BATTERIES HANDLING AND DISPOSAL PROCEDURE

Rev No.	Reason for Revision	Prepared By	Checked By	Approval by
Rev No. 00	First release	R&P Sub-committee	D R Kamath	Vijay Chourey
Rev No. 01	Standardization of procedure	Ravindra Panchal (Lead - MIS & SAP; Corp Safety.)	Navendra Singh (Group Head – P & CB; Corp Safety.)	Vijay Chourey (Chief – Corp Safety)
Rev 02	Periodic revision	Navendra Singh Head- Safety (T&D) Corp safety	Rajesh Sharma Head- Safety (Generation) Corp safety	Suresh Khetwani Chief - Corporate Safety & Environment

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1. OBJECTIVE:

To provide procedure for recycling and / or safe disposal of used / waste batteries in compliance with all legislation.

2. SCOPE:

This procedure applies to all operating plants and project sites of Tata Power Group companies including JVs/Subsidiaries.

3. EXPECTED RESULTS:

3.1. Manage activities with reduction of risk involved with hazardous Materials.

4. ACCOUNTABILITY & RESPONSIBILITY:

4.1. ACCOUNTABILITY: Concerned Division's Heads / Assets Custodian.

4.2. RESPONSIBILITY: Concerned Engineer in Operation and Maintenance of Coal Handling Plant

5. GLOSSARY/ DEFINITIONS:

Battery- a cellular device which is used to convert chemical energy to electrical energy Battery Room – any room which is used for the storage, use or charging of batteries.

BC – Business Concern: Any hazard and Risk which will result in Fatal accidents / severe damage to human health and safety, Damage to property resulting in loss of Production, huge financial implications etc. (Example - major fire, gas leak, explosion, toxic release etc.)

Controls: Methods used to manage safety risks. Controls can be Elimination, Substitution, Isolation/ separation, Engineering controls, signage/warnings and /or administrative controls, PPE.

Hazard Identification & Risk Assessment: Hazard Identification & Risk Assessment is to identify and evaluate the hazards, Risk and put controls measures for safe execution of activities.

Hazardous material: hazardous material is any item or agent (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment,

Hazard: Source or situation with potential for harm, something that can cause body injury / occupational illness, damage property.

IPC – Interested Party Concern: The hazard / Risk having a concern expressed by Employees, Neighbours, local residents etc.(Example – excavation on public road for cable laying job which involve traffic interface, erection of transmission tower at community area etc.)

Job Safety Analysis: Job safety analysis (JSA) is a procedure which helps integrate accepted safety and health principles and practices into a particular job. In a JSA, for each basic step of the job, it is to identify potential hazards and to recommend the safest way to do the job.

Job: A piece of physical work defined by time or other limits and that has a clear start and end point

(Note: The head of the department conducts the risk assessment for any complaint received by any employee or interested party and if he is convinced with complaint then the same is considered as interested party concern and the risk is treated as significant. Proper control measures are to be taken to manage the risk)

LC – Legal Concern: The hazard or risk is addressed by applicable legal requirements such as Indian Factory act / State factory rules, Indian electricity Act & rules etc. (Example - use of uncertified lifting tools & cranes, operation of unguarded machines etc.)

Non Routine Job / Task: Where an SOP / SMP is not available or the conditions of the SOP / SMP have changed.

Non-Significant Risk: Any risk less than RPN 6 and not falling under any of qualitative risk category (Legal Concern, Business Concern and Interested Party Concern).

OCP: Operational Control Plan

Risk: Effect of uncertainty, Risk is a combination of the consequences of an event and the associated "likelihood" of occurrence

Risk Assessment: A systematic and structured process whereby hazards present in a workplace, or arising from workplace activity, are identified, risks assessed / evaluated, and decisions prioritized in order to reduce risks to acceptable levels.

Severity: The level of consequence / harm of an event that could occur due to exposure to the hazard present.

Significant risk: Any activity falling either under any of qualitative risk category (Legal Concern, Business Concern and Interested Party Concern) or having Risk Priority Number (RPN) 6 and above.

