Environmental Code of Practice (ECOP)

for the Proper Handling, Recycling and Disposal of Batteries for Rooftop Solar Systems

under the Yemen Integrated Urban Service Emergency Project (YIUSEP)

20 December 2018

# Environmental Code of Practice (ECOP) – Objectives

This ECOP has been developed specifically for equipment financed under the Yemen Integrated Urban Service Emergency Project (YIUSEP), namely solar PV systems, for critical facilities including schools and health clinics. The key issues associated with the project are the appropriate handling, recycling and disposal of Batteries. The ECOP seeks to set guidelines for contractors on battery management requirements for the provisions of solar PV systems under YEEAP.

# Responsibilities of the Contractor

## Community and User Awareness

Contractors are required to provide awareness and training to beneficiaries with the aim of improving knowledge of environmental and health issues associated with the entire battery lifecycle including end-of-life management. The awareness materials and training shall provide information on:

* The safe handling of batteries including installation, removal, transport, storage and disposal (more information provided below);
* The environmental and health aspects of poor battery disposal; and
* Focused information on the environmental and health issues associated with high toxicity content of batteries and explanation as to why they must be stored, transported and disposed of in certain ways and therefore why it is in the interests of individuals, the community, the environment (and therefore future generations in communities) that the methods outlined in this ECOP be followed.

## Direct Management of Used Batteries by the System Suppliers

The contractors shall provide a Battery Management Plan which details arrangements for the collection, transport, storage and disposal of batteries under the warrantee and/or O&M provisions as part of the bid submission process. The submission will be evaluated for compliance with the guidelines set out in this ECOP.

UNOPS will be responsible for monitoring and supervising the implementation of the ECOP by the contractors. They will carry out random checks on each contractor to verify compliance with the ECOP and provide status update reports to the World Bank on a frequent basis.

## Battery Collection, Transport, Recycling and Disposal

Within the Battery Management Plan that each contractor will submit as part of their bid, they must outline the arrangements they have made with local contractors and facilities to handle the following aspects of the reverse supply chain:

* After sales service centers for maintenance and reconditioning of batteries,
* Firms or centers that will handle the collection, storage and transportation of used and end-of life batteries from the facilities in which they were collected to re-exporting centers or to landfills for final disposal.

Firms and centers can be existing or new ones and could be the contractor’s own centers or subcontracted through a local partner. Geographic locations of these firms and centers should be in main cities/towns and should be provided by the contractor within the Battery Management Plan. These firms and centers will then be approved by UNOPS.

In all cases these firms and centers should comply with Occupational Health and Safety guidelines such as using personal protective equipment, using proper drums for storing acid, having impermeable grounds in maintenance and collection, adequate ventilation etc. The cost for OHS measures should be incorporated into the bidding documents.

The Battery Management Plan should outline how the contractor will include the end-user in the reverse-supply-chain management through training and setup of adequate procedures to ensure environmental concerns are taken into account from the beginning to the end of the chain.

# Guidelines for Safe Handling and Disposal of Batteries

The below clauses will be incorporated into all contracts for the installation of solar PV systems under the Yemen Emergency Electricity Access Project.

## Before Working with a Battery

Training in proper handling procedures is very important. Contractors should provide the following key aspects as part of any awareness and training program:

* Consult battery owners’ manuals for instructions on battery handling and hazard identification;
* Wear personal protective equipment (PPE) such as chemical splash goggles and a face shield;
* Wear acid-resistant equipment such as gauntlet style gloves, an apron, and boots;
* Do not tuck pant legs into boots because spilled acid can pool in the bottom of your boots and burn your feet;
* Place protective rubber boots on battery cable connections to prevent sparking on impact if a tool does accidentally hit a terminal;
* Ensure that all metal tools (spanners, socket wrench drivers, etc.) that will come in contact with the battery terminals have metal handles taped with electrical tape or are protected by other means to help prevent inadvertent short circuits.
* Clean the battery terminals with a plastic brush because wire brushes could create static and sparks;
* Always remove your watches and jewelry before working on a battery. A short-circuit current can weld a ring or strap to metal and cause severe burns;
* Cover maintenance tools with several layers of electrical tape to avoid sparking.

## Occupational and Bystander Health and Safety

The systems must be installed by qualified and experienced trades people in order to avoid or minimize electrocution and other health and safety issues associated with working with hazardous materials. Unauthorized access to battery areas should be prohibited.

## Chemical Hazards Posed by Batteries

Lead Acid: Sulfuric acid (electrolyte) in lead-acid batteries is highly corrosive and acid exposure can lead to skin irritation, eye damage, respiratory irritation, and tooth enamel erosion. Contractors should train beneficiaries to follow the following principles to minimize risk:

* Never lean over a battery while boosting, testing or charging it.
* If acid splashes on your skin or eyes, immediately flood the area with cool running water for at least 15 minutes and seek medical attention immediately.
* Always practice good hygiene and wash your hands after handling a battery and before eating.
* If you handle the lead plates in a battery and do not wash your hands properly, you could be exposed to lead. Signs of lead exposure include mood swings, loss of appetite, abdominal pain, difficulty sleeping, fatigue, headaches and loss of motor coordination.
* The chemical reaction by-products from a battery include oxygen and hydrogen gas. These can be explosive at high levels. Overcharging batteries can also create flammable gases. For this reason, it is very important to store and maintain batteries in a well-ventilated work area away from all ignition sources and incompatible materials. Cigarettes, flames or sparks could cause a battery to explode.
* Before working on a battery, disconnect the battery cables. Be careful with flammable fluids when working on a battery-powered system. The electrical voltage created by batteries can ignite flammable materials and cause severe burns. Workers have been injured and killed when loose or sparking battery connections ignited gasoline and solvent fumes during system maintenance.
* Before making wiring changes to the system, disconnect the battery, either through opening the circuit breaker or over-current device, or by disconnecting the cables. Adding distilled water or cleaning terminals can be done without disconnecting.

## Safe Battery Movement

Lifting and moving batteries needs to be undertaken with care so as to avoid personal and environmental harm. Contractors should remind beneficiaries of, at minimum, the following Key principles:

* Use proper lifting techniques to avoid back injuries;
* Battery casings can be brittle and break easily; they should be handled carefully to avoid an acid spill;
* Make sure that a battery is properly secured and upright in the vehicle or equipment;
* If a battery shows signs of damage to the terminals, case or cover, replace it with a new one.