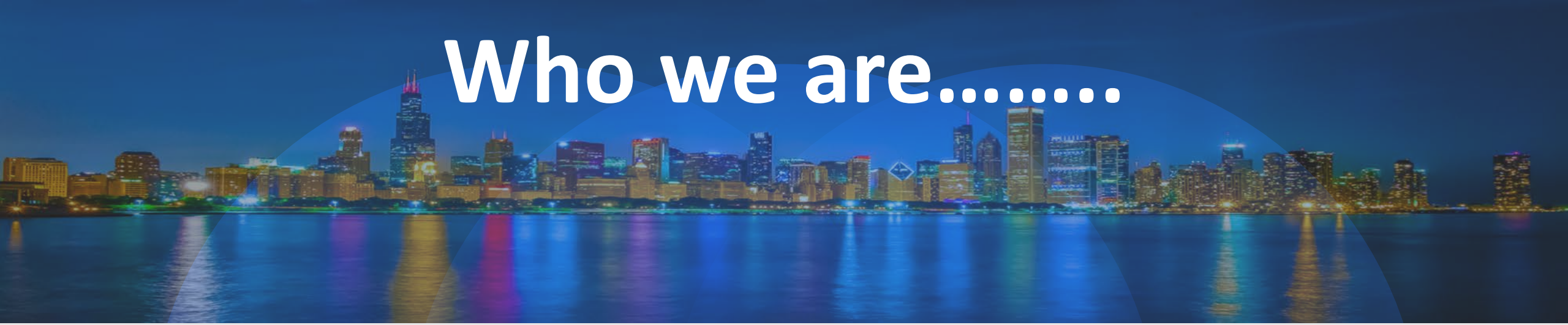
Hazards of Arc Flash

Sprint Electrical Service

Who we are……..



SPRINT electrical service

on-site. on-target. on-time.

A FULL-SERVICE INDUSTRIAL ELECTRICAL CONTRACTOR WITH FIELD EXPERTISE IN ALL TYPES OF ELECTRICAL WORK, INCLUDING DESIGNING AND INSTALLING ELECTRICAL SYSTEMS, PROVIDING MASTER CONTROLS WORK, PREVENTIVE MAINTENANCE AND SAFETY COMPLIANCE PROGRAMS.

What is an Arc Flash?

*An arc flash is the light and heat produced as part of an **arc fault**, a type of electrical explosion or discharge that results from a connection through air to ground or another voltage phase in an electrical system. (ref – Wikipedia)*

Another definition:

"An arc flash is a sudden release of electrical energy through the air when a high-voltage gap exists and there is a breakdown between conductors."

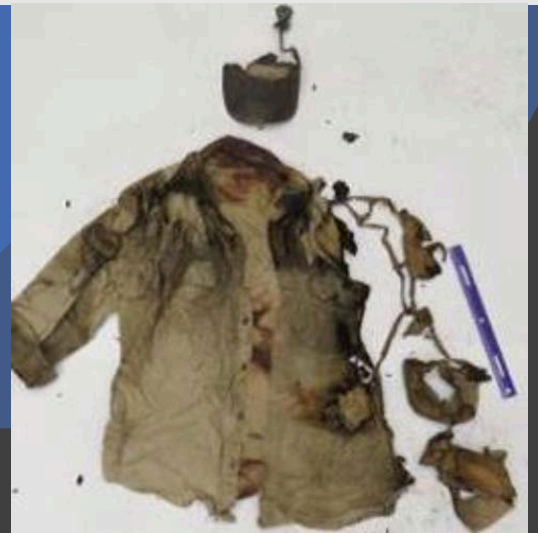
How an Arc Flash Occurs?

An **Arc Flash occurs** during a fault, or short circuit condition, which passes through this **arc** gap. ... An **Arc Flash** event can expel large amounts of deadly energy. The **arc** causes an ionization of the air, and **arc flash** temperatures can reach as high as 35,000 degrees Fahrenheit. This is hotter than the surface of the sun.

The Tragedy of an Arc Flash Incident in Injuries and Equipment

A report published in Industrial Safety and Hygiene News estimated that, on average, there are 30,000 arc flash incidents every year. The report went on to estimate that those incidents resulted in an average annual totals of 7,000 burn injuries, 2,000 hospitalizations, and 400 fatalities per year.

