



Electricity Engineers'
Association

**ASSET
MANAGEMENT**

Arc Flash Guide

REVIEW

EEA.CO.NZ



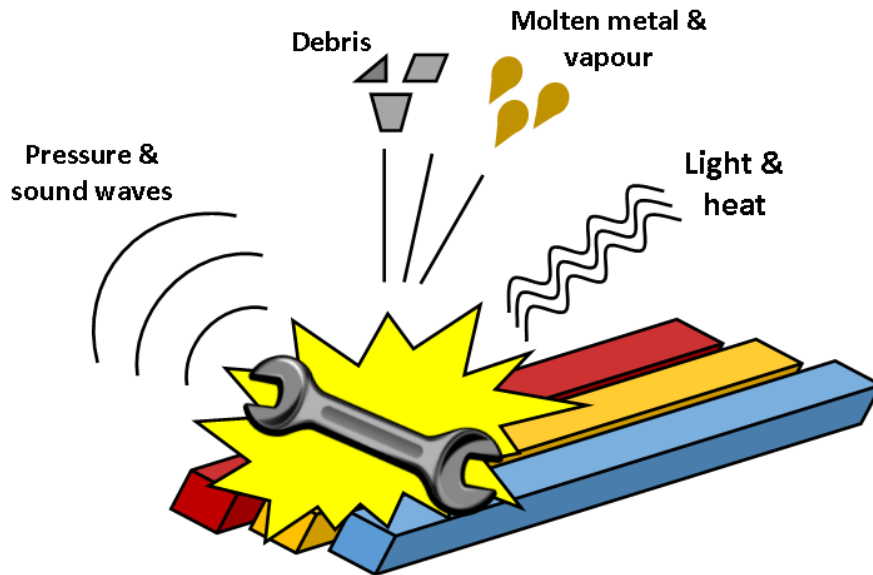
Scope

- What is arc flash?
- How to analyse/quantify arc flash?
- How to assess the risk of arc flash hazards?
- How to mitigate arc flash?



Introduction to Arc Flash

- What is arc flash?
- Contributing factors
- Consequences
- Serious hazard even at *low voltage*



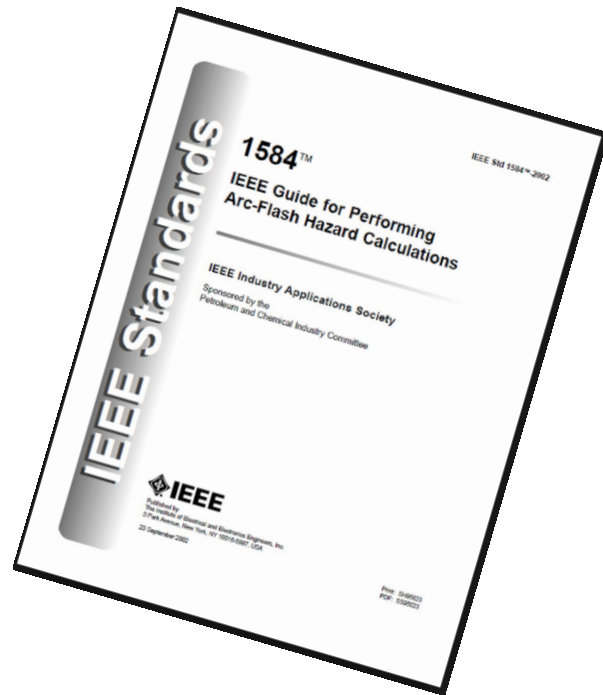


Arc Flash Analysis

- Gathering data
- Calculation methods

Results:

