



NEPRA Incident Alert # 2024-02/ June 06, 2024



## Electrician Electrocution

### Summary

A contractor was awarded a project work to construct a new foundation and install a capacitor voltage transformer (CVT), surge arrester, wave trap, and other hardware at new designated locations in the 220kV Grid Yard at 500kV Grid Station. However, the grid maintenance team agreed to carry out the task on-site instead of the contractor.

After the issuance of a Permit to Work (PTW), involving the opening of circuit breakers D2Q1 and D2Q3, the line isolator D2Q10, and the closure of the Earth Switch D2E10 of 220kV Circuit-I, the grid maintenance team began the project work. The 220kV Circuit-II remained energized while the work was in progress.

During work on the yellow phase, the team used a crane to remove the conductor of the surge arrester and detached the dropper jumper from the line isolator D2Q10. The dropper jumper was then only connected to a substandard temporary earthing cable with loose wires having no clamp. As a result, the permanent earth protection D2E10 became ineffective due to the dropper jumper's disconnection from the line isolator D2Q10. Subsequently, a team member attempted to hold the dropper jumper with bare hands to reattach it to the isolator, unaware that the temporary earthing cable was unsecured and not electrically connected to the work object. Consequently, the dropper jumper became charged with induced voltage due to the ineffective earth protection D2E10. Tragically, the individual was electrocuted by induced voltage from the adjacent 220kV Circuit-II lines. CPR was administered, and the victim was transported to a hospital, where he was pronounced dead upon arrival.

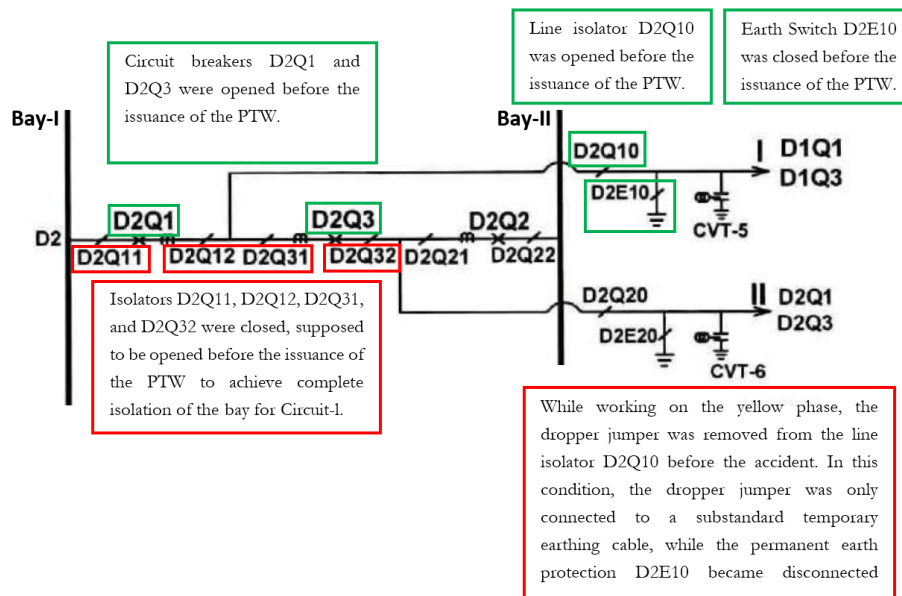


Figure-1: Single Line Diagram



## Findings

1. **Lack of Job Plan:** Site Management failed to provide a job plan for this critical task.
2. **Unauthorized Work:** The grid maintenance team performed unauthorized project work instead of the contractor. This violation went unreported by the PTW Issuer and Receiver
3. **Supervisory Lapses:** Site Management exhibited serious supervisory lapses and lack of control, allowing employees to handle operational matters unprofessionally, highlighting a deficient safety culture.
4. **Inadequate Staffing:** Non-technical and untrained staff, such as gardeners and watchmen, were assigned to isolation tasks in the grid yard without relevant training.
5. **Incorrect PTW Issuance:** The PTW was issued with an incorrect isolation scheme, missing the opening of isolators D2Q11, D2Q12, D2Q31, and D2Q32 necessary for complete isolation.
6. **Substandard Earthing:** A substandard temporary earthing cable with loose wires having no clamp was used for the critical task.
7. **Poor Site Supervision:** There was inadequate site supervision of critical activities by the PTW Issuer and Receiver, leading to unaddressed unsafe conditions.
8. **Lack of Voltage Testing:** Voltage tester or detector was not available to periodically test the line for the absence of voltage or detect induced voltage.
9. **Insufficient PPE:** The grid maintenance team lacked necessary Personal Protective Equipment (PPE) for this critical task such as a non-conductive helmet with a strap, non-conductive safety shoes, Class-2 insulated electrical rubber hand gloves and sleeves, demonstrating unprofessional behavior.
10. **Disregard for SOP:** Employees engaged in unprofessional and substandard workmanship by ignoring SOPs, risking their lives.
11. **Absence of Contractor's Engineer:** The contractor's Site Engineer was not present to supervise and oversee the critical task, failing to verify circuit isolation and ensure the correct use of PPE.
12. **Generation of Induced Voltage:** The accident occurred at 19:20 hours, shortly after sunset at 17:51 hours, when induced voltage from the energized Circuit-II increased. The relays on the 220kV Circuit-I detected induced voltages originated from Circuit-II.
13. **Completion of Project:** After the accident, the contractor staff completed the project tasks under PTW by correctly opening the necessary circuit breakers and isolators.



### High Focus Areas & Lessons Learned

1. **Develop Job Plan:** Site Management must develop and implement job plans after assessing risks for critical tasks.
2. **Qualified Staffing:** Only medically and physically fit personnel with necessary training and technical skills shall be authorized to work on electrical networks or installations.
3. **Isolation Procedure:** Develop, enforce and maintain isolation SOP for circuit isolation. Provide training to ensure proper application of isolation procedures in Sub-stations and Grid Stations.
4. **Enforce PPE Use:** Ensure the use of non-conductive PPE for all personnel working in Sub-stations and Grid Stations.
5. **Standard Earthing Kit:** Discard all substandard earthing cables and replace them with standard portable temporary earthing kits designed for the rated voltage, ensuring they are short circuit proof and securely connected to the work object.
6. **Voltage Testing:** Use a voltage tester, detector or beeper to confirm the line is dead. Alternatively, electrician/lineman shall carry a personal or proximity voltage detector (with voltage ranges from 120VAC to 500kV) all the time while working to detect induced voltage from adjacent conductors or circuit, particularly if the earthing clamp is loose or not electrically connected.
7. **Site Supervision:** Develop, implement and maintain SOP for adequate site supervision of high-risk activities, under close and direct supervision by the job supervisor, PTW Issuer and Receiver, ensuring all procedures are followed by employees and contractors.
8. **Counseling and Coaching of Workers:** Site Management must take a firm approach to willful violations to maintain discipline. Individuals who repeatedly violate workplace rules and SOPs should receive appropriate counseling and coaching to improve their attitude towards risky behavior. If these measures do not lead to improvement, the errant employees should be removed from the workplace to ensure their safety and the safety of others.

Implementing these measures can significantly enhance safety and prevent future incidents in Sub-stations and Grid Stations.