The photos of injuries and deaths are so horrific we will not (in good conscience) show them. However, these photos illustrate the aftermath of an arc flash incident on heavy equipment and protective clothing (PPE), so you can imagine what would occur to human flesh.



Issues and Circumstances that cause an Arc Flash Incident

System failures

- Accumulated debris, dust and even **a dead animal**, can be substantial in causing an Arc Flash.
- Non-compliance with the stipulations of NFPA 70 (National Fire Protection Association) for ground fault protection, which requires detectors for some specific applications of ungrounded electrical systems.
- Failure to implement formal work controls for working on ungrounded delta systems that could have a ground fault.
- Arc flash calculations for the building where an incident occurs are not completed and warning labels not posted.
- Pre-job briefings are not held.

- Personnel do not stop work when they observe an electrical engineer not wearing proper PPE.
- The OSHA required (PPE) hazard assessment requirements for breaker installation are not conducted.
- An employer's practices regarding working on, or near, energized electrical equipment violate OSHA standards.
- Frequent mistakes are made in calculating safe working distance. If a larger than normal working distance is used, it can give a false sense of safety. Also, working distance appears to be a simple concept until you attempt to determine the location of the possible source of the arc. eg: *The working distance generally assumes the energized conductors are located near the rear of the equipment, but that may not always be true.*

Human Carelessness

“Carelessness” may be too broad of a generalization. Fatigue or being pushed to quickly restore power by supervisory personnel is not pre-meditated carelessness. In general, too many accident investigations “take the path of least complications” and point blame at the worker.

Culture failures (company or facility specific)

Operational system or working culture issues often fail to find equipment problems or correct at-risk behavior. Both OSHA and NFPA 70E require an electrical hazard analysis prior to beginning work on, or near electrical conductors, that are, or may become energized.

> An Arc Flash analysis will determine the work practices, protection boundaries, personal protective equipment, and other procedures.

Reducing the Probabilities of an Arc Flash Incident

While no facility can be 100% free from an Arc Flash incident, there are solutions to greatly reduce the percentage of risks, potential harm to people and severe damage / destruction, of costly equipment.

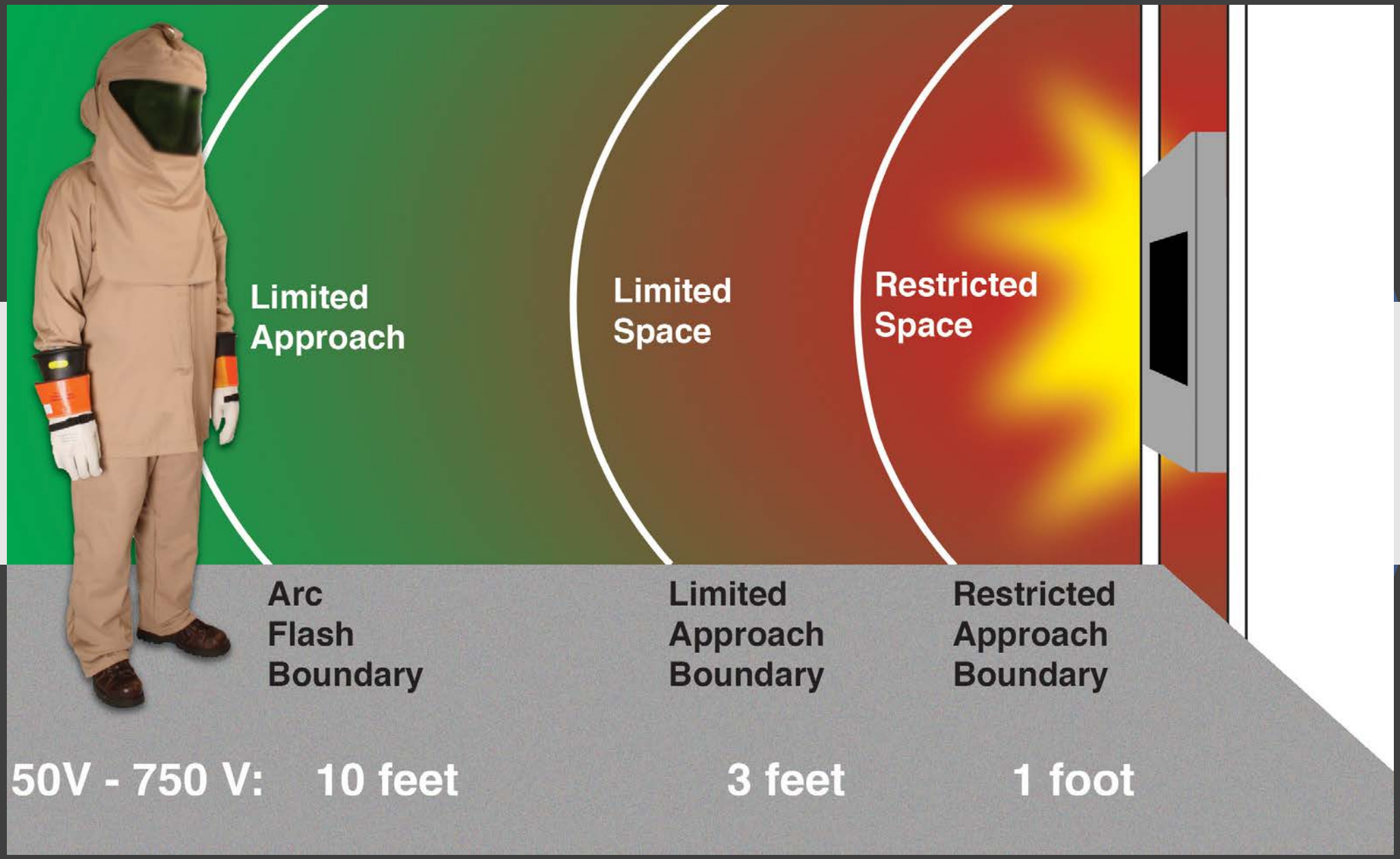
1) Ongoing Preventive Maintenance
2) Safety checks in addition to the OSHA standard requirements
3) A facility-wide Arc Flash Analysis (or sometimes called survey)
4) Ongoing Arc Flash training of maintenance crews and electricians