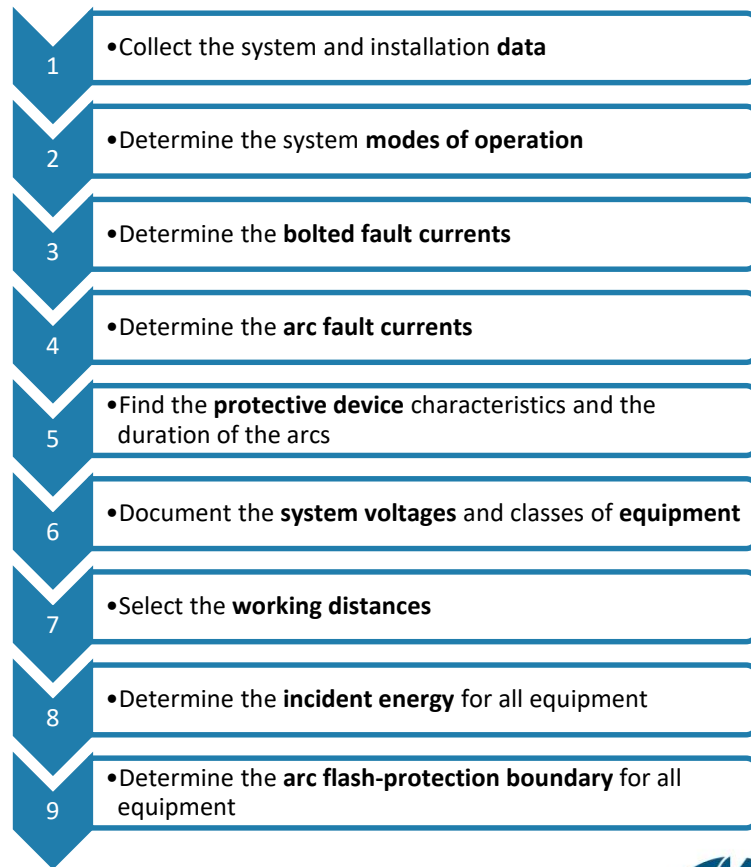
- Incident energy levels (cal/cm^2)
- arc flash boundaries.



Arc Flash Analysis

- IEEE1584 (empirical)
- Ralph Lee (theoretical)
- Doughty Neal (empirical)
- Dan Doan (theoretical)
- Table methods
 - NFPA 70E
 - NESC

