on awareness-raising campaign and the PACE can certainly be credited for some of it. Designing campaigns that can lead eventually to behavioral changes in the general public is a work in progress.

PRIVATE SECTOR ENGAGEMENT: In most of the pilot projects, private sector participation was substantial, and opened highly interesting avenues and commitments for e-waste management. Here the multinational producers and their representatives in the countries (importers, national associations), as well as the local private sector engaged in waste collection and recycling, all play crucial roles. Extended Producer Responsibility (EPR) – a strategy for assigning more financial and physical responsibility to the private sector – has become part of the legislation of many countries, and,

Corporate Social Responsibility standards have become commonplace for many industries. The direct impact of the PACE on the developments in the countries is difficult to quantify, but many interlocutors mentioned their work with the private sector as innovative and effective.

3. Lessons Learned

LEGISLATION AND POLICY FRAMEWORKS AND STRATEGIES: With policy frameworks and legislation being the essential elements for addressing e-waste, partnerships like PACE can be expected to get the most traction in this area. But then, these legislative and policy processes take longer to unfold than the scope of a typical PACE pilot project. Thus, quantifying the direct impact of the PACE in this area is rather difficult. Still, during the period of the PACE partnership, enormous progress was made in all the regions with regard to policy frameworks, legislation, strategy and EPR. These catalytic efforts need to be continued in one way or another to achieve sustainability, and existing legislation needs to be analyzed for potential impacts on the generation and handling of e-waste (the importing of second-hand electronic goods, for example). This should, however, not be seen as a reason to prolong PACE pilot projects, since their main intention is to stimulate innovation and catalyze change.

ACCESSIBILITY OF THE GUIDELINES: Producing the guidelines in local languages is an essential first step, and the project produced versions in English, French, Spanish, Serbian and Romanian. Helping the target audiences – in the case of the PACE this covers a very wide range of stakeholders from government officials (local, national, regional), private enterprises as well as a more general public audience engaged in waste collection 'on the ground' - understand the guidelines is also essential, and the use of cartoons, animated movies or other media may be appropriate. Some of the pilot projects produced excellent spin-off products that have contributed considerably to the spread of the concepts and guidelines. Future partnerships may want to develop concise, visual "advocacy kits" for further dissemination at an early stage.

SPECIFIC ACTIONS: Concrete and tangible e-waste efforts, such as the installation of collection points, events at schools and training in technology, have greatly enhanced the visibility of the issue and triggered action. Such activities also help us gain insights into what actually does and does not work. On the other hand, the purpose of a global partnership should not be to establish collection points or disseminate waste bins, unless these activities are linked to a wider national or regional programme ensuring sustainability in one way or another.

EVIDENCE, DATA, INFORMATION: Dealing effectively with e-waste in a country requires relatively precise estimates of volumes, and information for decision-makers and the public needs to be based on simple, understandable facts and figures. The design of appropriate collection facilities, and investments in assembly and refurbishment depend on good information, as will plans for full metal recovery whether in-country, in-region or through appropriate export. Some of the PACE projects have contributed to this effort.

Beyond hard data on quantity, the PACE has also helped to gather behavioral evidence. In some parts of the world, people prefer to store obsolete equipment at home rather than bringing it to a collection point. This because they believe it still has some value or that the equipment may still work or that they should be compensated for having it collected. Many of the interview subjects stressed the importance of evidence and data visualization for decision-makers.

IMPLEMENTATION: The Basel Convention Regional Centres (BCRC) implemented the PACE pilot projects – with the exception of Jordan – through national focal points in the countries. This project structure is efficient in terms of identifying the regional needs and mobilizing expertise and project implementation. The BCRCs also play an important role for the activities sustainability. One drawback of this project structure maybe the longer project pathways that may be responsible for some of the project delays. In addition, the role and responsibilities of the regional centre's (BCRC) and their impact on country activities was not uniform across regions, some countries have indicated that they would prefer to work directly with the BRS secretariat in Geneva. Whatever drawbacks there are, e-waste is an issue to be dealt with regionally (and globally) and in this respect, the BCRCs are an invaluable asset for project delivery.

4. Summary of Finding

The PACE partnership addressed e-waste issues on a global, broad and comprehensive range, with the main focuses on creating a platform for exchange and on developing global guidelines on e-waste.

In this context, the PACE pilot projects can be seen as a mixed basket of activities to – with quite limited funding – bring guidelines to action. The projects spawn an enormous range of activities – from regional awareness-raising and partnerships to support for the development of national legislation to the engagement and capacity-building of the private sector, and finally to local activities on awareness-

raising, education and physical waste collection. While such a comprehensive and integrated approach can be a powerful vehicle to spread innovation, there is always a risk of spreading resources too thin, leaving a lot of work undone. In this context, leverage with various other initiatives and actors is key, and in this respect the PACE has done an excellent job. One factor for this success was good timing: with the consumer electronic boom, the PACE was surfing on the e-waste wave. Almost all the PACE-initiated activities have found continuation in one way or another, ranging from the development of regional strategies, sustainable partnerships with the private sector, development and adoption of national legislation including EPR, rapid growth in systematic e-waste collection, and in general increased awareness about the issue also in remote parts of the countries.

List of interviewees and interview dates (in chronological order)

Dana Lapesova, BCRC-Slovakia, 2 December 2016

Miguel Araujo, BCRC-El Salvador, 19 December 2016

Predrag Jovanovic, National Team Leader, Serbia, 11 January 2017

Koebu Khalema, BCRC-South Africa, 13 January 2017

Michel Seck, BCRC-Senegal, 20 January 2017

Rana Saleh, Nedal Alouran, UNDP Jordan, 24 January 2017

Ahmed Khan, BCRC-Trinidad and Tobago, 25 January 2017

Tatiana Tugai, Environmental Pollution Prevention Office, MoE, Moldova, 27 January 2017