Arc Flash Analysis / Survey

Knowing the Safety Perimeters from an Arc Flash Survey

You and your EHS or Compliance department must consider the necessity of these guidelines. The Arc Flash Survey team will assess all facilities building power, document all of the required information, and create a one-line diagram. From there, special software will compute all hazard energy levels.

Once the Arc Flash Analysis is completed, there will be clearly identified, designated areas of safe working perimeters, required PPE category levels listed on all switch gears, distribution centers, load centers, bus ducts, control cabinets, by labeling clearly the minimum standards for working while a panel is energized.


Limited
Approach
Limited
Space
Restricted
Space
Arc
Flash
Boundary
Limited
Approach
Boundary
Restricted
Approach
Boundary
50V - 750 V:
10 feet
3 feet
1 foot

WARNING

Qualified Persons Only

Arc Flash and Shock Risk

Appropriate PPE Required

Review Safe Work Practices Prior To Work

7.43 cal/cm²
AF Incident Energy

Arc Flash Boundary: 45 inch
Working Distance: 18 inch

480 VAC	Shock Hazard
00	Glove Class
42 inch	Limited Approach
12 inch	Restricted Approach
632.08 kA	Short Circuit Amps

Recommended (minimum) PPE:
Arc-Rated (meet or exceed AF Incident Energy) Long-Sleeve Shirt & Long Pant (or Coverall), [Balaclava, Hardhat + Arc-Rated Face Shield] or [Arc Flash Suit Hood], Safety Glasses, Hearing Protection, Voltage-Rated Electrical Gloves with Leather Protectors, Heavy-Duty Leather Work Shoes.

Site Specific

2

PPE Level

NFPA Guidelines

Minimum Clothing Requirements			
HRC	**Protective Clothing**	**Minimum Cal/cm²**	**PPE (Safety glasses, hearing protection, leather safety shoes required for all)**
0	Natural fiber long-sleeved shirt and pants	N/A	
1	FR Long-sleeved shirt and pants or FR coveralls	4	Hard Hat, Arc-Rated Face Shield
2	FR Long-sleeved shirt and pants or FR coveralls	8	Hard Hat, Arc-Rated Face Shield and 8cal/cm2+ Stocking Hood or Multi-Layer Switching Hood
3	Natural fiber short sleeved shirt and long pants and Arc Rated (25 cal) Arc Flash Suite Jacket and Bib Overalls / Coveralls / 50" Coat with Leggings with Switching Hood	25	Hard Hat, Multi-Layer Switching Hood
4	Natural fiber short sleeved shirt and long pants and Arc Rated (40 cal) Arc Flash Suite Jacket and Bib Overalls / Coveralls / 50" Coat with Leggings with Switching Hood	40	Hard Hat, Multi-Layer Switching Hood

