**Solar Electric Technician Training**

**Module 2: Occupational health and safety**

**Case Study: Failure to follow standards in a solar PV installation**

**Background**

In 2018, a mid-sized solar PV installation was commissioned on the rooftop of a commercial building in Kathmandu, Nepal. The system was designed to provide 50 kW of power, enough to offset a significant portion of the building's electricity consumption. The installation was completed by a local contractor who had limited experience with solar projects.

**Problem**

Shortly after commissioning, the system began experiencing frequent faults, including inverter shutdowns, tripped breakers, and underperformance. Within six months, the system suffered a significant failure when an electrical fire broke out in one of the junction boxes, causing extensive damage to the wiring and some PV modules.

**Investigation findings:**

A thorough investigation was conducted by a third-party solar engineering firm to determine the root cause of the issues. The investigation revealed several critical failures to follow established professional and technical standards:

1. **Improper wiring practices (National Electrical Code, NEC Violation)**

The investigation found that the contractor did not follow the National Electrical Code (NEC) guidelines for wiring and protection. Conductors were undersized for the current they were carrying, leading to overheating. The lack of proper conduit protection in certain areas exposed wires to mechanical damage, which eventually caused a short circuit and the subsequent fire.

1. **Non-compliant components (IEC Standards Violation)**

The PV modules used in the installation were found to be non-compliant with IEC 61215 standards for module quality and safety. These substandard modules were prone to microcracking, which led to reduced efficiency and eventual failure under normal operating conditions.

1. **Lack of proper grounding (NEC and IEEE Standards Violation)**

The system was inadequately grounded, which violated both NEC and IEEE 1547 standards. This lack of grounding created a significant safety hazard, as it increased the risk of electric shock and contributed to the system's frequent inverter shutdowns due to grounding faults.

1. **Failure to follow OSHA safety guidelines**

During the installation, the contractor did not adhere to OSHA guidelines for fall protection and electrical safety. Workers were observed using improper personal protective equipment (PPE), and there were no lockout/tagout procedures in place. Although no serious injuries were reported, the lack of safety measures could have led to severe accidents.

**Consequences of non-compliance with technical standards and guidelines**

The failure to adhere to these standards had several severe consequences:

* **System downtime and financial loss**: The frequent faults and eventual fire led to significant system downtime, causing the building owner to lose the expected savings on electricity. The cost of repairs and replacing damaged components further added to their financial burden.
* **Safety hazards**: The improper installation practices created numerous safety hazards, including the risk of electric shock, fire, and injury to workers and building occupants.
* **Legal and regulatory repercussions**: The building owner filed a lawsuit against the contractor for negligence and non-compliance with industry standards.

**Lessons learned**

This case highlights the importance of adhering to professional and technical standards in solar PV installations. Key takeaways include:

* **Strict compliance with electrical standards**: Adhering to NEC, IEC, and IEEE standards is non-negotiable for ensuring the safety and efficiency of solar PV systems. Proper wiring, grounding, and the use of compliant components are essential to avoid failures.
* **Importance of using qualified contractors**: Building owners must ensure that contractors have the necessary qualifications, experience, and understanding of solar PV standards before commissioning a project.
* **Regular Inspections and Audits**: Regular inspections and audits by third-party professionals can help identify and rectify non-compliance issues before they lead to system failures or safety hazards.
* **Prioritizing safety**: Following OSHA safety guidelines and implementing proper safety procedures, such as lockout/tagout and fall protection, are crucial in protecting workers and preventing accidents.