**STANDARD OPERATING PROCEDURE**

**LMV CAMPER OPERATION**



**ODISHA MINING CORPORATION LTD.**

**KODINGAMALI BAUXITE MINE**



**Authorized By**

### SOP for Electrical Safety

**Purpose:** The Standard Operation Procedure establishes a safe working environment and system of work, also defining competencies, in order to ensure that all electrical works are effectively controlled, and that all electrical equipment connected with generation, transmission, distribution and use of electricity are installed, operated, and repaired/attended to & maintained in a safe working order so that potentiality of any injury, shock or burn to any person or any unplanned fire incident which may have cause damage to equipment or property and other hazards and incidents related with use of electricity are eliminated.

**Potential Electrical Accidents can be –**

* **Electrical Shock** – due to persons coming in contact with bare conductors, touching poorly insulated conductors or improperly insulated joints, improperly earthed equipment, faulty earth-fault relays
* **Electrical Burns** – can be contact burns (thermal effect of current) or flash-over burns when electrical current passes through air (normally associated with high voltages). Flash-over can occur due to over-current too or because of failure of insulation material.
* **Fire & Explosion** in electrical equipment due to over-current, earth-fault & overheating. May as well damage other electrical installations/apparatus connected to the system/circuit.

Following guidelines and directives of Central Electricity Authority Regulations (Measures Relating to Safety & Electrical Supply) 2010, applicable to Mines, shall be implemented as part of the SOP -.

1. An Electrical Safety Plan shall be framed and implemented mentioning therein all systems, processes, procedures and safeguards that shall be undertaken to manage risks identified through a structured Risk Assessment process.

* 1. The Electrical Safety Plan shall include guidelines framed in conformity with all the directives of Central Electricity Authority Regulation (Measures Relating to Safety & Electrical Supply) 2010 applicable to Mines and shall be implemented.
  2. Appropriate maintenance system & procedures, and testing schedules shall be framed and Implemented of to ensure that all electrical installations & equipment, including sources of power generation, transformer stations, transmission lines, and electrical equipment/machinery and devices are kept maintained in a safe working order

**Responsibility: RM, Manager, & Engineer (Electrical)**

2 All contractors engaged in any work related to electrical installation, maintenance or repair shall possess a valid electrical license granted by the State Licensing Board or the appropriate authority.

2.1 Adequate number of competent Electrical Supervisors and other personnel shall be employed by such contractors.

**Responsibility: RM, Manager, & Engineer (Electrical)**

3. It shall be ensured that engineers, electrical supervisors and electricians employed in the mine, including by contractors, if any, in connection with generation, transmission, distribution or use of electricity shall possess relevant qualifications and license as stipulated in CEAR 2010. An Electrical Safety Officer shall also be designated if so called for by the provisions of CEAR 2010.

3.2 All persons deputed to carry out duties connected with or incidental to generation, transmission, distribution or use of electricity in the mine shall be duly designated/ authorized for the purpose to operate, and carry out work related to upkeep, repair & maintenance on electrical lines and apparatus.

3.3 A bound paged register listing therein the names of the designated persons and the purpose for which they are engaged, shall be kept maintained in the mine.

**Responsibility: Manager, & Engineer (Electrical)**

1. Job-specific training shall be imparted to all contractors & his employees and to all other employees, supervisors, competent persons designated/authorized **before they are deployed/employed in the mine.** Such training shall also be imparted whenever any new electrical equipment, machinery/device, power lines or other energy sources are installed/commissioned or there is a change in the electrical supply/transmission-systems or, there is a change in the electrical equipment/ machinery/installation including in their working voltage or place of installation.

4.1 All such employees shall also be imparted electrical hazard awareness training, including fire-fighting and first-aid (more particularly resuscitation of persons suffering from electric shock) during induction as well as at regular intervals and whenever there is a change in the electrical equipment/layout.

4.2 Training to the concerned personnel shall also be imparted if there is a change in his job profile or area of work.

4.3 A feed-back test shall form part of the training modules to ensure that the electrical hazards & the manner in which the same are to be dealt with have been well under

**Responsibility: Engineer (Electrical), Safety Officer & VTO**

5 A correct plan showing the position of all fixed electrical machinery and apparatus including lighting, telecommunication or signaling apparatus and conductors thereof shall be kept maintained in the Mines Office.

5.1 Single-line diagrams, showing details of switches/isolators/relays & other protective devices and their ratings, electrical equipment and devices connected thereto, fault current protection settings, etc., shall be kept prominently displayed and readily available at every electrical installation as well as at the mine’s office.

5.2 All Plans and single line diagrams/electrical drawings shall be kept maintained up-to-date and shall be appropriately version controlled, whenever any new electrical equipment, machinery, device, power lines or other energy sources are installed or commissioned, or there is a change in the electrical supply/transmission-systems, or, there is a change in the electrical equipment/machinery/ installation including in their working voltage or place of installation.

