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Consideration and further development of work commenced during the intersessional period: development of waste stream fact sheets

Development of waste stream fact sheets

Note by the Secretariat

1. The terms of reference for the expert working group on the framework for the environmentally sound management (ESM) of hazardous wastes and other wastes contained in annex II to decision BC-11/1 requests the expert working group to, among other things, identify ESM elements and develop practical guidance in the context of relevant national systems and structures, on certain waste streams (to be decided by the expert working group). At its first meeting, the expert working group requested the Secretariat retain a consultant to develop fact sheets on the ESM of priority waste streams.

2. The annex to the present note contains draft waste stream facts sheets on medical/healthcare waste and on used lead-acid batteries. This information has not been formally edited by the Secretariat and is presented as received.

* UNEP/CHW/CLI_EWG.2/1.

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Annex

I. Medical or healthcare waste

1. Waste Stream

a. Name

Medical or healthcare waste.

b. Waste description

Healthcare waste comprises all the waste generated in healthcare establishments, research centres and laboratories related to medical procedures. Between 75% and 90% of the waste produced by healthcare providers is nonhazardous waste comparable to domestic waste; it is usually called general healthcare waste. The remaining 10–25% of healthcare waste is regarded as hazardous and may pose a variety of environmental and health risks.

Hazardous healthcare waste comprises: (1) used or unused sharps (e.g. hypodermic, intravenous or other needles; scalpels; broken glass); (2) infectious waste suspected to contain pathogens and that poses a risk of disease transmission (e.g. waste contaminated with blood and other body fluids; laboratory cultures and microbiological stocks; waste including excreta and other materials that have been in contact with patients infected with highly infectious diseases in isolation wards); (3) pathological waste (e.g. human tissues, organs or fluids; body parts; foetuses; unused blood products); (4) pharmaceutical and cytotoxic waste (e.g. pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals; waste containing cytostatic drugs; genotoxic chemicals); (5) chemical waste (e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents; broken thermometers and blood-pressure gauges); (6) radioactive waste (e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources).

c. Information on waste / non-waste classification

National provisions concerning the definition of waste may differ and, therefore, the same material may be regarded as waste in one country but as non-waste in another country. Determining whether a substance or object is or not a waste may not always be straightforward; however, it is ultimately the mandate of the national competent authority on waste to decide when an item is to be defined as waste or non-waste. Further work on clarifying this matter under the Basel Convention is in progress ([1]).

d. Classification under the Basel Convention (Annexes I, II, III, VIII and/or IX)

Healthcare waste belong to category Y1—clinical wastes from medical care in hospitals, medical centres and clinics —in Annex I, and is further classified as A4020 in Annex VIII—clinical and related wastes; that is wastes arising from medical, nursing, dental, veterinary, or similar practices, and wastes generated in hospitals or other facilities during the investigation or treatment of patients, or research projects. However, healthcare waste comprises a broad range of materials, many of which should be classified under other categories. For example: (i) hazardous waste pharmaceuticals should be classified under the Y3 category—waste pharmaceuticals, drugs and medicines—and as A4010—wastes from the use of pharmaceutical products—; (ii) used fixer and developer solution from X-ray diagnostics, fall under category Y16, “wastes from…use of photographic chemicals and processing materials”; (iii) wastes containing solvents belong to categories Y6 (“wastes from the…use of organic solvents”) and Y41 or Y42 (halogenated solvents and non-halogenated solvents), which may be further classified as A3150 and A3140, respectively; (iv) a disinfected, or unused, medical device containing a nickel-cadmium battery should be classified as Y26 in Annex I, “cadmium; cadmium compounds”, and assigned to Annex VIII entry A1180, “waste electrical and electronic assemblies…containing components such as accumulators and other batteries included on list A”.

Healthcare waste which poses a risk of infection, by definition possesses the hazardous property H6.2—infectious substances. Most cytotoxic drugs are teratogenic (H10), and all may cause toxicity (H6.1); the

full list of hazards will depend on the individual medicine. Amalgam waste from dental care is hazardous from mercury, and to a lesser extent from the other constituents of the amalgam (e.g. silver and tin); hazard H13 applies as chemical or thermal processes used for its disposal may liberate mercury from the amalgam. Developer and fixer solutions may be toxic (H6), corrosive (H8) or ecotoxic (H12). Medical devices containing nickel-cadmium batteries are likely to possess hazard characteristics H6.1, H8, H11, H12 and H13, arising from cadmium, nickel and potassium hydroxides.

Wastes which, as a result of being radioactive, are subject to other international control systems, including international instruments, applying specifically to radioactive materials, are excluded from the scope of the Basel Convention.

e. Basel Convention guidelines and other guidelines/instruments

General guidelines:

– SBC Technical Guidelines on the Environmentally Sound Management of Biomedical and Healthcare Wastes (Y1; Y3) – Available at http://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/AdoptedTechnicalGuidelines/tabid/2376/Default.aspx

– WHO Safe Management of Wastes from Healthcare Activities (Second Edition) – Available at http://apps.who.int/iris/handle/10665/85349

– WHO-UNEP/SBC Preparation of National Healthcare Waste Management Plans in Sub-Saharan Countries: Guidance Manual – Available at http://www.who.int/water_sanitation_health/medicalwaste/guidmanual/en/

– International Committee of the Red Cross (ICRC) Medical Waste Management – Available at http://www.icrc.org/eng/assets/files/publications/icrc-002-4032.pdf

– SBC Draft Guidance Paper on Hazard Characteristic H6.2 (Infectious Substances) – Available at http://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/AdoptedTechnicalGuidelines/tabid/2376/Default.aspx

National guidelines:

– UK Department of Health Safe Management of Healthcare Waste (Health Technical Memorandum 07-01) – Available at https://www.gov.uk/government/publications/guidance-on-the-safe-management-of-healthcare-waste

– Hong Kong Environmental Protection Department Code of Practice for the Management of Clinical Waste for Major Clinical Waste Producers and Waste – Available at Collectorshttp://www.epd.gov.hk/epd/clinicalwaste/nonflash/english/downloads/document.html

– Philippines Department of Health Manual on Healthcare Waste Management – Available at http://www.wpro.who.int/philippines/publications/health_care_waste_management_manual_3rd_ed.pdf

– Waste Management Association of Australia Industry Code of Practice for the Management of Clinical and Related Wastes – Available at http://www.epa.vic.gov.au/business-and-industry/guidelines/waste-guidance/clinical-waste-guidance

Waste-specific guidelines:

– UNDP/GEF Guidance on the Cleanup, Temporary or Intermediate Storage, and Transport of Mercury Waste From Healthcare Facilities – Available at http://www.gefmedwaste.org/downloads/Guidance%20on%20Cleanup%20Storage%20and%20Transport%20of% 20Mercury%20from%20Health%20Care%20July%202010.pdf

– WorkSafe New Zealand Guidelines for the Safe Handling of Cytotoxic Drugs and Related Waste – Available at http://www.business.govt.nz/worksafe/information-guidance/all-guidance-items/cytotoxic-drugs-and-related-wastes-guidelines-for-the-safe-handling-of

– Government of South Australia Safe Handling of Cytotoxic Drugs and Related Wastes – Available at http://www.sahealth.sa.gov.au/wps/wcm/connect/Public+Content/SA+Health+Internet/Clinical+resources/Clinical+topics/Medicines+and+drugs/Hazardous+drugs/Hazardous+drugs