Shall: Mandatory requirement
Should: Optional requirement
Statutory requirements: Laws, regulations applicable at the location of plant /work.
SOP: Standard Operating Procedure
SMP: Standard Maintenance Procedure
Task / Activity: A sequence of steps taken to conduct a job. A task is a sub element of a Job.
Unacceptable Risk: Any activity having Risk Priority Number (RPN) 10 and above.
WI: Work Instructions
PPE: Personal Protective Equipment

PTW: Permit to Work

SAP: System application product for data processing

6. PROCEDURE:

6.1. Batteries and Batteries room safety:

There are three common classifications of batteries: • Acid, such as car batteries, which use sulphuric acid • mildly acid, such as inexpensive household batteries, which include a variety of salts to produce the desired acidity • Alkaline batteries, using sodium hydroxide or potassium hydroxide for applications where long lasting, high-energy output is needed.

There are wet and dry cell batteries. In wet cells the electrolyte is in liquid form and is allowed to flow freely within the cell casing. Dry cells use a solid or powdery electrolyte and are less sensitive to the orientation of the battery.

All batteries contain hazardous substances and their use and disposal should be assessed for risks.

Batteries must be suitable for the use to which they will be put and must be used in accordance with the equipment and battery supplier's instructions.

Battery types should not be mixed as this can cause a malfunction may occur, for example, where a battery has been set up of different cells: say three alkaline manganese cells and one ammonium chloride cell. The alkaline cells last longer than the odd one and continue to pass current round the circuit. The gases generated in the flat cell cause a build-up of pressure which causes it to burst.

Batteries must be protected against short circuit to prevent flash, fire or explosion.

6.1.1. Battery Room: Battery rooms shall provide easy access for batteries and battery stands. In addition, battery rooms shall be dry, well lit, well ventilated and protected against the ingress of dust and foreign matter.

I. Battery rooms shall provide easy access for batteries and battery stands. In addition, battery rooms shall be dry, well lit, well ventilated and protected against the ingress of dust and foreign matter.

II. Only flat or stepped single row single tier, double row single tier ,three row centre terraced and four row centre terraced wooden stands (normally ordered from the battery manufacturer at the time the batteries are ordered) shall be used.

III. Battery rooms shall provide for possible future expansion / refurbishment, therefore it shall be located at the end of the building. Battery rooms shall be situated as near to the associated loads and

IV. Rectifier equipment as possible.

V. Separate battery rooms shall be provided for batteries with different types of electrolyte, i.e. nickel cadmium and lead-acid batteries shall not be installed in the same room. Two or more batteries with the same type of electrolyte may be installed in the same room but on separate battery stands.

VI. An access passage at least one meter wide to all battery rows and a minimum of one meter between rows of battery stands shall be provided. Only single row or stepped double row single tier battery stands may be positioned against a wall.

VII. The minimum distance between any battery terminal and the nearest water supply point shall be two meters.

VIII. Rows of battery stands shall be positioned such that they do not jeopardize or obstruct the doorway.

IX. Wherever possible the stands shall be positioned perpendicular to the entrance wall. The battery arrangements shall comply with the layout drawing, showing the positioning of the different batteries.

6.1.1.1. **Floors Construction**

i) Expansion joints shall be avoided.

ii) When the battery room is located at ground level, the floor shall comprise a concrete surface bed laid on compacted earth. When the battery room is situated above ground level, the floor shall comprise a reinforced concrete slab.

iii) Due to the mass of the batteries the floor shall be absolutely stable.

iv) The floor shall be given a uniform fall. The lower end being that where the tapped water supply is located.

6.1.1.2 **Floor Protection**

i) In lead-acid battery rooms, the electrolyte shall be sulfuric acid (H2SO4).

ii) As concrete is highly vulnerable to corrosion by this acid, the floor shall be given a protective coating of acid-resistant, non-skid ceramic floor

tiles or an approved acid-resistant epoxy coating applied in accordance with the manufacturer's specifications.

