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ASSET MANAGEMENT

# Arc Flash Guide

REVIEW

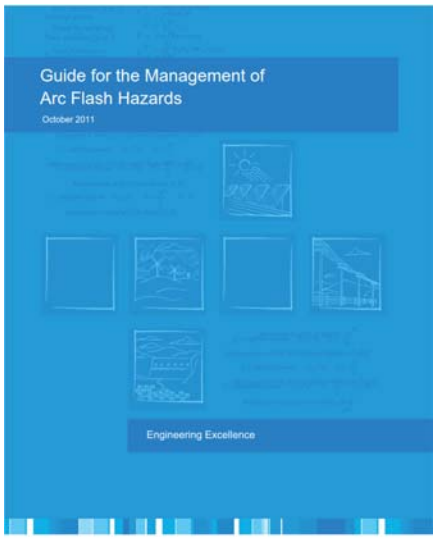
EEA.CO.NZ

## Guide Review

The original 'Guide for the Management of Arc Flash Hazards' was published in 2011

It contained the first steps to continuing development

And deadlines
"A programme for assessment of all assets shall be in place by no later than 30/6/2012, with assessments completed by no later than 31/12/2013."

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# 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 |

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1. Purpose
2. Definitions
3. Scope
4. Legislation, Standards and Guidelines
5. Introduction to Arc Flash
6. Arc Flash Analysis
7. Risk Assessment
8. Mitigation
9. Conclusion

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## Scope

- Provides a basic description of arc flash and key characteristics
- Guidance on arc flash hazard and risk assessment and subsequent mitigation programme
- Explains the background to quoted Standards and how they apply.

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## Legislation, Standards and Guidelines

Health and Safety at Work Act (HSWA 2015)

**IEEE 1584**:2002 Guide for Performing Arc Flash Hazard Calculations

**NFPA 70E**:2015 Standard for Electrical Safety in the Workplace

Safety in Design Guide (EEA)

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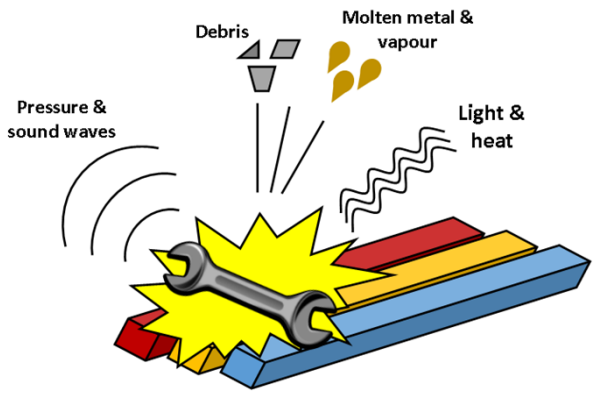
# Introduction to Arc Flash

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

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# Arc Flash Analysis

| Calculation Method | Application |
|---|---|
| IEEE1584 | This method calculates incident energy and arc flash boundary for: 208 V to 15 kV; three-phase; 50 Hz to 60 Hz; 0.7 kA to 106 kA short-circuit current; and 13 mm to 152 mm conductor gaps. |
| Ralph Lee | This method calculates incident energy and arc flash boundary for arc in open air; conservative over 600 V and becomes more conservative as voltage increases. |
| Doughty Neal | This method calculates incident energy for three-phase arc on systems rated 600 V and below; applies to short-circuit currents between 16 kA and 50 kA. |
| Dan Doan | This method calculates the incident energy for dc systems rated up to 1000 V dc. |
| Table Method (NFPA 70E) | The table method presented in NFPA 70E uses tables that are for specific fault currents and specific clearing times and the tables do not cover all applications or installations. While these tables are intended to be conservative for most applications, they may not enable the user to select adequate protection. |

1. Collect the system and installation **data**
2. Determine the system **modes of operation**
3. Determine the **bolted fault currents**
4. Determine the **arc fault currents**
5. Find the **protective device** characteristics and the duration of the arcs
6. Document the **system voltages** and classes of **equipment**
7. Select the **working distances**
8. Determine the **incident energy** for all equipment
9. Determine the **arc flash-protection boundary** for all equipment

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# 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 18 |

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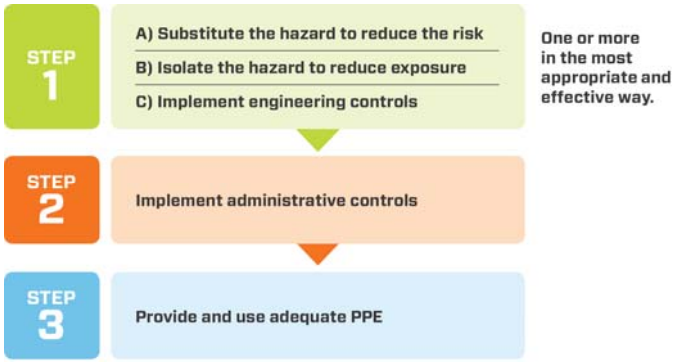
# Mitigation