– United States EPA Draft Guidance Document: Best Management Practices for Unused Pharmaceuticals at Healthcare Facilities – Available at http://water.epa.gov/scitech/wastetech/guide/upload/unuseddraft.pdf

Disposal guidelines:

– IETC-UNEP Compendium of Technologies for Treatment/Destruction of Healthcare Waste. – Available at http://www.unep.org/ietc/InformationResources/Publications/Heathcarewastecompendium/tabid/106702/Default.aspx

– UNEP Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices Relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Waste Incinerators – Available at http://chm.pops.int/Implementation/BATBEP/BATBEPGuidelinesArticle5/tabid/187/Default.aspx

– European IPPC Bureau Reference Document on Best Available Techniques for the Waste Treatments Industries – Available at http://eippcb.jrc.ec.europa.eu/reference/

– European IPPC Bureau Reference Document on Best Available Techniques for Waste Incineration – Available at http://eippcb.jrc.ec.europa.eu/reference/

2. Waste Management

a. Segregation

Segregation should be carried out by the producer of the waste (e.g. nurses, physicians and technicians) as close as possible to its place of generation (bedsides, operating theatres, laboratories, etc.).

Ideally, the same system of segregation should be in force throughout a country, and many countries have national legislation that prescribes the waste segregation categories to be used and a system of colour coding for waste containers. Where there is no national legislation, the World Health Organization (WHO) segregation scheme is recommended: (1) highly infectious waste, should be placed in yellow, autoclavable, leak-proof plastic bags or containers, that are marked “HIGHLY INFECTIOUS” and with the biohazard symbol; (2) other infectious waste, pathological and anatomical waste, in yellow leak-proof plastic bags or containers labelled with the biohazard symbol; (3) sharps, in yellow puncture-proof containers marked “SHARPS” and with the biohazard symbol; (4) chemical and pharmaceutical waste, in brown plastic bags or rigid containers, labelled with the appropriate hazard symbols; (5) low-level radioactive waste labelled with the radiation symbol, packaged in line with transport requirements; (6) general nonhazardous healthcare waste, in black plastic bags. The use of internationally recognized symbols and signs is of very basic importance and is essential for the safety of handling and disposal of waste.

For segregation systems to work effectively, it is important that staff be provided with the necessary training, support and equipment, including appropriate colour-coded and labelled waste containers. Staff should never attempt to correct segregation errors by removing items from a bag or container; if general and hazardous wastes are accidentally mixed, the mixture should be managed as hazardous healthcare waste.

b. On-site collection

Collection should be daily for most wastes, with collection timed to match the pattern of waste generation during the day; the collection period should ensure that odours from the waste do not cause nuisance. Collection should take place during the less busy times and using set routes to prevent exposure to staff and patients. The use of waste chutes is not recommended, because they can increase the risk of transmitting airborne infections. To prevent contamination, general waste should not be collected at the same time or using the same equipment as used for infectious or other hazardous wastes. Trucks, trolleys, tugs or

wheeled containers used to transport waste receptacles should be easy to clean and drain, and should contain any leakage from damaged containers or receptacles.

Waste bags and sharps containers should be filled to no more than three quarters full. Once this level is reached, they should be sealed ready for collection. Plastic bags should be tied or sealed with a plastic tag or tie. Replacement bags or containers should be available at each waste-collection location so that full ones can immediately be replaced.

Waste bags and containers should be labelled with the date, type of waste and point of generation to allow them to be tracked through to disposal. Where possible, weight should also be recorded.

Hazardous waste generated in medical areas should be stored in designated locations near to those areas (but away from patients and public access) and should be sufficient in size to allow different waste streams to be clearly separated, such that a leak from one waste category cannot contaminate the contents or packaging of another. From here, the waste can be collected conveniently and transported to a central storage facility. Another possibility for interim storage is a closed container stationed indoors, within or close to a medical area; storage containers used for infectious waste should be preferably lockable. Containers should not be allowed to accumulate in places accessible to unauthorised personnel or members of the public.
Transport staff should wear adequate personal protective equipment, gloves, strong and closed shoes, overalls and masks.

c. Storage

The WHO recommends that central storage areas within healthcare facilities should: (1) have an impermeable, well-drained hard-standing floor, that is easy to clean and disinfect; (2) include the means to keep general waste separated from infectious and other hazardous waste; (3) have a water supply for cleaning purposes; (4) be readily accessible to authorised personnel, and be lockable to prevent access by unauthorized persons; (5) have easy access for waste-collection vehicles; (6) be sheltered from the sun; (7) be secure from entry by animals and free from insect or rodent infestations; (8) be well-lit and ventilated; (9) be sited away from food preparation and general storage areas; (10) have a supply of cleaning equipment, protective clothing and waste bags or containers located conveniently close to the storage area; (11) have washing facilities readily available for the staff; (12) be cleaned at least weekly; (13) have spillage containment equipment; (14) be appropriate to the quantities of waste generated and the frequency of collection (off-site transport). In addition, storage facilities should be labelled in accordance with the hazard level of the stored waste.

To prevent putrefaction, the following maximum storage times are suggested by the WHO: (i) temperate climate: 72 or 48 hours in winter and summer, respectively; (ii) warm climate: 48 or 24 hours during the cool and hot seasons, correspondingly. If the waste is to be stored for longer than a week, refrigerated storage should be available to keep infectious waste at a temperature no higher than 8 °C. The floors and walls of infectious waste storage areas should allow easy disinfection. Pathological waste storage places should have the same conditions as those for infectious and sharps wastes.

The storage place for hazardous chemical waste should be separated from other waste storage areas, and the following separate storage zones should be available to prevent reactions between incompatible wastes: explosive waste; corrosive acid waste; corrosive alkali waste; toxic waste; flammable waste; oxidative waste; halogenated solvents; non-halogenated solvents. Pharmaceutical waste should be segregated from other wastes and domestic regulations followed for disposal (e.g. controlled drugs or antibiotics). Cytotoxic waste should be stored separately in a designated secure location.

Hazardous waste should be labelled with the following information: hazard symbol(s), waste classification, date, and point of generation (if applicable).

Generally, a permit/licence is not required for the storage of waste on the site where it was produced, however it is recommended that storing non-infectious hazardous waste for a period greater than 180 days or in quantities greater than 1000 kg should be licensed and regulated as waste storage facilities.

d. Packaging and labelling

Hazardous waste should be packed in good quality packaging that is strong enough to withstand the shocks and loadings normally encountered during transport; it should also prevent any loss of contents which may be caused under normal conditions of transport—by vibration or by changes in temperature, humidity or pressure.

Waste packages transported offsite should be identified using the most appropriate United Nations (UN) number and the proper shipping name, and should be assigned to a class of dangerous goods. Information on the packing group, packing instructions and any special packing provisions that apply may be found in the United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations, or equivalent national standard or legislation.

