



Global Risk Experts

Improving Health & Safety - Protecting Assets

ARC FLASH AND ELECTRIC SHOCK HAZARD STUDY - Greenfield Projects

Why Greenfield Projects?

Although there is never a wrong time to perform Arc Flash & Electric Shock Hazard Studies, preferred application is during a Greenfield Project as the study results will flow directly into the design, before any equipment is installed. This study adds another 3rd party design review and is very cost-effective.



Arc Flash is caused by high impedance at an electrical source which results in a burst of energy and extreme heat. This might happen during energized works when two conductors are shorted. It can be caused by un-insulated tools, metal worn by workers, loose cable connections, faulty circuit breakers or other protective devices. Consequences might include burns, loss of life and severe property damage.

Electric shock is formed by a low impedance path to ground. It can be caused by exposed metal parts like panels, bus bars and cables carrying fault currents which come in contact with personnel. Consequences might include injuries from light to severe, even loss of life.

To determine if and how work at energized installations or equipment can be carried out in a safe way, an arc flash and electrical shock hazard study needs to be performed in compliance with the following standards *:

- IEEE Standard 1584 Guide for Performing Arc Flash Hazard Calculations
- OSHA 29 Code of Federal Regulations (CFR) Part 1910 Subpart S
- NFPA 70 National Electric Code
- NFPA 70E Standard for Electrical Safety in the Workplace (2012 edition)

* and/or relevant local and national standards and regulations

Why Global Risk Experts?

Global Risk Experts is a Swiss-based risk management consultancy with a branch office in Malaysia, and is led by a group of highly experienced professionals to provide independent, unbiased risk management services.

Our objective is to help companies identify the various risks they face, assess their operational vulnerabilities across the organization and provide practical, cost-effective solutions for minimizing / mitigating those risks.

Flexible and responsive

Our teams are available whenever and wherever they are needed, and can respond immediately in the event of an emergency or major loss.

Practical, realistic and cost-effective

Our technical expertise is coupled with deep business experience; we understand that risk management necessarily involves trade-offs, and look at risk in the context of the specific business situation - not the theoretical "ideal".

Global reach

We have experience in all regions of the world and are specifically knowledgeable about internationally and local regulatory requirements in numerous countries around the world.

Study Schedule:

The Arc Flash and Electric Shock Hazard Study for Greenfield Projects will be carried out in 2 main steps:

Step1: Document Analysis

After the detailed design has been reviewed and approved by the contractor but before approval of the customer (owner) with the aim to identify incident energy level above PPE Level 2 to allow changes to the system before physical installation. The actual activities are as follows:

1. **Document Collection:** Analysing each and every power distribution system (desktop analysis)
2. **Data Analysis:**
 - a. List of details of all relevant existing electrical equipment
 - b. Fault current calculation
 - c. Protection device coordination study
 - d. Arc Flash Analysis
 - e. Electrical Shock Hazard Analysis
 - f. Respective modelling (preparing best / worst case) with advice on reducing arc flash exposure
 - g. Preparation of Step 1 report

Step 2: Verification & Labelling

After installation of all electrical equipment but before commissioning. Activities are:

1. **Data Collection & Verification:** Site Visit. Analysing each and every power distribution system, verifying the existing documentation, adding missing information and/or equipment.
2. **Data Analysis:**
 - a. Preparation of as-built line diagrams
 - b. Same activities as above (2. Data Analysis a - f)
 - c. Preparation of the final report
3. **Labelling:** To carry out labelling of all electrical panels analysed for Arc Flash and Electric Shock to ensure that technical staff has all relevant information at hand at any time.
4. **Training:** Based on requirement, designated staff will be trained in understanding Arc Flash hazards and safe working practices to prevent arc flash and electric shock exposure.



