

Electrical Safety Program Arc-Flash How It Impacts Projects

October 7, 2013

Agenda

- ★ Our Obligation – Provide a safe work environment
- ★ What is Arc Flash?
- ★ How will this affect OPM Projects?
- ★ Creating and Maintaining Arc Flash Studies?
- ★ Arc Flash Study Flow Diagram
- ★ Expectations of OPM – AF Study

Our Obligation – Safe Work Environment

★ Overall Requirements

- OSHA and NFPA 70E requires Duke to inform employees & contractors of work hazards, mitigate those hazards where possible and provide information regarding appropriate PPE.
- Comply with Duke's Electrical Safety Program & other Work Procedures
- FMD's Electrical Safety Program (ESP) is based entirely upon:
 - OSHA Electrical Safe Work Practices
 - NFPA 70E: *Standard for Electrical Safety in The Workplace*®

★ FMD ESP applies to:

1. All FMD employees and contractors working at Duke involved in any electrical work over 50V.

Providing a Safe Work Environment

★ Providing an Electrically Safe Work Environment

- Three types of electrical hazards
 - Electrical Shock
 - Arc Blast <http://www.youtube.com/watch?v=4bBvmPRqfmo>
 - Arc Flash (burns) <http://www.youtube.com/watch?v=xCwVnWp6YhU>
- An Arc Flash Study will be conducted for every building on campus (*In-progress*)
- Each study will produce labels identifying the Hazard Category, Available Fault Current, Voltage, PPE Required, and Approach Distances at each electrical panel.

What is an Arc Flash? - Definition

Arc Flash: An electrical breakdown of a gas which produces an ongoing plasma discharge, resulting from a current flowing through normally nonconductive media such as air.

- Plasma temperature can reach 35,000° F.
- Fatal burns can occur at distances over 10 feet.
- Over half of arc flashes occur at 277 volts.
- Energy released is measured in **calories**

Shock/Arc Flash Labeling

 WARNING	
Arc Flash and Shock Hazard	
Appropriate PPE Required	
12 inches	Flash Hazard Boundary
0.63 cal/cm²	Flash Hazard at 18 inches
Category 0	Untreated Cotton
10.81 kA	Available Fault Current (Isc)
480 VAC	Shock Hazard when cover is removed
00	Glove Class
42 inches	Limited Approach
12 inches	Restricted Approach
1 inches	Prohibited Approach
Panel:	SWBD-MDP(PG4)
 JACOBS [™]	
Jacobs Engineering Group 111 Corning Road, Suite 200 Cary, NC 27518	
Job#:	FEWE0801
Prepared on:	07/06/12
By:	EHL
Warning: Changes in settings or configuration will invalidate the calculated values and PPE requirements	

Hazard Risk Category (HRC) – Utilize Table 3 For PPE

Hazard Risk Category (“PPE Category”)	Incident Energy (Calories/cm ²)
0	≤ 1.2
1	1.2 – 4
2	4.1 – 8
3	8.1 – 25
4	25.1 – 40

Shock/Arc Flash Labeling



DANGER

NO SAFE PPE EXISTS

ENERGIZED WORK PROHIBITED

189 inches	Flash Hazard Boundary
57 cal/cm²	Flash Hazard at 18 inches
Dangerous!	No FR Category Found
26.73 kA	Available Fault Current (Isc)
208 VAC	Shock Hazard when cover is removed
00	Glove Class
42 inches	Limited Approach
Avoid Contact	Restricted Approach
Avoid Contact	Prohibited Approach

Panel: PNL-DOP-P (0021)

Duke Electrical Safety Policy – What to Expect

- ✦ OSHA and NFPA 70E both **require de-energization to work on circuits** above 50V **unless it creates a higher hazard or is infeasible**.
- ✦ Examples of higher hazard are:
 - Interruption of life support systems
 - Deactivation of life safety alarm systems
 - Shutdown of ventilation equipment serving a Classified Hazardous Location
- ✦ Infeasible example: Testing & troubleshooting typically require circuits to be energized. It is infeasible to perform these tasks with the circuit de-energized.
- ✦ Feasible example: Changing a receptacle that is on the same circuit as the room lighting. It is feasible to provide temporary lighting so this circuit can be de-energized.
- ✦ De-energized condition is always the goal!