Note: some methods come from the US and will use different units and voltages

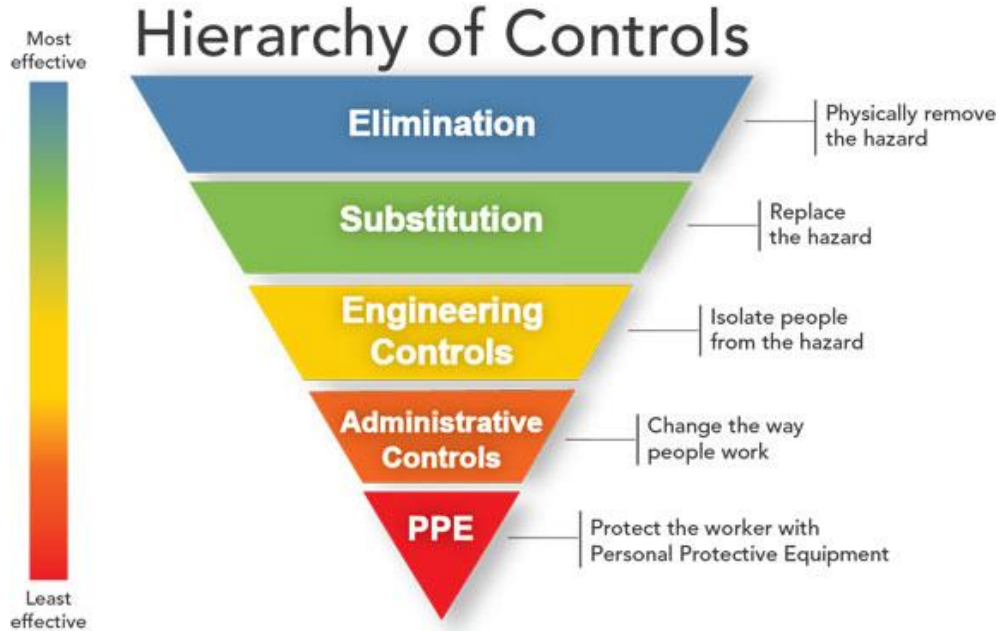


Risk Assessment

			Consequence				
			Trivial	Minor	Moderate	Major	Catastrophic
			Trivial or no treatment required	Injury with short-term recovery	Injury with medium term recovery	Severe or permanent injury or fatality	Multiple fatalities
Likelihood	Frequent	Routinely seen in this industry	High 11	High 13	Extreme 20	Extreme 22	Extreme 25
	Likely	Occasionally seen, 2 or 3 times per year	Moderate 5	High 12	High 15	Extreme 21	Extreme 24
	Possible	Seen less than once per year	Moderate 4	Moderate 7	High 14	High 17	Extreme 23
	Unlikely	Occurs once every few years	Low 2	Moderate 6	Moderate 9	High 16	High 19
	Rare	Hypothetical occurrence	Low 1	Low 3	Moderate 8	Moderate 10	High 15



Mitigation



Elimination or Isolation?

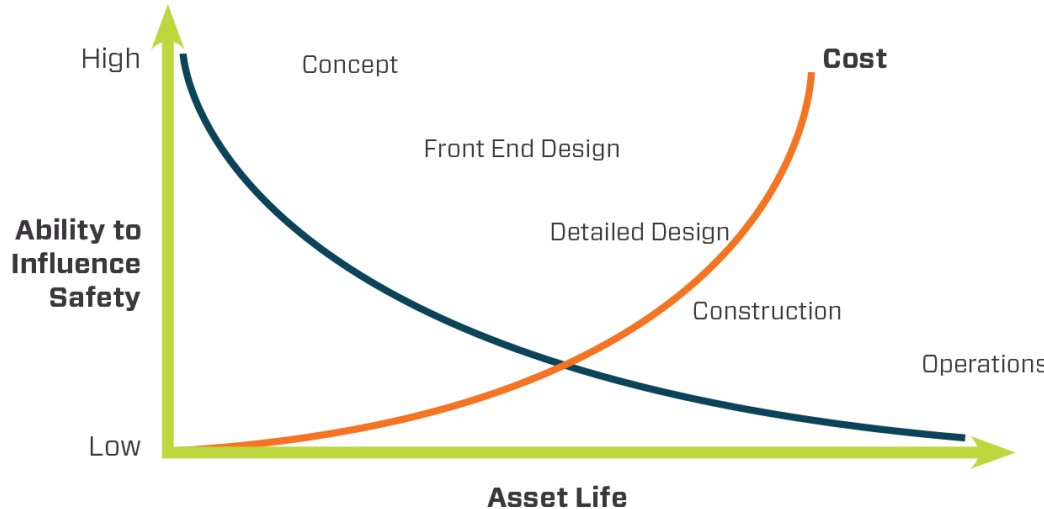
Remove the electrical hazard

- Electrical isolation is dependent on a set of procedures (SM-EI), and therefore can hypothetically fall prey to *human error*
- Switching to isolate equipment introduces its own set of hazards
- Electrical isolation is still an important tool, but it may not be considered to entirely *eliminate* the hazard.