600 V Class Switchgear (with power circuit breakers or fused switches) - Notes 5 and 6			
TASK (equipment is energized & work is done within the flash protection boundary)	V-Rated Gloves	V-Rated Tools	HRC
CB or fused switch operation with enclosure doors closed			0
Reading a panel meter while operating a meter switch			0
Work on control circuits with energized parts 120 V or below, exposed	Y	Y	0
CB or fused switch operation with enclosure doors open			1
Insertion or removal (racking) of CB's from cubicles, doors closed			2
Opening hinged covers (to expose bare, energized parts)			2
Application of safety grounds, after voltage test	Y		2
Work on energized parts, including voltage testing	Y	Y	2
Work on control circuits with energized parts >120 V exposed	Y	Y	2
Insertion or removal (racking) of CB's from cubicles, doors open			3
Removal of bolted covers (to expose bare, energized parts)			3

NEMA E2 (fused contactor) Motor Starters, 2.3 kV through 7.2 kV			
TASK (equipment is energized & work is done within the flash protection boundary)	V-Rated Gloves	V-Rated Tools	HRC
Contactor operation with enclosure doors closed			0
Reading a panel meter while operating a meter switch			0
Work on control circuits with energized parts 120 V or below, exposed	Y	Y	0
Insertion or removal (racking) of starters from cubicles, doors closed			2
Contactor operation with enclosure doors open			2
Insertion or removal (racking) of starters from cubicles, doors open			3
Opening hinged covers (to expose bare, energized parts)	Y		3
Application of safety grounds, after voltage test	Y	Y	3
Work on control circuits with energized parts >120 V exposed	Y	Y	3
Work on energized parts, including voltage testing	Y	Y	3
Removal of bolted covers (to expose bare, energized parts)			4

Arc Flash Safety in Chemical Facilities

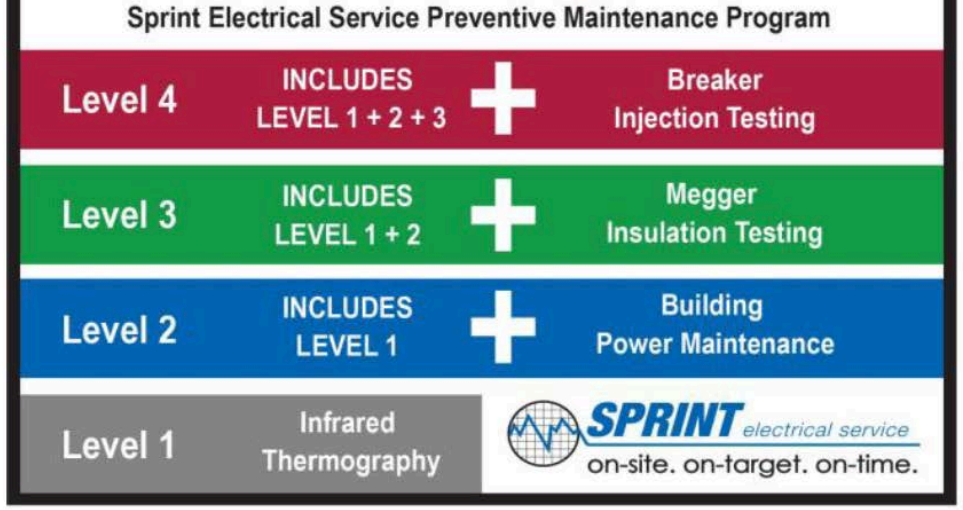
Each facility has its own unique set of circumstances.

Every facility must be assessed on a case-by-case basis - there are no short cuts.

- Does your facility have designated areas of Class 1 Division 1? (Explosive conditions)
- What type of particles are airborne and can accumulate in electrical components?
- Who and how many people have access to electrical systems?

Once the Arc Flash Analysis is completed, keeping it updated is critical. NFPA guidelines also change and YOUR facility is responsible for ongoing safety.

Sprint Electrical provides ongoing preventive maintenance that helps reduce the risks of an Arc Flash Incident.



Safety is NOT an option – it’s a culture

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