Also, it's the right thing to do!

Maintaining Accurate Labels

- ★ Duke is required to maintain and update AF labels as changes are made to the electrical system.
 - FMD-Engineering will be responsible for updating all existing AF Models and Labels as changes are made to a building's electrical system.
 - Engineering, MS Shops, and OPM must work together to maintain accurate AF models and labels by documenting changes to a building's electrical system as they occur.

3 Types of Projects

★ New Construction:

- Will include design of entirely new electrical system
 - i.e. new building
- Designer shall complete full Arc Flash Study (SKM model) per Duke University Design Guidelines website – [16570 – Arc-Flash Studies](#)
- Labels must be applied prior to building acceptance
- SKM model must be turned over to FMD

★ Major Renovation:

- Will include design to extensively modify or replace existing electrical system
 - i.e. adding/removing/replacing several pieces of electrical equipment
- Designer shall complete full Arc Flash Study (SKM model) per Duke University Design Guidelines website – [16570 – Arc-Flash Studies](#)
- Labels must be applied prior to building acceptance
- SKM model must be turned over to FMD

★ Selective Renovation:

- Small jobs requiring little modification to electrical system model
 - i.e. replacing device protection serving only 1 or 2 panels
- If an AF Study exists, FMD-Engineering shall update existing model and provide new labels.
- If a study does not exist, a partial study shall be completed and partial labels shall be provided (partial studies may be done in-house or by one of our AF consultants depending on scope and workload).

When is a AF Model Update Required?

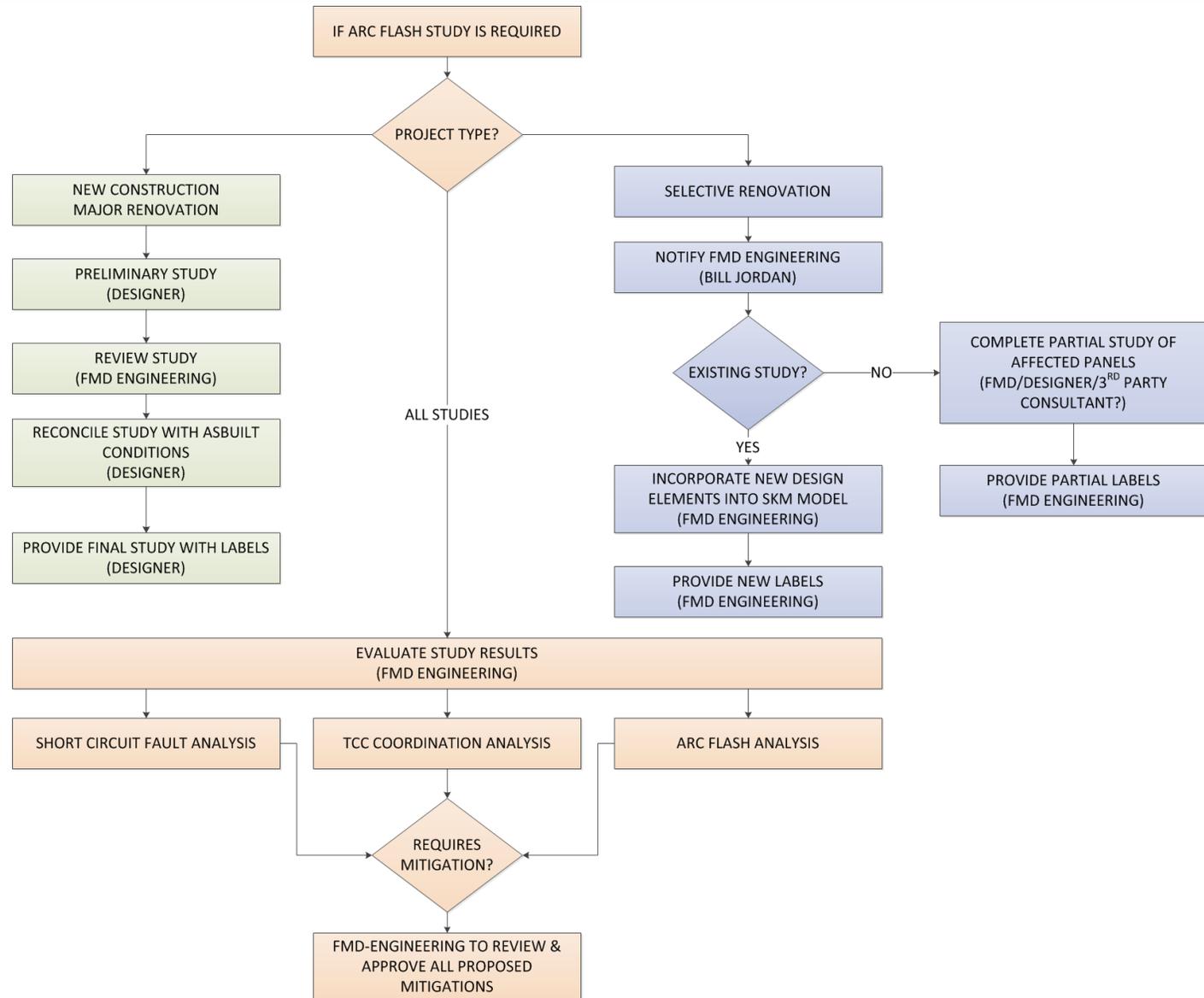
★ Update Required if:

- Work that alters existing Available Fault Current or Clearing Time.
- Add / Remove / Replace equipment with Overcurrent Protection Devices
 - Switchboards
 - Metal-Clad Switchgear
 - Panelboards
 - Motor Control Centers (MCC)
 - Circuit Breakers
 - Fused Disconnects
 - Fuses
- Adjustment to Breaker Settings

★ Update NOT Required if:

- Install new Feeders / Cables without new Panel

Arc Flash Study Flow Diagram



Expectations of OPM – AF Study

- ✦ Coordinate with FMD-Engineering during the early stages of electrical system projects that may affect Arc Flash models. Send written notice to Bill Jordan.
- ✦ Ensure New Construction & Major Renovation projects includes AF Study in scope & cost estimate.
 - Allow time & cost for data collection, study, and review
 - Ensure all labels are applied prior to building acceptance
 - Refer to Duke University Design Guidelines website
 - [16570 – Arc-Flash Studies](#)
- ✦ Ensure preliminary AF study is completed and submitted for approval prior to construction
- ✦ Ensure final study is submitted and labels are applied at project completion
- ✦ Compliance with FMD Electrical Safety Program is a requirement.
 - OPM shall notify Contractor of FMD's ESP
 - OPM shall verify Contractor has a their own ESP that complies with OSHA and NFPA
 - OPM shall verify Contractor has trained, qualified personnel to complete work.

What is an Arc Flash Hazard?

Condition associated with the possible release of energy caused by an electric arc. A condition may exist when energized electrical conductors or parts are exposed or when an individual is **interacting with the equipment or device** in a manner that could cause an electric arc. Equipment operating automatically that has been properly installed and maintained is not likely to pose an arc-flash hazard.

Possible Triggers of Arc Flash

- ★ Panelboards 240V & Below
 - Voltage testing
 - Remove/install breakers
 - Remove bolted covers
- ★ Panelboards 240V to 600V
 - Same as above
 - CB or switch operation with cover open
- ★ Switchboards/Switchgear 240V to 600V
 - Same as above
 - Work on 120V control circuits
 - Opening hinged covers
 - Racking breakers w/doors open or closed
 - Application of grounds