

## A Multi-Tier Causative Analysis of Fatal Electrical Accidents Triggered by Conductor Snapping in Power Distribution Networks

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### Abstract

Electricity is the driver and one of the prime indices of human development in a country, providing multiple aspects of quality of life. In contrast, electrical accidents remain a challenge to maintaining safety standards, especially in industries involved in the generation, transmission, and distribution of electricity. The electricity distribution system accounts for about 76% of electrical accidents across sectors in India in 2024-25, a trend that has been consistent over the years. Direct and indirect contact with overhead power lines is a significant cause of electrocution, where 29 out of 55 (about 53%) fatalities are due to contact with energized snapped overhead conductors. The purpose of the study is to identify the causes of conductor snapping in the electricity distribution system and to develop a safety framework to prevent fatalities from overhead conductors. The study employs a causal analytical approach through content analysis of accident investigation reports for 141 fatal electrical accidents from 2018 to 2023, of which 55 (39%) fatalities were due to contact with an energized power line. The data were coded using a framework analysis structure, with coding categories for the type of contact, sources of the accident, and causes of the accident. The study's thematic analysis identifies both the primary and secondary causes of the accident, thereby pinpointing the root causes. Five sources of accidents are identified, with snapped conductors being the most significant. Failure to maintain distance, non-operational safety devices, broken line insulator, tree falling on the line conductor, and ageing conductor are prominent causes. Moreover, failure to de-energize is the root cause of electrical accidents involving snapped power lines. Based on the findings of this investigation, fatalities can be prevented by avoiding electrical accidents. Thus, the outcomes may help reverse the current upward trend in fatal electrical accidents.

### Keywords

Electrical accident, distribution system, overhead power lines, conductor snapping.