# TECHNICAL SUPPLEMENT

ELECTRICAL SAFETY FCX-HS03|ARC FLASH MANAGEMENT

RELEASE 07/2018 | VERSION 1

## GENERAL INFORMATION

This technical supplement is intended to establish minimum requirements for electrical Arc Flash studies in all Freeport-McMoRan mining operations and plants in order to balance production requirements, distribution system reliability and troubleshooting, to protect equipment, and to define administrative safety controls to properly protect our people.

### Management Process

FCX will assign an Electrical Safety Lead to oversee compliance to this policy and manage a process that includes: tracking the completion of electrical studies, application of arc flash labels, and updating of drawings.

### Electrical Safety Lead

The Electrical Safety Lead, in coordination with site leaders, is responsible for verifying and documenting that each site is in compliance with FCX-HS03 Electrical Safety Policy. This includes verification and documentation that each site has updated arc flash results, in compliance with Arc Flash Study requirements section, and updated arc flash labels, single line drawings and an electrical equipment database, as defined in this document.

### Arc Flash Engineer

The site will assign an Arc Flash Engineer should be a qualified Electrical Engineer, competent in performing all analysis required to complete the arc flash study and deliver arc flash labels.

The Arc Flash Engineer will keep the electrical equipment documentation/database updated, will be able to perform ad-hoc arc flash studies as needed, in the case of minor changes, and is responsible for performing or oversight of contract engineering when the site-wide arc flash study is completed in compliance with the Arc Flash Study Requirements section.

## Arc Flash Study Requirements

Three Phase electrical equipment, rated greater than 240V (RMS-LL), such as switchboards, panel boards, industrial control panels, meter socket enclosures, switchgear, and motor control centers (MCC) that are in other than dwelling units and that are likely to require examination, adjustment, servicing, or maintenance while energized shall have an arc flash analysis performed. One of two methods below shall be used to obtain the arc flash incident energy.

1. Incident Energy Analysis Method
2. Arc Flash PPE Category Method

Equipment rated equal to or less than 240V may be labeled as follows:

- 3-Phase equipment rated 240V may be labeled with an incident energy of 4.0cal/cm$^2$.
- 3-Phase equipment rated less than 240V:
  - Fed by a transformer rated less than 125KVA, may be labeled with an incident energy of less than 1.2cal/cm$^2$.
  - Fed by a transformer rated greater than or equal to 125KVA, may be labeled with an incident energy of 4.0cal/cm$^2$
- 1-Phase equipment rated 120V (RMS-LN):
  - Fed by a transformer rated less than 50KVA, may be labeled with an incident energy of less than 1.2cal/cm$^2$.
  - Fed by a transformer rated greater than or equal to 50KVA, may be labeled with an incident energy of 4.0cal/cm$^2$

Reference – Electrical Power Research Institute (EPRI) for equipment 50V to 240V

Re-engineering review is required when arc flash levels in 480VAC MCC bus bars are greater than 40 cal/cm$^2$. Engineering controls will be required for any 480VAC MCC bus bar as a minimum.

**Re-engineering should be based on adjustment of relay protection, implementation of maintenance switches (for instantaneous trip), replacement of protection devices, replacement of circuit breakers and the implementation of arc flash reduction devices like Fast Acting fuses, ultra-fast earthing switches or others**.

**Arc Flash Labels, Single Line Drawings, Electrical Equipment Documentation / Database:**

- Accurate arc flash calculations require a complete representation of system configuration and electrical equipment data, to include an arc flash model. Sites must maintain:
  - Electrical drawings
  - Arc flash Model
  - Electrical equipment database (if feasible or must have annual reviews of the first two bullets)
- Each department will have a person responsible to manage and maintain their electrical drawings. Electrical drawings will be updated per MOC procedures.
- Any changes to electrical drawings must:
  - Be provided to the Arc Flash engineer
  - Be signed by the appropriate electrical supervisor or superintendent
  - Be evaluated for accuracy
  - Updated in the drawing database/system
  - Generate new arc flash labels if necessary
- Additionally, electrical equipment documentation or database, arc flash calculations, arc flash labels, and single line drawings shall be reviewed at least every 5 years.
- The results of the Incident Energy Analysis must be on an arc flash label, to be applied directly to the equipment. Labels must contain the following, at a minimum: (see example below)
  1. Nominal equipment voltage
  2. Arc Flash Boundary
  3. Either available incident energy (or) minimum required arc rating of clothing
- Every switchgear, switchboard or MCC with a main breaker will have two arc flash stickers. The first one indicating the arc flash level in the bus bar and the second one indicating the arc flash in the bus bar upstream of the main breaker: