Electricity Engineers' Association

ASSET MANAGEMENT

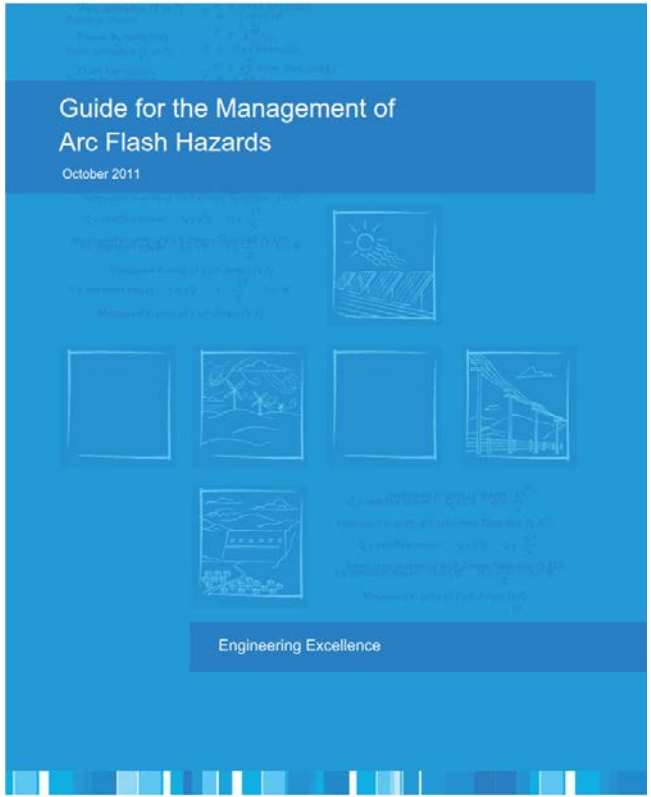
Arc Flash Guide

REVIEW

EEA.CO.NZ

Guide Review

- The original guide was published in 2011.
- It contained the first steps to continuing development.
- Being reviewed as part of a five-yearly cycle. Prioritised.



Working Group

Representative	Organisation
Steve Macdonald (chair)	Orion
Stuart Banks	Mitton ElectroNet
Cosmin Cosma	Westpower
Yanosh Irani	Meridian Energy
Glen Busby	RPS
Brian Ultee	Contact Energy
Graeme Johnson	Aurora
Dave Hammond	PowerCo
Andrew McMahon	Transpower
Ian Stedall	Genesis Energy
Gilbert Zieleman	ABB

Aim

Improve the understanding of, and the ability to manage arc flash hazards for everyone within the wider Electrical Supply Industry.

Legislation, Standards and Guidelines

- New Zealand:
  - H&S Act and Regulations
  - Electricity Act
  - EEA Safety in Design Guide

- North America:
  - IEEE 1584 – AF Calculations
  - National Fire Protection (NFPA 70E) – PPE and tables method
  - The National Electrical Safety Code (NESC) – Tables method

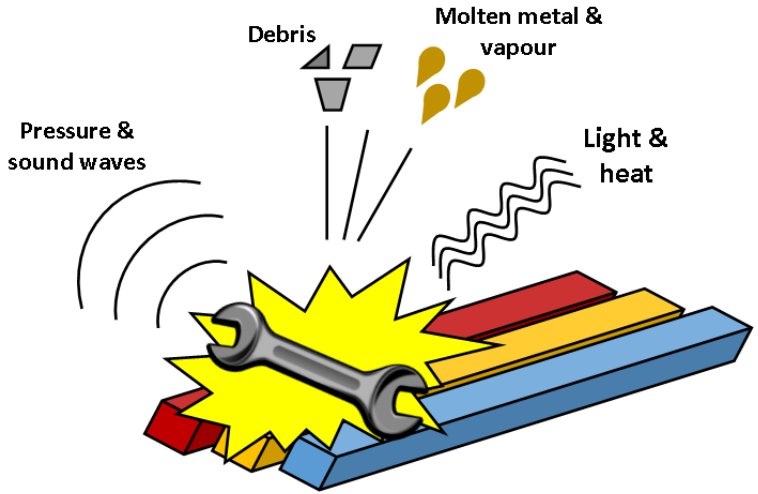
Technical Content

The guide has been prepared under four main parts:

1. Arc Flash Knowledge
2. Engineering Analysis
3. Risk Assessments
4. Mitigation of Hazard

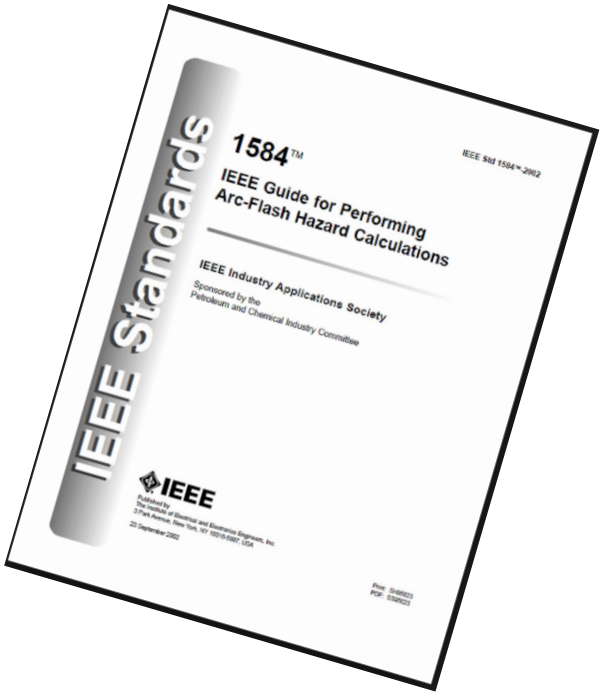
1. Arc Flash Knowledge

- Background appreciation.
- Goal to get people to stop, think and consider alternative ways of completing tasks.
- Contributing factors.
- Consequence of exposure.
- Pass on the knowledge.



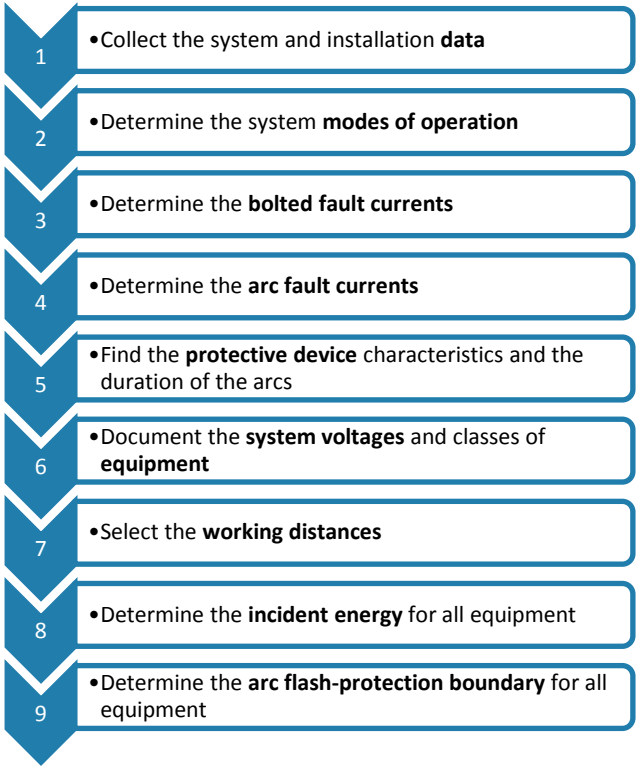
2. Analysis

- Gathering data.
- Calculation methods.
- Incident energy levels (cal/cm^2) & arc flash boundaries.



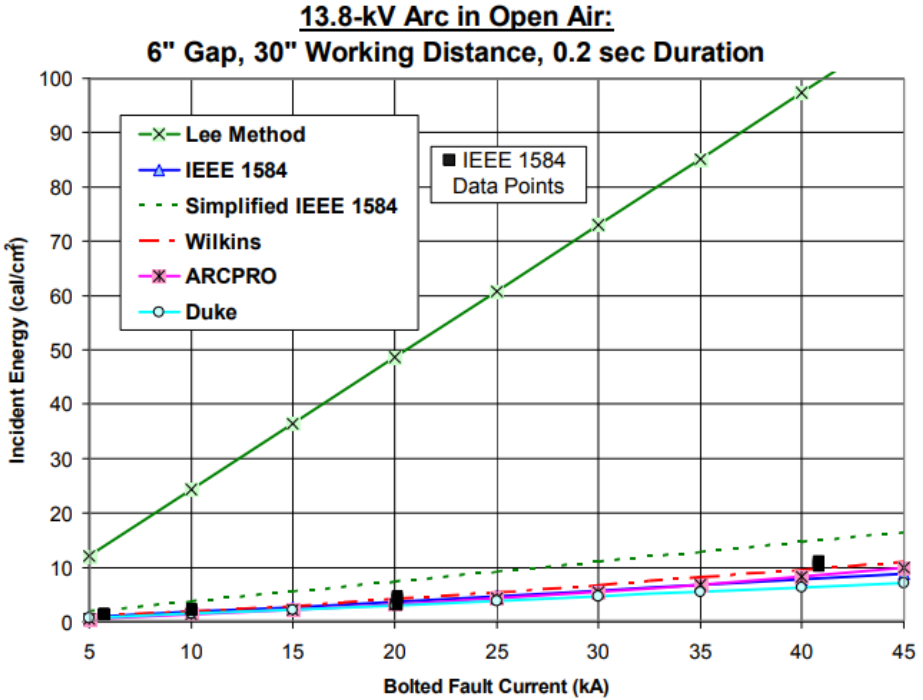
Varying Methods

- IEEE 1584 (empirical)
- Doughty Neal (empirical)
- Ralph Lee (theoretical)
- Dan Doan (theoretical)
- Table methods
  - NFPA 70E
  - NESC