Most clinical waste will be transported as UN 3291—clinical waste, unspecified, not otherwise specified (N.O.S.) or (bio)medical waste, N.O.S. or regulated medical waste, N.O.S.—, classified in Division 6.2 and will be subject to the packing requirements P621, IBC620 and LP621 ([2]). For the purpose of transport regulations, pharmaceutical waste may be classified in Division 6.1 and assigned to UN 1851—waste medicine, liquid, toxic N.O.S.—or UN 3249—waste medicine, solid, toxic N.O.S.—, or classified in Class 3 and assigned to UN 3248—waste medicine, liquid, flammable, toxic N.O.S.—, and will be subject to packing requirements P001 or P002. These last three entries are however generic and will not be appropriate for all medicines (e.g. cytotoxics and cytostatic); in most cases, material safety data sheets (MSDS) should show the appropriate transport classification. Dental amalgam should be transported as UN 2025—waste mercury compound, solid, N.O.S.—, classified in Division 6.1, and subject to packing requirements P002, IBC08 and LP02. Product MSDS or original container labels will normally indicate the appropriate UN number for other waste substances.

e. Transportation

Transport of healthcare waste should be in conformity with national legislation. Where there are no such regulations, responsible authorities should refer to the latest revised edition of the United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations ([3]).

Vehicles or containers used for transporting healthcare waste should not be used for transporting any other material. Vehicles should be kept locked at all times, except when loading and unloading, and kept properly maintained. The internal finish of the vehicles should allow them to be steam-cleaned or disinfected following leakages or spills, and at regular intervals. There should be a suitable system for securing the load during transport. Refrigerated containers could be used if the storage time exceeds the recommended limits described previously, or if transportation times are long.

Transport vehicles should be properly marked with placards (international hazard signs) identifying the type of waste that is being transported. Empty plastic bags, suitable protective clothing, cleaning equipment, tools and disinfectant, together with special kits for dealing with liquid spills, should be provided for the transport personnel, who should be trained in its emergency use.

Hazardous waste manifests or consignment notes must accompany each shipment of hazardous waste in accordance with national law, until it reaches its final destination. On completion of a journey, the transporter should complete the hazardous waste manifest form and return it to the healthcare establishment. If the waste regulatory authority is sufficiently well established, it may be possible to pre-notify the agency about a planned offsite transport and disposal of hazardous healthcare waste and to obtain the agency's approval.

Emergency response information—Emergency Response Intervention Cards (ERICards) ([4]), Emergency Response Guides ([5])—should accompany shipments of hazardous waste to provide guidance on initial actions in response to a transport accident.

3. Disposal Operations (Annex IV, Sections A and B)

a. Best available techniques (BAT) and best environmental practices (BEP)

Healthcare facilities should ensure that they send their waste to disposal facilities that are properly licensed. Disposal facilities should meet all basic requirements to ensure an environmentally sound management

(ESM) of wastes and commit to continual improvement in their operations. A facility should have the following, which should meet the approval of the competent authorities: (a) appropriate design and location; (b) an environmental and social impact assessment, where appropriate; (c) sufficient measures in place to safeguard occupational safety and health, including an appropriate and adequate training programme for its personnel; (d) sufficient measures in place to protect the environment; (e) an applicable environmental management system (EMS) in place, if feasible and appropriate; (f) an adequate and transparent monitoring, recording, reporting and evaluation programme; (g) an adequate emergency plan and response mechanism; (h) an adequate plan for closure and aftercare. ([6])

Healthcare waste treatment should be viewed in the context of the waste (management) hierarchy, with waste prevention (avoidance) being the most desirable option and final disposal the least preferred approach. Best practice waste management should aim to avoid or recover as much of the waste as possible. The treatment of infectious healthcare waste is intended to render the waste non-infectious or less infectious prior to final disposal, and when evaluating treatment technologies for healthcare waste (regardless of size or technology used), the ability to destroy pathogens is a critical factor. For infectious waste, the treatment must demonstrate, as a minimum, inactivation of vegetative bacteria, fungi, lipophilic/hydrophilic viruses, parasites, and mycobacterium at a 6 $\log_{10}$ reduction or greater, and inactivation of *Geobacillus stearothermophilus* (formerly called *Bacillus stearothermophilus*) spores and *Bacillus atrophaeus* (formerly *Bacillus subtillis var. niger*) spores at a 4 $\log_{10}$ reduction or greater—Level III microbial inactivation ([7]). The ability to achieve this should be demonstrated for the worst-case challenge load. Regular testing is important to ensure that adequate levels of disinfection are achieved.

Human pathological wastes, human blood and blood products, cultures and stocks of infectious agents, contaminated animal waste, isolation wastes and sharps, may be treated by incineration using best available techniques (BAT) and best environmental practices (BEP). However, when deciding which disposal method to use, priority consideration should be given to processes, techniques or practices that avoid the formation and subsequent release of unintentional POPs, such as steam sterilization, advanced steam sterilization, microwave treatment, dry-heat sterilization, alkaline hydrolysis and biological treatment ([8]); these techniques still require final disposal in sanitary landfills. In some countries anatomical waste, particularly recognizable body parts or foetal material, must also be rendered unrecognisable before landfilling. Infectious waste that has been appropriately treated to render it non-infectious is no longer considered infectious for handling and disposal purposes.

Incineration technologies considered BAT—dependent on local conditions—for the prevention or minimization of the formation and subsequent release of unintentional POPs include pyrolysis plants, rotary kilns, grate incinerators, fluidized bed incinerators, and modular systems; single-chamber, drum and brick incinerators are not considered BAT. Best environmental practices (BEP) include source reduction, segregation, resource recovery and recycling, training, and proper collection and transport. Implementation of BAT requires measures to prevent (or minimize) the formation of POPs (primary measures) and additional measures to prevent these compounds from entering the environment (secondary measures). With a suitable combination of primary and secondary measures, air emission levels of PCDD/PCDF no higher than 0.1 ng I-TEQ/Nm^3 (at 11% O_2) may be achieved ([9]). The primary measures are to: (1) introduce the waste into the combustion chamber only at temperatures of 850 °C; (2) install auxiliary burners for start-up and shut-down operations; (3) avoid regular start-up and shut-down of the incineration process; (4) avoid combustion temperatures below 850 °C and cold regions in the flue gas; (5) control oxygen input depending on the heating value and consistency of feed material; (6) maintain minimum residence time of two seconds above 850 °C in the secondary chamber after the last injection of air or at 1100 °C for wastes containing more than 1% halogenated organic substances (generally the case for healthcare waste) and 6% O_2; (7) maintain high turbulence of exhaust gases and reduction of excess air by injection of secondary air or recirculated flue gas, preheating of the air-streams or regulated air inflow; (8) conduct online monitoring for combustion control (temperature, oxygen, carbon monoxide, dust), and operation and regulation of the incinerator from a central console. The secondary measures to further reduce PCDD/PCDF are an appropriate combination of dust-removal equipment and other techniques, such as catalytic oxidation, gas quenching and wet or (semi) dry adsorption systems. Furthermore, fly and bottom ash, as well as wastewater, should be treated appropriately.

A compendium of technologies for the treatment/destruction of healthcare waste, published by the International Environmental Technology Centre of the United Nations Environment Program (IETC-UNEP), presents an overview of generic treatment technologies, and provides detailed information on

specific technologies ([10]); the compendium outlines a process of technology selection based on UNEP's Sustainable Assessment of Technologies (SAT) methodology ([11]). For a detailed analysis of what represents BAT for waste incineration reference should be made to the Reference Document on the Best Available Techniques for Waste Incineration published by the European Integrated Pollution Prevention and Control (IPPC) Bureau ([12]).