**Responsibility: Engineer (Electrical), Electrical Supervisor**

6. Transmission and use of electricity in the mine shall conform to voltage limits prescribed under CEAR 2010.

6.1 Cables, used in connection with transmission and use of electricity, including flexible cables used for portable & transportable apparatus, shall also strictly comply with the stipulations of CEAR 2010.

6.2 All Electrical Equipment/Apparatus used in the mine shall conform to the relevant Standards and Approvals as applicable.

**Responsibility: Manager, Engineer (Electrical), Electrical Supervisor**

7. All outdoor sub-stations, except pole type sub-stations and outdoor switching stations shall be efficiently protected by fencing not less than 1.8metres in height or other means so as to prevent access to the electric supply lines and apparatus therein by an unauthorized person and the fencing of such area shall be earthed efficiently. The area within & around the sub-station shall be kept free of vegetation

7.1 Transformers and switchgears shall be placed in a separate room or compartment or box to prevent danger of mechanical damage. No inflammable material shall be used in the construction of such room, compartment or box unless the apparatus is so constructed, protected and used as to obviate the risk of fire. Efficient ventilation shall be provided for all apparatus installed in such room/compartment and the room/compartment shall be kept dry and illuminated.

7.2 Properly constructed switchgear for disconnecting supply of electricity from the **entire mine** shall be provided and kept maintained as approved by the Electrical Inspector of Mines.

7.3 Switchgears/appropriate apparatus shall also be provided for disconnecting the supply from every part of the electrical system and/or electrical apparatus to ensure their proper protection & isolation.

7.4 Efficient means of communication shall be provided between the switchgear from where the power to the entire mine can be disconnected and other distributing centres.

7.5 The switchgears/apparatus shall be so designed and constructed as to disconnect automatically, from the power supply any section of the system or installation/ motor subjected to a fault or in the event of conditions of over-current, over-voltage and single phasing.

7.6 Fuses and relays of appropriate rated capacity shall only be used in switchgears of electrical installations.

7.7 In every opencast mine where dumpers or trackless vehicles are operated, it shall be ensured that a minimum clearance of not less than 12 metres is kept maintained between the lowest conductor of over head lines and the ground/road where dumpers or trackless vehicles cross.

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**Responsibility: Engineer (Electrical), Electrical Supervisor**

8. All panels shall be painted with the description of its identification at front and at the rear.

8.1 All principal switches or isolators shall be labeled to indicate the circuit/equipment connected to it as to ensure proper isolation.

8.2 An insulating floor or mat conforming to IS-l5652: 2006, of appropriate voltage level shall be provided in front of the switchgears and control panels for the safety of operating personnel.

**Responsibility: Engineer (Electrical), Electrical Supervisor**

9. All circuits and apparatus shall be so arranged that there is no danger of any part thereof becoming accidentally charged to any voltage beyond the limits of voltage for which they are intended.

9.1 In case of a fault in any circuit, the part of the electrical system affected shall be made dead without delay and shall remain so until the fault has been remedied.

9.2 Appropriate equipment shall be suitably placed to automatically disconnect power supply to any part of the system, should any fault, including an earth fault, occur and fault current shall be restricted to 750mA in installations of voltage exceeding 250V and 50A in installations of voltage exceeding 1100V by employing suitably designed, restricted neutral system of power supply.

9.3 Neutral point of every generator and transformer shall be earthed by connecting it to the earthing system by not less than two separate and distinct connections.

9.4 All switchgear and control panels shall be properly earthed. All non-current carrying metal parts of switchgear and control panels, frames, instrument covers, handles, switch & fuse covers of boxes, all lamp holders, and frames and bed-plates of generators, transformers and motors, and metallic sheaths, coverings & joint boxes of cables, shall be **earthed** by a connection to an earthing system at the surface, and in a manner approved by the Electrical Inspector of Mines. The conductivity of the earthing system shall be as prescribed by the CEAR 2010.

9.5` The tripping of the relays in the switchgear shall be recorded daily at the generating station, sub-station or switch station in a register kept for the purpose.

**Responsibility: Engineer (Electrical), Electrical Supervisor**

10 Every overhead line, sub-station or generating station and other installations exposed to lightning shall be protected by efficient means for diverting to earth any electrical surges due to lightning which may result into injuries.

10.1 The earthing lead for any lightning arrestor shall not pass through any iron or steel pipe, but shall be taken as directly as possible (subject to avoidance of bends) from the lightning arrestor "without touching any metal part” to a separate-vertical ground electrode or junction of the earth mat.

**Responsibility: Engineer (Electrical), Electrical Supervisor**

11 Before commissioning any new apparatus, or re-erecting any apparatus in a new position, and all apparatus/equipment after major repairs shall be tested to ensure that the equipment is in safe working order.

11.1 Every switchgear and protective system shall always be kept maintained in good working order, and shall be checked/tested once every three months by the supervisor/competent person and the results thereof shall be recorded in a bound paged book kept for the purpose.