Comparison

- IEEE1584 completed tests to 13.8 kV.
- Typical to use Lee method:
  - Higher voltages
  - Lines scenarios
- Lee method limited to I_{bf} only.
- EPRI research
  - New empirical model



Source: https://ieeexplore.ieee.org/document/4664001/

3. Risk Assessments

Once hazards are established,
We can determine the risk.

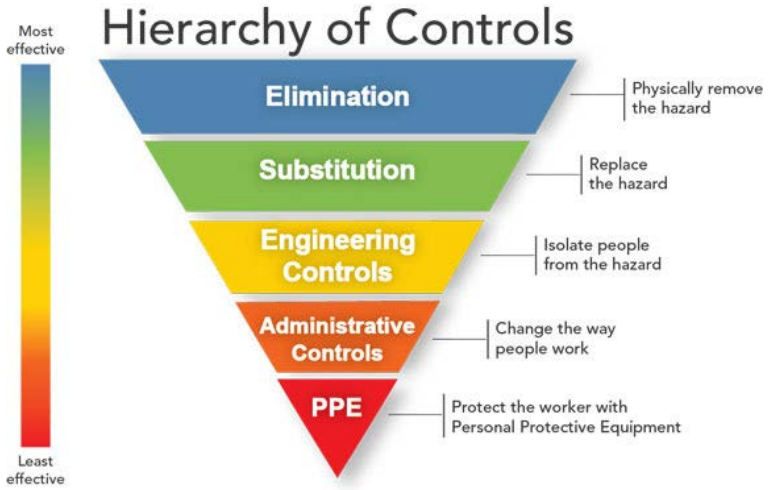
- SiD Guide process.
- Anyone can complete a risk assessment, at any stage.

			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 18

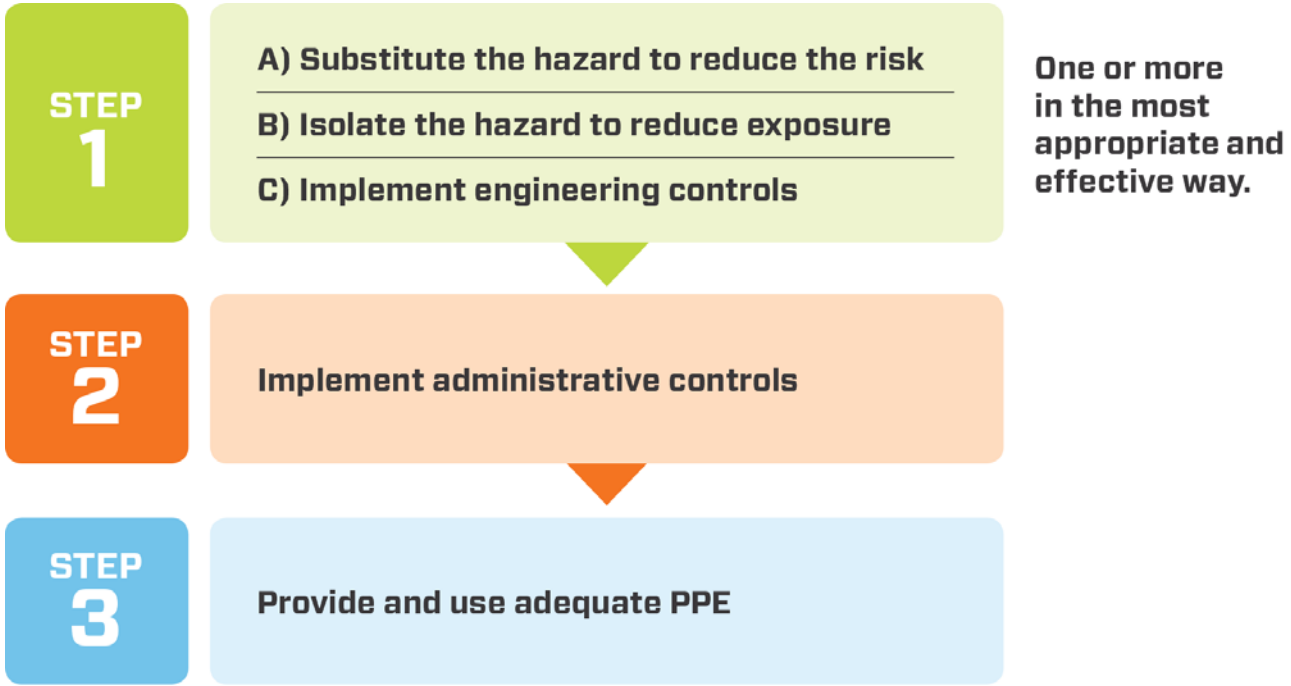
Source: EEA Safety in Design Guide

4. Mitigation

- Health and Safety at Work Act 2015.
- Health and Safety at Work (General Risk and Workplace Management) Regulations 2016.
- Electricity Act 1992.
- Electricity (Safety) Regulations 2010.