General healthcare waste, if properly segregated from hazardous waste, can be disposed of through municipal waste disposal systems.

4. Sustainable Materials Management (SMM)

a. Extended Producer Responsibility (EPR)

Healthcare facilities should develop partnerships with product manufacturers (of both clinical and general goods) to initiate EPR collection programmes.

– Canada: In Ontario, a regulation for the collection of post-consumer waste pharmaceuticals and sharps implements an EPR approach that requires producers of pharmaceuticals and sharps (e.g., manufacturers, brand owners and importers selling in Ontario) to be responsible for the management of the wastes resulting from their products (i.e. unused or expired pharmaceuticals, or used, unused or expired sharps), ensuring that consumers have access to convenient locations to return waste pharmaceuticals and sharps. The Ontario Sharps Collection Program (OSCP), administered by the Health Products Stewardship Association (HPSA), addresses EPR for all types of sharps sold for use in the province of Ontario but is limited to the "consumer" waste stream ([13]).The Ontario Medications Return Program (OMRP) covers the costs associated with the responsible disposal of health products returned by the public ([14]).The Alberta ENVIRx Program, British Columbia Medications Return Program (BCMRP), Manitoba Medications Return Program (MMRP) are similar province-wide programmes.

– United States: Alameda County, California, requires drug manufactures and producers that sell, offer for sale, or distribute certain prescription drugs in the county to participate in a Product Stewardship Program. The program must include a process for the collection and disposal of Unwanted Products from residential prescription drug consumers ([15]).

b. Environmentally preferable purchasing (EPP)

EPP refers to the purchase of the least damaging products and services, in terms of environmental impact. At its simplest, EPP may lead to the purchase of recycled paper, through to more sophisticated measures such as the selection of medical equipment based on an assessment of the environmental impact of the equipment from manufacture to final disposal.

c. Green procurement

Reducing the toxicity of waste is also beneficial, by reducing the problems associated with its treatment or disposal. For example, management at a healthcare facility could investigate the possibility of purchasing plastics that may be easily recycled, or order goods supplied without excessive packaging.

Procurement programmes for mercury-free products should be encouraged in order to pursue waste prevention and promote uses of mercury-free products and products containing less mercury. Purchasing practices should aim "to purchase mercury-free products," except in the few cases where alternatives to mercury-added products are practically or technologically unavailable, or "to purchase products whose mercury content is minimized". In some cases, financial incentives could be used to encourage green procurement programmes. Some states in the United States, for instance, have subsidized the purchase of mercury-free thermometers

5. Legislation

a. Existing national, regional and international legislations

– United States (Environmental Protection Agency): Emission Guidelines and Compliance Times for Hospital/Medical/Infectious Waste Incinerators (40 CFR Part 60, Subpart Ce); Standards of Performance for New Stationary Sources: Hospital/Medical/Infectious Waste Incinerators (40 CFR Part 60, Subpart Ec);

and Federal Plan Requirements for Hospital/Medical/Infectious Waste Incinerators Constructed on or Before December 1, 2008 (40 CFR Part 62, Subpart HHH), available at http://www.epa.gov/ttn/atw/129/hmiwi/rihmiwi.html. Some states, such as Arkansas (http://www.healthy.arkansas.gov/aboutADH/RulesRegs/MedWasteReg.pdf), Connecticut (http://www.sots.ct.gov/sots/lib/sots/regulations/title_22a/209.pdf), Delaware (http://regulations.delaware.gov/AdminCode/title7/1000/1300/Split1301/1301.pdf), Massachusetts (http://www.mass.gov/eohhs/docs/dph/regs/105cmr480.rtf) and Rhode Island (http://www.dem.ri.gov/pubs/regs/regs/waste/medwaste10.pdf), require either incineration or interment—the disposition of waste by burial or cremation according to standards and practices of the mortuary industry—for pathological waste. Other states, such as California (http://www.cdph.ca.gov/certlic/medicalwaste/Documents/MedicalWaste/2013/MWMAfinal2013.pdf), Texas (http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=25&pt=1&ch=1&rl=136) and Hawaii (http://gen.doh.hawaii.gov/sites/har/AdmRules1/11-104-1final.pdf) allow alternative treatment methods.

– Canada: Québec (Ministry of Sustainable Development, Environment and Parks) “Regulation Respecting Biomedical Waste” (CQLR chapter Q-2, r.12); available at http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=3&file=/Q_2/Q2R12_A.htm. Ontario (Ministry of the Environment) “Collection of Pharmaceuticals and Sharps: Responsibilities of Producers” (Ontario Regulation 298/12); available at http://www.e-laws.gov.on.ca/html/source/regs/english/2012/elaws_src_regs_r12298_e.htm

– Ethiopia (Food, Medicine and Health Care Administration and Control Authority): Healthcare Waste Management Directive No.16/2013. Available at http://www.fmhaca.gov.et/standardsdirectivesguidelines.html

– India (Ministry of Environment and Forests): Bio-Medical Waste (Management and Handling) Rules, 1998, and the Bio-Medical Waste (Management and Handling) (Amendment) Rules, 2003. Available at http://www.moef.nic.in/hazardous_substances_management

– Chile (Ministry of Health): Regulation on Handling Waste from Healthcare Establishments (Supreme Decree No. 6/2009) as amended by Supreme Decrees No.64/2010 and No.24/2012. Available at http://www.leychile.cl/Navegar?idNorma=1008725 (in Spanish)

6. Capacity and Feasibility

Ideally, a government should identify the resources needed to build up a national network of disposal facilities for healthcare waste. At present, there are four basic options for managing healthcare waste treatment: (1) an onsite treatment facility in each healthcare establishment; (2) regional or cooperative healthcare waste-treatment facilities, supplemented by individual facilities for outlying hospitals; (3) treatment of healthcare waste in existing industrial or municipal treatment facilities (e.g. municipal facilities), where these exist; (4) partial treatment undertaken onsite, and remaining waste treated offsite. Each option has advantages and disadvantages, and the suitability of each option should be considered in a national plan. A national or regional plan should account for local circumstances, such as the number, location, size and type of healthcare establishments, quality of the road network, and financial and technical resources available in each area.

7. Permitting

A national policy document should form the basis for developing the law and should be complemented by technical guidelines developed for implementation of the law. This legal “package” should specify regulations on the treatment of different waste categories; segregation, collection, storage, handling, disposal and transport of waste; and responsibilities and training requirements. The national policy should take into account the resources and facilities available in the country concerned and any cultural aspects of waste handling. A national law on healthcare waste management may stand alone, or constitute part of more comprehensive legislation. A national law should include the following elements: a clear definition of hazardous healthcare waste and its various categories; a precise indication of the legal obligations of the healthcare waste producer regarding safe handling and disposal; specifications for record keeping and reporting; establishment of permit or licensing procedures for systems of treatment and waste handling;

specifications for an inspection system and regular audit procedures to ensure enforcement of the law and for penalties to be imposed for contravention; designation of courts responsible for handling disputes arising from enforcement of, or non-compliance with, the law.

8. Enforcement

ESM of wastes requires a regulatory and enforcement infrastructure that ensures compliance with legal instruments and standards. Consideration should be given to a national policy that includes provisions to allow prompt, adequate and effective enforcement actions to be undertaken, including sanctions and penalties that will serve as a deterrent to non-compliance.