6.1.1.3 **Walls**

Walls shall be continuous from floor to ceiling and be securely anchored. The walls of lead acid or nickel Cadmium battery rooms shall be protected against electrolyte splashes, by applying an approved light colored,
Acid resistant enamel paint.

6.1.1.4 **Windows**

i) Windows shall not be provided in battery rooms.
ii) Where windows have been installed in older rooms, they shall be suitably blanked off to prevent ingress of sunlight.

6.1.1.5 **Ceilings**

i) The ceilings shall be flat preferably and be at least 3m to 5m above floor-level.
ii) Being considerably lighter than air, the hydrogen given off during battery charging will rise and accumulate under the high points of ceilings and overhead structures. All such high points shall be vented to the atmosphere. Special attention shall be paid to this ventilation when ceiling beams have
To be used.
iii) Skylights and false ceilings shall not be used.
iv) Ceilings shall be given the same paint treatment as walls.

6.1.1.6 **Doors**

i) The battery room door shall have the applicable fire and security rating and shall be not less than 800mm wide and 2000 mm high.
ii) The door shall have one leaf that opens outwards.

6.1.1.7 Plumbing

i) A laboratory type sink of glazed fire clay shall also be installed at the lower end of the floor, preferably the door side of the battery room. This sink shall be the large rectangular type preferably with draining boards on either side, or an acid resistant laboratory receiver beneath.
ii) The sink shall be provided with a supply of suitable running water and controlled by an elbow action mixer tap. Discharge from the sink and from the laboratory receiver shall be into the white-glazed fire clay block channel.
iii) An industrial safety shower, in addition to eye wash facilities shall be located in the vicinity of the normal water supply (sink) and shall not obstruct the door exit.
iv) Where there is not enough space for civil extensions to accommodate an industrial emergency shower, it shall be located outside the battery room next to the door. The shower drain shall be connected to the battery room drain system.
v) At sites where only low water pressure is available a booster pump shall be installed to achieve 3(three) bar water pressure.

6.1.1.8 **Cable Entry Facilities**

Where the cable entry is through the floor, the following shall be adhered to:

i) The cable opening shall be adjacent to the wall and stands where applicable.

ii) PVC or cement cable pipes curved to the bending radius of the cable shall be cast into the floor in such a way that the entry of the cables into the battery room is perpendicular to the floor.

iii) To prevent fluids or foreign matter from entering the pipe, its upper end shall project at least 50mm above the finished floor surface.

For any other form of cable entry, the following shall be adhered to:

i) These cable entries shall be either vertically from the floor above, if applicable or horizontally (at a satisfactory height) through one of the battery room walls.

ii) A separate entry, as near as possible to the battery terminals, shall be provided for each battery bank.

iii) These entries shall be kept sealed with vermiculite or equivalent material, to prevent hydrogen transfer before and after installation of the cables.

6.1.1.8 Ventilation

i) Battery rooms shall be so positioned and designed that they are subjected to only very slight changes in temperature.

ii) The nominal temperature in the battery room shall be 25 °C and the temperature shall be kept as close to this as possible. If the temperature exceeds 35 °C, special consideration shall be given to controlling the air temperature. Air used for ventilating battery rooms shall not exceed 25 °C.

iii) Where a powered room ventilator cannot be used, a wall mounted axial type extract fan with back draught dampers shall be used. The fan shall be mounted as high as possible in the wall, but not below the level of the light fittings.

iv) In very large battery rooms with deep roof beams, especially where cross flow between inlets and outlets is difficult to achieve (for example, when inlets and outlets must be in the same wall), the extract system shall include a duct with several intake points made available at high level.

v) Hydrogen gas from battery rooms shall be extracted or ventilated to a safe area, i.e. outdoors or to an area where the gas will always dissipate into the atmosphere without possible danger of the gas accumulating in any part of that area.

vi) Where it is necessary to provide ventilation ducts to discharge hydrogen gas to a safe area, such ducting shall comply with the above requirements.