11.2 All apparatus shall be thoroughly examined and continuity of earth conductors and metallic coverings shall be tested as often as may be necessary.

11.3 The results of all tests carried out in accordance with the provisions of CEAR 2010 shall be recorded in a bound paged book prescribed for the purpose.

**Responsibility: Engineer (Electrical), Electrical Supervisor**

12 Fire-extinguishers and other fire-extinguishing appliances of adequate capacity and of an approved type shall be installed and kept maintained at every electrical installation (other than at cables and at telecommunication & signaling apparatus) or places containing electrical apparatus,

**Responsibility: Manager, Engineer (Electrical), Safety Officer**

13 On every motor, generator, transformer and other electrical plant and equipment operated at voltage exceeding 250V, as well as on apparatus used for controlling or regulating the same, and on all supports of overhead lines of voltage exceeding 650V, a **danger notice** in Hindi or English and the local language with a sign of skull & bones of a design as per IS -2551 shall be affixed at conspicuous places.

13.1 A notice in English or Hindi and the local language shall be exhibited at every electrical apparatus, forbidding un-designated/unauthorized persons to operate or otherwise interfere with such apparatus;

13.2 Instructions, in English or Hindi and the local language along with pictorials for the resuscitation of persons suffering from electric shock, shall be affixed at conspicuous places in every generating station, enclosed sub-station, switch-rooms and at installations where electricity is in use.

**Responsibility: Manager, Engineer (Electrical), Safety Officer**

14. Every person who is allowed to work on an electric supply line or apparatus shall be provided with tools and devices such as gloves, rubber shoes, safety belts, ladders, earthing devices, helmets, line testers, hand lines, and the like for protecting him from mechanical and electrical injury.

14.1 Such tools and devices shall always be maintained in sound and efficient working condition. Defective & damaged tools and devices shall immediately be replaced.

**Responsibility: Manager, Engineer (Electrical), Safety Officer**

15. All electrical installations/apparatus/motors including electrically operated portable and transportable machines shall be operated only by a person duly designated or authorized for the purpose.

* 1. Person designated/authorized to operate any electrically operated portable and transportable machinery shall not leave the machine while it is in operation. Before leaving the machine he shall ensure that the power supply to the machine is disconnected. Portable & transportable machines used in underground mines may be operated on remote control from the concerned switchgear with pilot core protection.
  2. Working on any electrical apparatus/equipment in wet conditions shall be avoided whenever possible. Persons shall not stand on wet ground when operating electrical equipment.
  3. Where a plug-and-socket-coupling other than of bolted type is used with flexible cables, an electrical inter-lock or other approved device shall be provided to prevent the opening of the coupling while the conductors are live.
  4. Designated persons, before working on any electrical equipment/apparatus/ installation or transmission lines shall ensure that they wear required PPEs – particularly hand gloves & rubber shoes, and use the desired-rated instruments and standard, good quality, insulated tools, probes, and prods.

**Responsibility: Engineer (Electrical), El. Supervisor, Designated Person**

16 Before any conductor or apparatus is handled for the purpose of repairs, maintenance or examination, adequate precautions shall be taken, by earthing or other suitable means, to discharge electrically such conductor or apparatus, and any adjacent conductor or apparatus if there is danger there-from, and to prevent any conductor or apparatus from being accidentally or inadvertently electrically charged when persons are working thereon.

* 1. No person shall work on any live electric supply line or apparatus and no person shall assist such person on such work. Before carrying out any task, it shall be doubly ensured that the equipment/transmission line is 100% dead and is in no condition to get energized at any stage of work. They shall strictly follow the work instruction provided to them and in case of doubt discuss with the supervisor.

16.2 All such work shall be undertaken after electrical Isolation of the equipment or the apparatus (other than hand-held ones operating at 30V) or on the supply/ transmission lines supplying power at 125V or more through due process of Lock Out & Tag Out or LOTO in short, so that the isolator cannot be accidentally switched ON, as to endanger the life and safety of persons engaged in repairs, maintenance, inspection or examination on such equipment, device or apparatus or the power-supply/transmission lines, as the case may be. A removable fuse in shall in no case be considered as an isolator/switch.All such repairs, maintenance or examination shall be **carried out under a system of Permit** (to be issued by the Electrical Engineer) and under personal supervision of a Supervisor **(see SOP for LOTO).**

16.3 No HEMM/equipment shall be allowed to pass underneath a transmission line unless the power to such transmission line has been disconnected. A proper **Permit system** shall be followed for the purpose **(see relevant SOP)**

16.4 Adequate precautions shall be taken during **shot-firing** to protect all electrical apparatus and conductors from injury. All electrical overhead lines and all electrical equipment within a radius of 100m of blasting area shall be de-energized before blasting and shall not be re-energized till a physical inspection is made after blasting and all overhead lines & equipment are found in order.

**Responsibility: Engineer (Electrical), El. Supervisor, Designated Person**

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