Deliverables:

- **Updated single line diagrams of the electrical systems:** Fully updated line diagrams are required to allow modelling and development of various scenarios, leading to reduction of arc flash exposure and lower PPE levels.
- **Fault Current Study:** Calculating the fault current at each panel, busbars, and/or switchboard
- **Protection Device Coordination Study :** Indication of in-coordination of cascaded protective devices.
- **Arc Flash Analysis :** Leading to detailed information on incident energy and duration, arc flash boundaries, and the resulting PPE requirement.
- **Electric Shock Hazard Analysis :** The calculation of the fault currents of every circuits leads to the definition of boundaries to prevent electric shock. These boundaries (Limited / Restricted / Prohibited Approach Boundary) are printed on each warning label.
- **Compliant Labelling :** All affected equipment will be labelled in accordance with the respective standard. Warning and Danger labels are provided depending on the severity of exposure.
- **Final Report :** All details documented, including updated line diagrams, list of protective equipment, fault current calculations (analysis), protective device data, time coordination graphs, resulting PPE levels, approach boundaries, warning/danger labels etc.. Furthermore, advice on improving the electrical installation to reduce arc flash intensity and to reduce PPE levels will be prepared.
- **Training :** Based on requirement of the site, designated technical staff will be trained in understanding Arc Flash hazards, safe working to prevent arc flash and electric shock exposures.

Benefits Specific to Greenfield Projects:

All benefits associated with an Arc Flash & Electric Shock Hazard Study of existing installations apply to the one for Greenfield Projects as well. However, there are a number of specific benefits, worth to be considered:

Improving Design Quality

Carrying out the Study after the detailed design is finished adds an important independent 3rd party review step into the overall design process. It will guarantee, the design of the electrical power distribution system throughout the new plant is compliant, no unacceptable arc flash exposures exist or - if identified during the study - will be reduced to an acceptable level through redesign. No expensive replacement of installed equipment will be required as studies of running operations result in.

Higher Safety Level During Commissioning & Testing

Commissioning and testing of a new electrical distribution system comprises the highest frequency of accidents and incidents due to the burn-in phase, possible installations errors and defects, and caused by the large number of contractors and other 3rd party personnel on-site. It is this time when work on energized equipment (e.g. testing) is frequent and the safety information provided by the Arc Flash labels will have the highest positive impact.

Cost Reduction

The 2 steps approach leads to significant savings regarding the time requirement for such a study. Although, the analysis has to be done twice, the time-consuming data collection and verification process is greatly reduced, thus the overall costs are considered lower when compared with a study of a respective running operation.

The highest impact regarding savings is the avoidance of design errors or inefficiencies that will require capital expenditure at a later time to change unacceptable high arc flash exposures.

Main Overall Benefits:

- **Compliance**
One aim of the study is to ensure the analysed site is in compliance with the most demanding requirement of international standards (NFPA / IEEE / OSHA) and respective local standards as well. Compliance with the latest international standards guarantees state-of-the-art installations regarding Arc Flash and Electric Shock exposures, a prerequisite to prevent accidents, financial losses, negative reputation issues and legal actions - to name some.
- **Occupational Health & Safety Improvement**
The nature of Arc Flash Studies is to eliminate as far as possible any arc flash incident. This demanding goal might not always be achievable. However, the frequency (probability) of arc flash events will be significantly reduced and - equally important - the severity of any remaining incident will be lowered to a level where severe injuries are not expected anymore. By providing relevant information regarding electrical safety throughout the plant on all panels and other parts of the power distribution system, staff members have required electric safety information right in front of their eyes where they need it and can respond accordingly. Of course, relevant training is part of the study.
- **Higher Level of Asset / Business Interruption Protection**
Arc flash is a severe ignition source for fires in industrial and commercial environments. Statistics show arc flash being a significant cause of fires and explosions (arc blast) with their devastating effect on physical property. Reducing the probability and severity of arc flash incidents not only decreases the direct physical losses, the impact on consequential financial losses is usually even higher, thus financial losses overall can be expected to be significantly reduced as well.
- **Higher Reliability of the Electrical Distribution System**
The Arc Flash Study is an exercise that covers the complete electric power distribution system of a plant. It is one of the few opportunities in a plant to look at the whole of the distribution system in one go. Deviations from good design and installation will be observed. Equipment or circuits with a high incident and loss potential will be identified and the respective severity quantified.

The Team

Our team of electrical engineers consists of personnel with more than 15 years' experience in design, installation, commissioning and maintenance of electrical power systems.

All elements of these studies are subjected to rigorous engineering review, from the data collection phase through engineering and report preparation, in order to ensure that the highest standards of quality are met.



Contact Us!



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