Measures should be in place to ensure adequate monitoring, inspection and enforcement of waste imports and exports subject to the requirements of the Basel Convention, by agents of the State and cooperation with enforcement agencies in other States (to prevent illegal traffic). Adequate penalties and sanctions for illegal traffic should discourage such movements in the future.

9. Certification and Auditing Systems

Healthcare facilities can build an EMS on many of the organization's practices already in place through other requirements such as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and other regulatory requirements. In the United States, most healthcare facilities are guided by the JCAHO Environment of Care standards which contain numerous opportunities for managing environmental operations, procedures and staff training

It is recommended that licensed waste management facilities should be subject to annual inspections and/or audits by a recognised independent auditor. The objective of the inspection and/or auditing procedure would be to: check conformance of the facility with all basic requirements to ensure an ESM of wastes, with relevant environmental regulations, and, if applicable, current EMS systems. Verifying compliance with existing laws and regulations is embodied in the European Community Eco-Management and Audit Scheme (EMAS). Under ISO 14001, a facility is required to know whether or not it is in compliance with applicable laws and regulations; without that knowledge, the facility would be considered out of conformance with that ISO standard. The inspection and/or audit should also assess the performance of the facility with respect to environment, health and safety objectives ([16]).

In Germany, waste facilities may be certified as "Entsorgungsfachbetrieb" (specialised waste management companies) according to the requirements set out in the Ordinance on Specialised Waste Management Companies (EfbV) ([17]).

10. Transboundary Movements

Governments should put in place legal requirements to implement and enforce the provisions of relevant international and/or regional instruments in relation to the transboundary movement of wastes (pre-notification, etc.), including the Basel Convention.

Transboundary movements of wastes for management in another country cannot be assured to result in ESM by evaluating receiving facilities alone. Elements such as those for effective legal systems, government oversight and other infrastructure to protect the occupational health and safety of workers, communities and the environment, should also be considered. Transboundary movements of wastes should not be considered to be legal where there is a reason to believe the waste in question will not be managed according to ESM.

Notifications received by the Secretariat of the Basel Convention from Parties—pursuant to Article 13 of the Convention—on decisions to prohibit or restrict the import/export of hazardous or other wastes are published on the website of the Secretariat ([18]).

II. Used lead-acid batteries (ULABs) or spent lead-acid batteries (SLABs)

1. Waste Stream

a. Name

Used lead-acid batteries (ULABs) or spent lead-acid batteries (SLABs).

b. Waste description

ULABs are a well-defined type of hazardous waste and there is detailed knowledge about their composition. Batteries used in cars typically weigh between 10 kg and 30 kg, while those used in trucks can weight up to 70 kg. Moreover, they may be used as traction batteries for electric vehicles and for industrial purposes. The electrolyte—a dilute solution of sulphuric acid—content is about 15–25 wt% and the lead content is about 65–75 wt%. The lead is in the form of plates of pure lead or lead alloys covered with a layer of lead oxide and lead sulphate.

c. Information on waste / non-waste classification

National provisions concerning the definition of waste may differ and, therefore, the same material may be regarded as waste in one country but as non-waste in another country. Determining whether a substance or object is or not a waste may not always be straightforward; however, it is ultimately the mandate of the national competent authority on waste to decide when an item is to be defined as waste or non-waste. Further work on clarifying this matter under the Basel Convention is in progress ([19]).

Notwithstanding the above, batteries that are unable to be charged or to hold power, or are cracked and there is a possibility of leakage, are deemed unusable and should be managed as hazardous waste.

d. Classification under the Basel Convention (Annexes I, II, III, VIII and/or IX)

ULABs belong to category Y31—lead; lead compounds—in Annex I, and are further classified as A1160 in Annex VIII—waste lead-acid batteries, whole or crushed. Drained sulphuric acid electrolyte should be classified under the Y34 category, “acidic solutions or acids in solid form”; used lead-acid batteries can also be classified as Y34 if the acid was not drained. Used lead-acid batteries are likely to possess hazard characteristics H6.1, H8, H11, H12 and H13 in Annex III. The primary immediate hazard from battery electrolyte is corrosivity (H8).

e. Basel Convention guidelines and other guidelines/instruments

General:

– Technical Guidelines for the Environmentally Sound Management of Waste Lead-Acid Batteries – Available at http://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/AdoptedTechnicalGuidelines/tabid/2376/Default.aspx

– Training Manual for the Preparation of National Used Lead Acid Batteries Environmentally Sound Management Plans in the Context of the Implementation of the Basel Convention – Available at http://www.basel.int/TheConvention/Publications/TrainingManuals/tabid/2363/Default.aspx

– Practices and Options for Environmentally Sound Management of Spent Lead-acid Batteries within North America – Available at http://www3.cec.org/islandora/en/item/2323-practices-and-options-environmentally-sound-management-spent-lead-acid-batteries

Secondary lead smelting:

– Technical Guidelines on the Environmentally Sound Recycling/Reclamation of Metals and Metal Compounds (R4) – Available at http://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/AdoptedTechnicalGuidelines/tabid/2376/Default.aspx

– Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices Relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Thermal Processes in the Metallurgical Industry not Mentioned in Annex C, Part II – Available at http://chm.pops.int/Implementation/BATBEP/BATBEPGuidelinesArticle5/tabid/187/Default.aspx

– Reference Document on Best Available Techniques for the Waste Treatments Industries – Available at http://eippcb.jrc.ec.europa.eu/reference/

– Reference Document on Best Available Techniques for the Non-ferrous Metals Industries – Available at http://eippcb.jrc.ec.europa.eu/reference/

2. Waste Management

a. General handling

Appropriate personal protective equipment (PPE) should be worn, and Materials Safety Data Sheet (MSDS) should be readily available for employees to seek additional information about potential hazards and the appropriate corrective action in the event of an accident.

ULABs must be stacked in an upright orientation with all the vent and inspection caps firmly in place so that acid is not spilled. Batteries that are “damaged”—cracked, broken, or missing any caps—should be placed in a clear, heavy-duty polyethylene bag—provided they are not visibly leaking electrolyte— that is securely closed or in an acid-resistant container. Batteries that are leaking electrolyte should be placed in a suitable plastic container.

ULABs should be stored, handled and transported in accordance with domestic hazardous waste, dangerous goods and workplace health and safety legislation.

b. Collection

– Simplified reverse-distribution system (reverse logistics): ULABs are returned by consumers to retailers, where they are stored until transported to the waste facility. It is better suited to circumstances where the facility is relatively close to the collection points.

– Collectors’ system: This system relies on the premise that retailers, after the collection of ULABs, will use a specialised collectors’ network that will deliver the ULABs to the waste management facility. Different from the simplified reverse-distribution system, the role played by the collectors ensures that the transportation costs will not be absorbed completely by the retailers. Due to the higher number of operators in this system, its implementation allows for a wider geographic area to be served.

– Manufacturer-supported return system: The manufacturers are responsible for planning and implementing the logistics of returning the ULABs so that they can be delivered to the waste management facility. The collectors and those responsible for the transportation are linked to the manufacturers. Thus, despite the fact that the manufacturers are not directly involved with the collection and transportation of the ULABs, it remains their responsibility to provide the necessary means to accomplish these steps to a high environmental standard.