vii) The ducting shall be protected with a one-hour fire rated material or plaster. Fire rating however will only be required if the ducting passes through intermediate rooms or potential fire zones.

viii) In applications where there is complete dependence on forced ventilation, it is recommended that redundancy be provided in the extract fans, with suitable non-return dampers and a means of monitoring operation so that, in the event of failure of the operating fan, the stand-by unit can be

Switched on.

ix) Where both supply and extract powered systems are provided, they shall be selected to ensure that there will, under normal conditions, be a slight negative pressure in the battery room.

x) Fans shall be selected to provide the required performance even when operating against normal system resistance, including dust-laden filters, as well as considering prevailing wind and any other detrimental effects. Generally speaking, axial or centrifugal fans are required in applications where the fans have to overcome filter resistance. Each application shall be checked to ensure that fan noise will not be a negative factor to the adjacent environment.

xi) Air inlets, through which the necessary replacement air would enter the battery room, shall be fitted into one of the longitudinal walls and / or in the door, opposite the air outlets, in such a way that they are evenly distributed along the section of wall opposite the battery cells, to ensure that there is a

Cross ventilation system. They shall also be located as close to the floor as possible to ensure that the incoming fresh air passes around and over the battery cells.

xiv) For a very small battery room, the ventilator-louvre combination shall be selected and installed so that it will be capable of removing the air-hydrogen mixture from the room at a rate not less than, 250 x 10-7 P m3/s, for example.

xv) All battery rooms shall be naturally or forced ventilated by ensuring that the minimum amount of air exchanges takes place thereby rendering the battery room safe. This can be done by determining the amount of hydrogen given off by the cells during the end-of-charge phase where gassing is caused by overcharging.

xvi) Battery rooms shall be provided with the following options wired to a central point:

A remote operated facility for ventilation. Some battery chargers have the facility to do this when they are switched to a higher charging rate. This option will not be used where the fan is required to function permanently.

A facility that can detect when the ventilation system fails or the filters are blocked. This shall be done by means of a pair of potential free contacts that would indicate when the system is abnormal, and can be used to inhibit the battery charger from switching to the higher charge mode or initiate an alarm on the charger.

6.1.1.9 **Artificial Lighting**

i) The entire lighting installation within the battery room shall consist exclusively of type 'e' apparatus and luminaries.

ii) The basic difference between the type 'e' protection now required and the traditional type of protection using flameproof or explosion-proof enclosures that has been in use for many years, is as follows:

•☐In the traditional method of protection, it is assumed that an explosion may occur inside the enclosure, and the enclosure is therefore designed so that such an internal explosion cannot damage it or cause the ignition of the gas or vapour surrounding it.

•☐In the type 'e' system however, flameproof and explosion-proof enclosures are not required because the equipment is instead designed in such a way that all possible sources of ignition, such as arcs, sparks and excessive surface temperatures, can be closely controlled. As a result Of this, the statistical probability of an explosion occurring is reduced to an acceptably low level.

6.1.1.10 **Main lighting installation**

i) The main lighting installation in the battery room shall be supplied from the station's 230/400 V A.C. auxiliary supply.

Ii) The installation shall consist of fluorescent luminaires only, type Exec' class 1 Div 1 (T1 – T4). This form of lighting is favored over mercury-

vapour lighting for the reason that the latter, when subjected to dips in supply voltage, may go out and remain out for periods of up to ten minutes. Incandescent lighting is also considered unsuitable because of its relatively low lumen output and short service life, both of which factors give rise to excessive maintenance costs.

iii) The fluorescent fittings chosen shall preferably be installed on the ceiling, and shall provide sufficient light output to illuminate the tops of the batteries to a level not less than a maintained 100 lux, in accordance with the OHS Act for battery and charging equipment rooms.

6.1.1.11 **Emergency lighting installation**

i) The emergency lighting installation shall consist of incandescent luminaires type Ex'e' (T1 – T4), with a standard two pin bayonet or screw type socket or fluorescent luminaires and fitted with D.C. to A.C. converters. These units shall be supplied from the station battery using the normal D.C. distribution system.

ii) These luminaires shall be mounted on the ceiling or walls only.

iii) The maintained level of emergency lighting required in this area shall be not less than 20 lux at floor level to enable employees to evacuate the workplace safely, in accordance with the OHS Act.