Source: The National Institute for Occupational Safety and Health (NISOH)

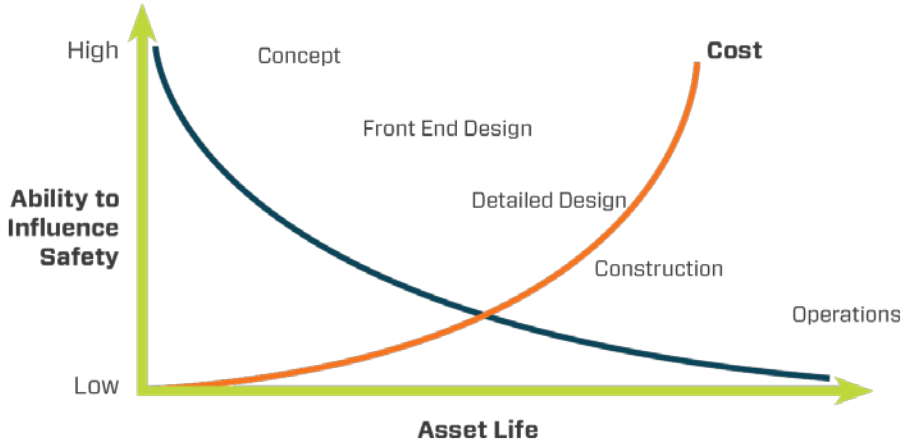


Source: EEA Safety in Design Guide

Engineering Controls

Some examples:

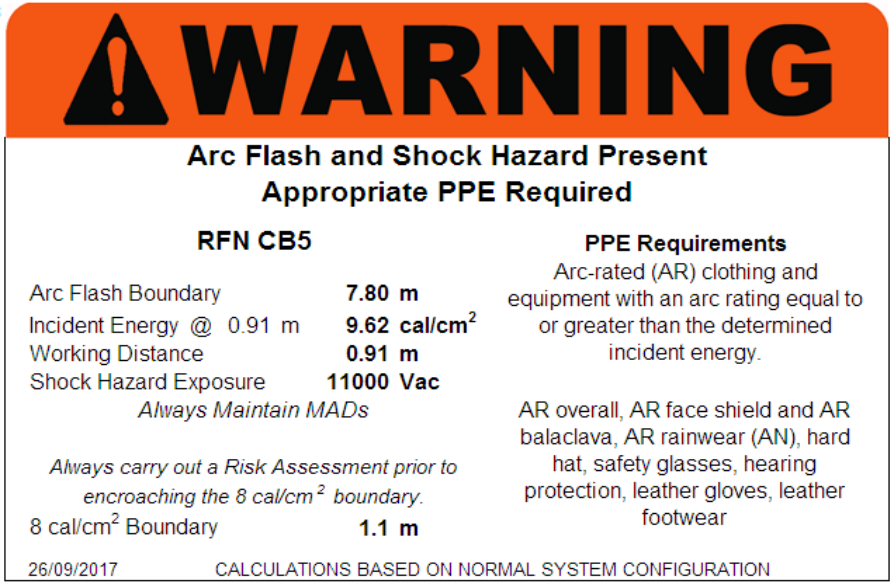
- Protection settings
- Arc flash detection
- Delayed opening / closing
- IAC Switchgear



The ability to influence safety, for lower cost.

Administrative Controls

- Establishing boundaries
- Warning Labels
- Training
- Process for operations (e.g. Remote switching)
- Manufacturers operating procedures (IAC). Doors closed.



Personal Protective Equipment
Arc Rated (AR)

- Layering
- Natural fibers
- Suits
- Hoods
- Face, eye and hearing protection
- NFPA 70E

- Common PPE mistakes.
- Usually a combination of control measures is required, which *includes* PPE.
- Consider if PPE is appropriate even if exposure is to an arc flash is <1.2 cal/cm^2

Continuing Cycle

1. Assess hazards first (previous section).

2. Likelihood/consequence of the identified hazard affecting a person.

3. Application of mitigation techniques.

What is Next?

- Industry consultation ✓
- Incorporating feedback.
- Final changes being made.
- Research of work by the Electric Power Research Institute.

Aiming to be available on the EEA website by the end of July 2018.

Questions