– Reverse-distribution system: ULABs are returned by consumers to retailers, picked up by wholesalers or battery manufacturers, and finally taken to waste management facilities for recovery.

c. Storage

Storage of ULABs at collection points should only be regarded as an interim measure, in order to permit time for the collection of sufficient volumes of ULABs for cost effective transportation to the disposal facility. Collection points should not store large amounts of ULABs or for a long time, as this increases the risk of accidental spills or leakage and should be avoided. It is recommended that collection points storing ULABs for a period greater than 180 days or in quantities greater than 1000 kg should be licensed and regulated as hazardous waste storage facilities.

Batteries should not be drained of electrolyte at collection points. Battery draining is a potentially hazardous activity that demands, not only special tools, containers and safety equipment, but also trained

personnel (and in most instances an effluent treatment plant). Processing ULABs for recovery by draining the electrolyte should be considered an activity that requires a hazardous waste disposal permit.

ULABs should be ideally stored inside acid-resistant containers that may also be sealed and used as the transport container, to minimize the risk of accidental spillage. However, if this is not the case, undamaged batteries should be placed on a wooden or plastic pallet and care should be taken to prevent the terminals from short-circuiting.

The following measures should be adopted: (a) the storage place should be sheltered from rain and other water sources, be equipped with an effluent collection system, and be located away from heat sources; (b) the storage place should have an impermeable surface with a curb or berm to control spills; (c) the storage place should have an exhaust ventilation system, or a fast air recirculation system, in order to avoid hazardous gas accumulation; (d) the storage place should have restricted access and be identified as a hazardous waste storing place.

ULAB collectors should ensure that they sell or send their batteries to facilities that are properly licensed, are in full compliance with regulatory requirements and have an environmental management system (EMS) in place.

d. Packaging and labelling

Batteries should be stacked not more than 3 layers high on pallets in good condition and of heavy duty construction—hardwood or plastic pallets are preferred. To ensure the safe transport of ULABs, batteries should be of similar size by layer with largest and heaviest on the bottom layer; lower height batteries can be stacked in the inner rows on each layer. Battery terminals should be oriented in such a manner as to prevent short circuits. A piece of electrical tape can be placed over each terminal to avoid terminal contact.

Large (sealed) used standby power batteries should only be stacked up to a maximum of 2 layers. Forklift battery cells and large flooded standby power should not be stacked higher than one layer. It is recommended that pallet weights should not exceed 1500 kg ([20]).

To prevent the batteries from sliding off, a layer of cardboard should be placed on the pallet before stacking the first layer of ULABs. To minimise the potential for short circuit and to prevent protruding battery terminals from one layer puncturing the bottom of battery cases in the layer above (and causing the leakage of electrolyte), a layer of thick corrugated cardboard should be placed between each layer of ULABs, as well as on the top layer. The use of thick cardboard is preferable to particleboard or fibreboard because small spills can be absorbed and are visible. The batteries should be secured to the pallet, to prevent them from falling off, with clear stretch wrap. The pallet should be wrapped as many times as necessary to stabilize the load, and strapped under tension with plastic tape.

Pallets and containers should be identified with labels marked “Corrosive” using the appropriate symbol, the relevant United Nations number and proper shipping name: UN2794, battery, wet, filled with acid; or UN2800, battery, wet, non-spillable.

e. Transportation

ULABs should be handled with appropriate care when being transported. The main risk associated with battery transport is the electrolyte, which may leak from the batteries, even if appropriately transported in an upright position. Transport of ULABs should be in conformity with national legislation on the transport of dangerous goods; only qualified, authorized and licensed transport companies should be used. The transporter must make certain that the batteries are loaded so as to prevent movement, damage (to the vehicle or ULABs), leakage, or short circuits during transit.

Transport vehicles should be properly marked with placards identifying the fact that corrosive and hazardous products are being transported. PPE should be provided for the transport personnel, who should be trained in its emergency use. Transport vehicles should be outfitted with the equipment necessary to neutralize any simple spillage or leakage problems, and the transport personnel trained on how to use it. All releases should be immediately contained.

Hazardous waste manifests or consignment notes must accompany each shipment of hazardous waste in accordance with national law, until it reaches its final destination. On completion of a journey, the transporter should complete the hazardous waste manifest form and return it to the healthcare

establishment. If the waste regulatory authority is sufficiently well established, it may be possible to pre-notify the agency about a planned offsite transport and disposal of hazardous healthcare waste and to obtain the agency's approval.

Emergency response information—Emergency Response Intervention Cards (ERICards) ([21]), Emergency Response Guides ([22])—should accompany shipments of hazardous waste to provide guidance on initial actions in response to a transport accident.

3. Disposal Operations (Annex IV, Sections A and B)

a. Best available techniques (BAT) and best environmental practices (BEP)

Facilities that handle ULABs should meet all basic requirements to ensure an environmentally sound management (ESM) of wastes and commit to continual improvement in their operations. A facility should have the following, which should meet the approval of the relevant authorities: (a) appropriate design and location; (b) an environmental and social impact assessment, where appropriate; (c) sufficient measures in place to safeguard occupational safety and health, including an appropriate and adequate training programme for its personnel; (d) sufficient measures in place to protect the environment; (e) an applicable EMS in place, if feasible and appropriate; (f) an adequate and transparent monitoring, recording, reporting and evaluation programme; (g) an adequate emergency plan and response mechanism; (h) an adequate plan for closure and aftercare.[23]

ULABs are the main source of feedstock for secondary lead production. Under the Basel Convention this constitutes an operation "which may lead to resource recovery, recycling, reclamation, direct reuse or alternative uses" under category R5—recycling/reclamation of other inorganic materials—of part B of Annex IV. Secondary lead operations include scrap pre-treatment—battery breaking, crushing, and sweating—, smelting and refining. For countries with no secondary smelters, there is no way to avoid exporting ULABs for ESM.

In order to prevent or reduce diffuse emissions from battery crushing, screening and classifying operations, BAT is to use enclosed equipment with a gas extraction system; to reduce dust emissions BAT is to use a bag filter or wet scrubber. To prevent the contamination of the soil and groundwater from battery storage and preparation, BAT is to use acid-resistant flooring with a spill collection system to reduce the risk of leakage into the environment. In order to reuse or recover the sulphuric acid collected from the battery recovery process, depending on the local conditions and of the impurities present in the acid, BAT is to use one or a combination of the following techniques: pickling agent; as raw material in a chemical plant; regeneration of the acid by cracking; production of gypsum; and/or production of sodium sulphate.

Processes considered as BAT for the prevention or minimization of the formation and subsequent release of unintentional POPs include the blast furnace (with good process control), the ISA Smelt/Ausmelt furnace, the top-blown rotary furnace, the electric furnace and the rotary furnace[24]. Possible measures to reduce or eliminate the generation and release of POPs include: (1) battery breaking prior to charging into the furnace and the removal of plastics and other non-leaded materials (whole battery feed or incomplete separation should be avoided); and (2) the use of process control systems to maintain process stability and operate at parameter levels that will contribute to the minimization of PCDD/PCDF generation, such as maintaining the furnace temperature above 850°C to destroy PCDD/PCDF. Other measures that may assist in controlling emissions of POPs include: (1) implementation of fume and off-gas collection in all stages of the smelting process—BAT for gas and fume treatment systems are those that use cooling and heat recovery if practical before a fabric filter—; (2) removal of dusts and metal compounds generated from the smelting process—techniques to be considered are the use of fabric filters, wet/dry scrubbers and ceramic filters—; (3) use of afterburners at temperatures over 950°C followed by rapid quenching of hot gases to temperatures below 250°C; and (4) use of activated carbon treatment for PCDD/PCDF removal from smelter off-gases. PCDD/PCDF performance levels associated with BAT for secondary lead smelters are below 0.1 ng I-TEQ/Nm^3 (at operating oxygen concentrations).