6.1.1.12 **Luminaire positioning**

i) The luminaires shall not be mounted directly over the battery stands.

ii) The luminaires shall be positioned in parallel with the battery stands. This precaution will facilitate maintenance on the fittings, and will also minimize the obvious dangers of working over the cells.

iii) No battery banks shall be installed directly under the luminaire.

6.1.1.13 **Other Electrical Equipment**

All light switches, power outlets, distribution boards, telephones and fan contactors shall be mounted outside but still in close proximity to the battery room door.

All batteries are classified as "hazardous waste." Batteries have been determined to be unsuitable for disposal as municipal solid waste because they contain highly toxic heavy metals like lead, mercury, cadmium, nickel, lithium, zinc etc and few types contain liquid with highly corrosive properties.

6.2 Battery Disposal:

1. Lead-acid batteries.- Most commonly used batteries are lead – acid batteries, which contain highly corrosive sulphuric acid and toxic metal lead. Reputed battery manufactures, suppliers and recycling agencies are equipped with most successful & efficient recycling technologies wherein each battery and all its chemical components are recycled.

- Keep the battery safely in area earmarked for their disposal ensuring that there is no leakage. In case of any leakage, place the battery in plastic bag / container.
- Batteries or battery packs must not show any signs of leakage or corrosion. To prevent short circuiting and heat buildup during storage and transport, use tape to cover the metal (+/-) terminals on any battery that is not individually wrapped or included in a battery pack.
- Call recycler who has been authorised by State Pollution Control Board for processing & recycling of such used batteries.

- In case, used batteries need to be disposed, call hazardous waste disposal agency authorized by State Pollution Control Board. These batteries require neutralization of its liquid content before processing for recovery of metallic and plastic constituents.

2. All other type of batteries other than those of Lead-acid batteries. – These batteries contain toxic heavy metals. The authorised recycler / disposal agency take care of the hazardous substances / chemicals contained in such batteries.

- Collect all used batteries in a strong cardboard or wooden box. When the box is full, close / seal it properly. Clearly label the box with "Used batteries for disposal".
- Call recycler / disposal agency that has been authorised by State Pollution Control Board for processing, recycling and / or disposal of such used batteries.

7.RECORDS :

7.1 record of Hazmat slip and disposal receipts (detention period-05 years)

8. Training & Communication:

a. Personnel involved in handling, storage and disposal process shall be fully aware of the requirements of Hazardous Waste Management Rules for batteries.
b. Knowledge about use of appropriate tools & PPEs for safe handling and use of Lead Acid batteries.
c. Initial Communication to be done through Corporate Communication, Email and subsequently shall be made available at safety portal at Sangam.

9. VERIFICATION

a. 1.5. Verification of implementation shall be done during Safety audit, field safety visit and site inspections.

10. **Exceptions:** Any Exception to this procedure shall only be done as per Document Control .Procedure (TPSMS/GSP/DC/014).

11. **REFERENCES**

- Tata Power Safety Management System (TPSMS) Manual
- OHSAS 18001:2007
- Tata Power Document Control Procedure (TPSMS/GSP/DC/014).
- Tata Power Safety Capability Building procedure(TPSMS/SCB/DC/016)
- Battery rules
- Hazardous waste management rules

12. **Review:**

12.1 Review of this procedure shall be done as and when but not later than once in every three (03) years. Typical Factors like Changes in legislation, Review of Incident Reports, Inspection & Audit findings, Feedback from users, Recommendations in Incident investigation reports may be inputs for the review and revision of the procedure.

12.2 In case release of revised procedure gets delay due to obtaining feedback or any other reasons, safety advisory may be issued immediately to take precautions for the proposed changes in the procedure and revised procedure should be released subsequently.

13. **ATTACHMENTS/APPENDIX :**

Nil