## Hierarchy of Controls

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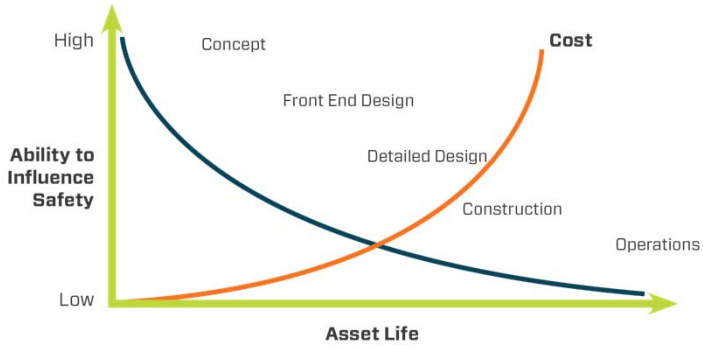
# Mitigation

## Engineering Controls




- Equipment design
- Arc containment & venting
- Legacy equipment
- Protection settings
- Delayed opening/closing
- Remote switching/ racking

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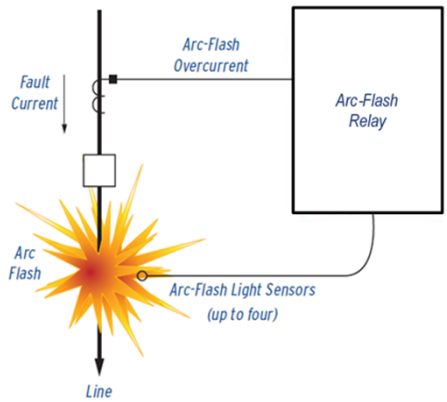
# Mitigation

## Engineering Controls

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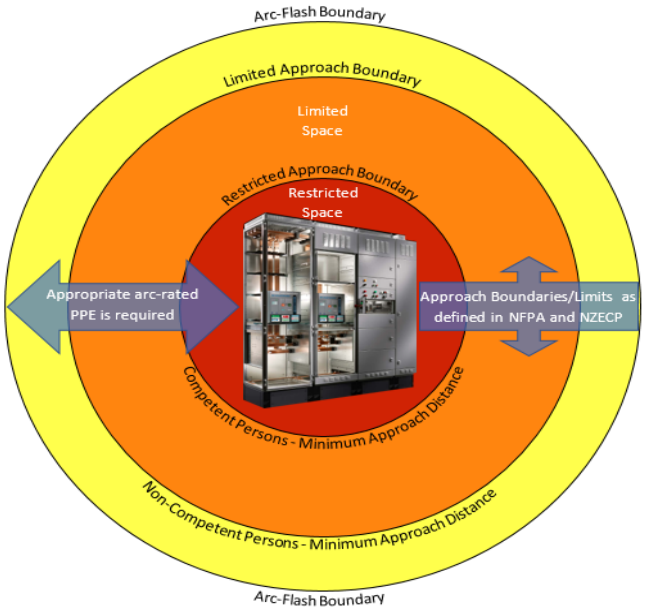
# Mitigation

## Administrative Controls

- Establishing protection boundaries

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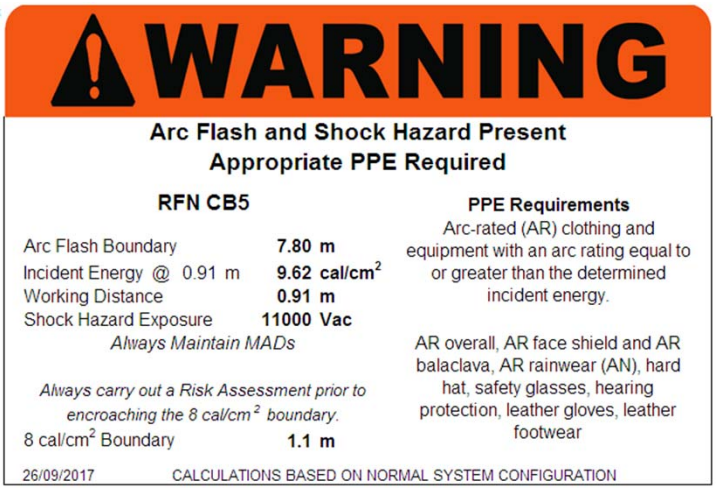
# Mitigation

## Labelling

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# Mitigation

Selection of Clothing and PPE


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

Other Considerations
- Hearing protection
- Respiratory issues
- Blunt force trauma

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# Areas requiring more work?

- Voltages > 15kV
- Estimated energy levels
- More detailed mitigation advice
- Tailor ‘risk analysis’ to arc flash hazard
- Develop mitigation ‘option assessment’
- Highlight common PPE mistakes
- How to approach ‘grossly disproportionate’ actions?
- Editing

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## Timeline

- Release for consultation by the end of 2017
- Review feedback early 2018
- Publish 2018
- Review 2023


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## Questions for industry

- Who in your organisation will be using the guide? What is the target audience?
- How far have organisations come since the 2011 guide?
- Is Safety in Design being applied to arc flash?
- What are unresolved issues that require further investigation?

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