4. Sustainable Materials Management (SMM)

a. Extended Producer Responsibility (EPR)

– European Union: Under Directive 2006/66/EC Member States are required to ensure that producers, or third parties, set up schemes to collect automotive batteries from end-users or from an accessible collection point in their vicinity, where collection is not carried out as part of an end-of-life vehicle programme. Furthermore, where the batteries have originated from private, non-commercial vehicles, the schemes may not involve any charge to end-users when discarding waste batteries, nor any obligation to buy a new battery. Member States are also required to ensure that producers of industrial batteries, or third parties, do not refuse to take back waste industrial batteries from end-users, regardless of chemical composition and origin.

– United States: Lead-acid batteries are subject to mandatory deposit systems in several states—Arizona, Arkansas, Connecticut, Idaho, Maine, Minnesota, New York, South Carolina and Washington—and voluntary deposit systems in most other areas. Many of the states have used model legislation developed by the Battery Council International (BCI), which recommends that retailers charge a US$10 fee (deposit) on all batteries sold, with the fee waived or returned if the customer brings back a used battery within 30–45 days of purchase.

– Canada: The "lead-acid battery product category" is managed in British Columbia in accordance with the stewardship plans approved under the Recycling Regulation. Province-wide lead-acid battery Stewardship Plans have been developed by the Canadian Battery Association[25] (CBA) and Interstate Battery System of Canada[26] (IBSC). All costs are borne by CBA and IBSC, and ULABs are accepted for free at participating retailers. To compete with independent recyclers CBA members may implement a business-to-business programme (at the wholesale level) involving a core charge (deposit) to encourage the return of ULABs from the retailer to the manufacturer. Typically these core charges are CAD$10 per automotive battery with greater amounts for larger sizes.

b. Financing systems

– Deposit/Refund Schemes: ULAB recovery can be incentivised with collection schemes based on a financial incentive, such as a refundable levy on new lead acid batteries, which is repaid to the customer when the ULAB is returned to the retailer. These financial incentives can be used in a number of ways, but should be sufficient to drive the consumer to return the ULAB into the formal and licensed sectors and prevent the ULAB from finding its way into the informal and unlicensed recyclers.

– Purchase Discount Schemes: Purchase discount schemes operate in a similar way to the deposit/refund schemes, but instead of the consumer paying a deposit the first time a new battery is purchased, the consumer will only pay the retail price. However, when the battery is at the end of its useful life and the ULAB returned to the retailer, a discount will be given on the price of a new battery and the ULAB will be retained by the retailer and sent to a licensed recycler.

These schemes are invariably run by the secondary lead recyclers and the battery manufacturers. The industry bears all the costs and sets up the necessary recovery infrastructure to make the scheme work, but the costs are such that the schemes are really only viable in countries with domestic recyclers and battery manufacturers.

c. Incentives and disincentives

– European Union: Under Directive 2006/66/EC Member States shall prohibit the disposal in landfills or by incineration of waste industrial and automotive batteries and accumulators.

– United States: Some states have prohibited the disposal of ULABs in solid waste landfills or incinerators. For example, New Hampshire (New Hampshire Revised Statutes Annotated, Section 149-M:27), New Mexico (New Mexico Administrative Code, Section 20.9.2.10), and Massachusetts (Code of Massachusetts Regulations, Section 19.017).

– India: Under the Batteries (Management and Handling) Rules, manufacturers, importers, assemblers and re-conditioners are required to set up collection centres for collection of used batteries from consumers or dealers, and collect a minimum of 90% of the new batteries sold. The take back provisions do not apply

to batteries sold in the wholesale market, original equipment manufacturers (OEMs) or government agencies.

5. Legislation

a. Existing national, regional and international legislations

– European Union: Directive 2006/66/EC of the European Parliament and of the Council, of 6 September 2006, on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC. Available at http://ec.europa.eu/environment/waste/batteries/

– India (Ministry of Environment and Forests): Batteries (Management and Handling) Rules, 2001, and Batteries (Management and Handling) Amendment Rules, 2010. Available at http://www.moef.nic.in/hazardous_substances_management

– British Columbia, Canada: Recycling Regulation of the Environmental Management Act (B.C. Reg. 449/2004) as amended by B.C. Reg. 296/2009. Available at http://www.bclaws.ca/Recon/document/ID/freeside/449_2004

6. Capacity and Feasibility

ULAB are a mix of lead, lead alloys, lead compounds, dilute sulphuric acid, and this will sometimes be in the form of a gel, polypropylene, polyester and PVC, and all these materials will be in differing proportions. Each material has the potential to impact differently on the environment and human health, depending on how the ULAB are recovered and recycled. It is therefore most important that the ULAB recycling plant has the capacity to process all the waste materials contained in a consignment of ULAB in a safe and environmentally sound and sustainable manner.

It is also essential to bear in mind that comprehensive ULAB recycling facilities are an expensive operation and while environmental sustainability is important the feasibility of maintaining such treatment processes remains viable.

7. Permitting

Waste facilities should be licensed/authorised/permitted. If there is no licensed smelter and the scrap exporter is the conduit for effective recovery, then the exporter should not only be licensed and achieve high standards of environmental protection in any storage facility (which could be quite long time depending on the battery demand), but also should present a detailed set of operating procedures describing its activities and those of its partners in other countries in order to facilitate governmental actions in the regional scenario.

8. Enforcement

The ESM of wastes requires a regulatory and enforcement infrastructure that ensures compliance with legal instruments and standards. Consideration should be given to a national (and sometimes a regional) policy that includes provisions to allow prompt, adequate and effective enforcement actions to be undertaken, including sanctions and penalties that will serve as a deterrent to non-compliance.

Measures should be in place to ensure adequate monitoring, inspection and enforcement of waste imports and exports subject to the requirements of the Basel Convention, by agents of the State and cooperation with enforcement agencies in other States (to prevent illegal traffic). Adequate penalties and sanctions for illegal traffic should discourage such movements in the future.

9. Certification and Auditing Systems

It is recommended that licensed waste management facilities should be subject to annual inspections by the appropriate government agencies and/or audits by a recognised independent auditor. The objective of the inspection and/or auditing procedure would be to: check conformance of the facility with all basic requirements to ensure the ESM of wastes, with relevant environmental regulations, and, if applicable, current EMS systems. Verifying compliance with existing laws and regulations is embodied in the European Community Eco-Management and Audit Scheme (EMAS). Under ISO 14001, a facility is

required to know whether or not it is in compliance with applicable laws and regulations; without that knowledge, the facility would be considered out of conformance with that ISO standard. The inspection and/or audit should also assess the performance of the facility with respect to environment, health and safety objectives.[27]

In the United States, the Recycling Industry Operating Standard ("RIOS"), created by the Institute of Scrap Recycling Industries (ISRI), is a management system integrating environmental, quality, and health and safety standards. This is an ISO-compatible management system that allows for third party audits, registration by certifying bodies, and certification. In Germany, facilities may be certified as "Entsorgungsfachbetrieb" (specialised waste management companies) according to the requirements set out in the Ordinance on Specialised Waste Management Companies (EfbV).[28]

10. Transboundary Movements

Governments should put in place legal requirements to implement and enforce the provisions of relevant international and/or regional instruments in relation to the transboundary movement of wastes (pre-notification, prior informed consent, etc.), including the Basel Convention.