Engineering Controls

Choice of equipment

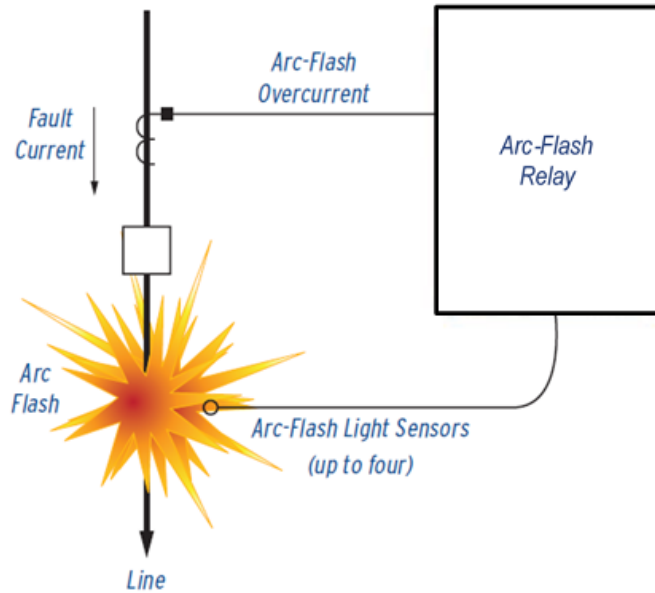


- Equipment design
- Arc containment & venting
 - Is equipment installed properly?
- **Legacy equipment**
 - What is a reasonable cost?



Engineering Controls

Protection

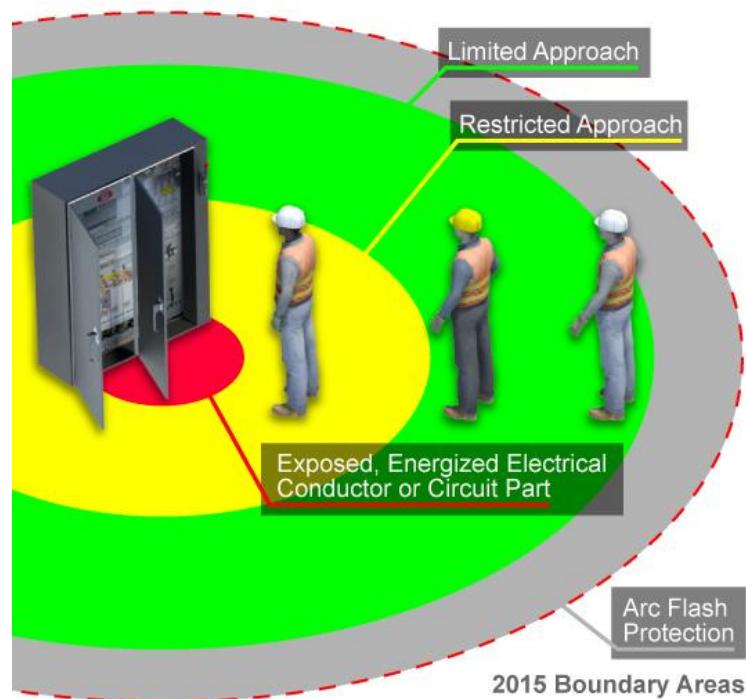


Remote switching



Administrative Controls

Boundaries



Labels

WARNING

Arc Flash and Shock Hazard Present
Appropriate PPE Required

RFN CB5

Arc Flash Boundary	7.80 m
Incident Energy @ 0.91 m	9.62 cal/cm ²
Working Distance	0.91 m
Shock Hazard Exposure	11000 Vac

Always Maintain MADs

Always carry out a Risk Assessment prior to encroaching the 8 cal/cm² boundary.

8 cal/cm ² Boundary	1.1 m
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PPE Requirements

Arc-rated (AR) clothing and equipment with an arc rating equal to or greater than the determined incident energy.

AR overall, AR face shield and AR balaclava, AR rainwear (AN), hard hat, safety glasses, hearing protection, leather gloves, leather footwear

26/09/2017

CALCULATIONS BASED ON NORMAL SYSTEM CONFIGURATION



Selection of Clothing and PPE

- Outer Wear
- Clothing layering
- Undergarments
- Care and maintenance
- Verification

Other Considerations

- Hearing protection
- Respiratory issues
- Blunt force trauma



Questions for industry

- How far have organisations come since the 2011 guide?
 - What % of assets have been assessed for arc flash?
 - Are there programmes for ongoing arc flash assessments?
- Is Safety in Design being applied to arc flash?
- What are unresolved issues that require further investigation?
 - New IEEE 1584 standard in the near future
- Is there a need for workshops or training?



Questions & Comments?



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