Transboundary movements of wastes for management in another country cannot be assured to result in ESM by evaluating receiving facilities alone. Elements such as those for effective legal systems, government oversight and other infrastructure to protect the occupational health and safety of workers, communities and the environment, should also be considered. Transboundary movements of wastes should not be considered to be legal where there is a reason to believe the waste in question will not be managed according to ESM.

Notifications received by the Secretariat of the Basel Convention from Parties—pursuant to Article 13 of the Convention—on decisions to prohibit or restrict the import/export of hazardous or other wastes are published on the website of the Secretariat[29].

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[1] For further information, refer to the development of "Technical Guidelines on Transboundary Movements of E-waste and Used Electrical and Electronic Equipment, in Particular Regarding the Distinction Between Waste and Non-waste Under the Basel Convention" (http://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/Ewaste/tabid/2377/Default.aspx) and the development of Guidance to Provide Further Legal Clarity in Relation to "Used and End-of-life Goods" (http://www.basel.int/Implementation/LegalMatters/CountryLedInitiative/OutcomeofCOP10/Providingfurtherlegalclarity/tabid/2673/Default.aspx).

[2] United Nations. 2013. Recommendations on the Transport of Dangerous Goods, Model Regulations. Eighteenth revised edition. Available at http://www.unece.org/trans/danger/publi/unrec/rev18/18files_e.html

[3] For further information, refer to http://www.unece.org/trans/danger/danger.html

[4] For further information, refer to http://www.ericards.net/

[5] For further information, refer to http://www.tc.gc.ca/eng/canutec/guide-menu-227.htm or http://phmsa.dot.gov/hazmat/library

[6] Secretariat of the Basel Convention. 2013. Framework for the Environmentally Sound Management of Hazardous Wastes and Other Wastes. Available at http://www.basel.int/Implementation/CountryLedInitiative/EnvironmentallySoundManagement/ESMFramework/tabid/3616/Default.aspx

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[8] United Nations Environment Programme (UNEP). 2007. Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices Relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Waste Incinerators. Expert Group on Best Available Techniques and Best Environmental Practices. Geneva: UNEP.

[9] United Nations Environment Programme (UNEP). 2007. Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices Relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Waste Incinerators. Expert Group on Best Available Techniques and Best Environmental Practices. Geneva: UNEP.

[10] International Environmental Technology Centre (IETC). 2012. Compendium of Technologies for Treatment/Destruction of Healthcare Waste. United Nations Environment Programme. Available at http://www.unep.org/ietc/InformationResources/Publications/Heathcarewastecompendium/tabid/106702/Default.aspx

[11] International Environmental Technology Centre (IETC). 2012. Application of the Sustainability Assessment of Technologies Methodology: Guidance Manual. United Nations Environment Programme. Available at http://www.unep.org/ietc/InformationResources/Publications/SustainabilityAssessmentofTechnologyManual/tabid/106701/Default.aspx

[12] European IPPC Bureau. 2006. Reference Document on Best Available Techniques for Waste Incineration. Available at http://eippcb.jrc.ec.europa.eu/reference/

[13] Health Products Stewardship Association (HPSA). 2013. Program Plan for the Ontario Sharps Collection Program. Available at http://www.healthsteward.ca/

[14] Health Products Stewardship Association (HPSA). 2013. Program Plan for the Ontario Medications Return Program. Available at http://www.healthsteward.ca/

[15] For further information, refer to http://www.acgov.org/aceh/safedisposal/index.htm

[16] Organisation for Economic Co-operation and Development (OECD). 2007. Guidance Manual on Environmentally Sound Management of Waste. Available at http://www.oecd.org/env/waste/39559085.pdf

[17] German Ordinance on Specialised Waste Management Companies (Entsorgungsfachbetriebeverordnung - EfbV), of September 1996. Available at http://www.bmub.bund.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/wastemanage.pdf

[18] For further information, refer to http://www.basel.int/Countries/ImportExportRestrictions/tabid/1481/Default.aspx

[19] For further information, refer to the development of “Technical Guidelines on Transboundary Movements of E-waste and Used Electrical and Electronic Equipment, in Particular Regarding the Distinction Between Waste and Non-waste Under the Basel Convention” (http://www.basel.int/Implementation/TechnicalMatters/DevelopmentofTechnicalGuidelines/Ewaste/tabid/2377/Default.aspx) and the development of Guidance to Provide Further Legal Clarity in Relation to “Used and End-of-life Goods” (http://www.basel.int/Implementation/LegalMatters/CountryLedInitiative/OutcomeofCOP10/Providingfurtherlegalclarity/tabid/2673/Default.aspx).

[20] Australian Battery Recycling Initiative (ABRI). 2013. Packaging Standard for Used Lead Acid Batteries (ULAB). Available at http://www.batteryrecycling.org.au/resources/abri-publications

[21] For further information, refer to http://www.ericards.net/

[22] For further information, refer to http://www.tc.gc.ca/eng/canutec/guide-menu-227.htm or http://phmsa.dot.gov/hazmat/library

[23] Secretariat of the Basel Convention. 2013. Framework for the Environmentally Sound Management of Hazardous Wastes and Other Wastes. Available at

http://www.basel.int/Implementation/CountryLedInitiative/EnvironmentallySoundManagement/ESMFramework/tabid/3616/Default.aspx

[24] United Nations Environment Programme (UNEP). 2007. Guidelines on Best Available Techniques and Provisional Guidance on Best Environmental Practices Relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants: Thermal Processes in the Metallurgical Industry not Mentioned in Annex C, Part II. Expert Group on Best Available Techniques and Best Environmental Practices. Geneva: UNEP.

[25] Canadian Battery Association (CBA). 2011. The Canadian Battery Association's British Columbia Stewardship Plan for Lead-Acid Batteries. Available at http://www2.gov.bc.ca/gov/topic.page?id=8BFD7790000043658C123DD6D81BB6A6

[26] Interstate Battery System of Canada, Inc. (IBSC). 2011. British Columbia Product Stewardship Plan. Available at http://www2.gov.bc.ca/gov/topic.page?id=8BFD7790000043658C123DD6D81BB6A6

[27] Organisation for Economic Co-operation and Development (OECD). 2007. Guidance Manual on Environmentally Sound Management of Waste. Available at http://www.oecd.org/env/waste/39559085.pdf

[28] German Ordinance on Specialised Waste Management Companies (Entsorgungsfachbetriebeverordnung - EfbV), of September 1996. Available at http://www.bmub.bund.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/wastemanage.pdf

[29] For further information, refer to http://www.basel.int/Countries/ImportExportRestrictions/tabid/1481/Default.aspx