Electricity Engineers' Association

HEALTH & SAFETY
ASSET MANAGEMENT
PROFESSIONAL DEVELOPMENT

Introduction to the New EEA Asset Criticality Guide

EEA ASSET MANAGEMENT FORUM JUNE 2019

EEA.CO.NZ

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Key Objectives of the Asset Criticality Guide

- ❑ Build upon established AHI concepts
- ❑ Incorporate operating context into intervention strategies
- ❑ Develop a pragmatic, easy-to-use method that can be adapted to individual business circumstances
- ❑ Devise a common format to present asset criticality information
- ❑ Enable use in conjunction with emerging techniques and approaches

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Recap – AHI

H5	As new condition. No drivers for replacement. No change in PoF from new.
H4	Normal in-service deterioration. No drivers for replacement. No material change in PoF from new.
H3	End of life drivers for replacement present, increasing asset-related risk. Onset of unreliability. Some increase in PoF.
H2	End of life drivers for replacement present. High asset-related risk. PoF is the maximum that would normally be tolerated in service.
H1	Replacement / renewal recommended. PoF higher than would normally be tolerated in service.

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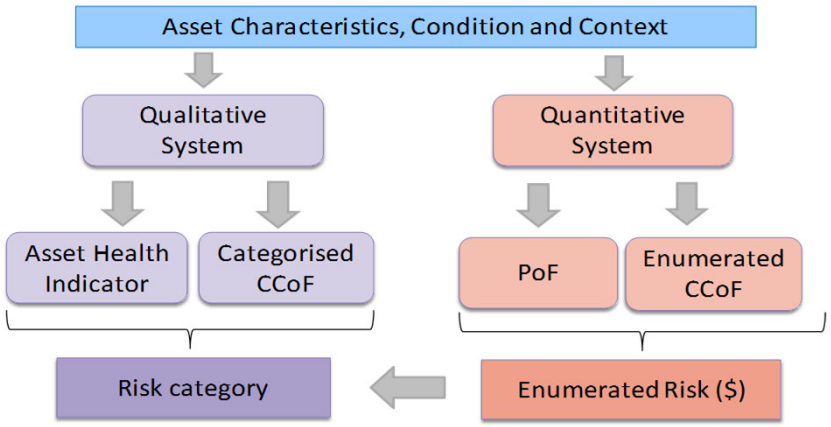
Dual Approach



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Definitions

Plausible Consequences of Failure	The conceivable, worst-case consequences expected for the asset with the most adverse combination of contextual factors within an asset fleet. This represents an upper benchmark consequence from which individual asset consequences are derived.
Credible Consequences of Failure	The conceivable, realistic consequences of failure for an individual asset after accounting for the contextual factors that would mitigate the plausible consequences of failure.

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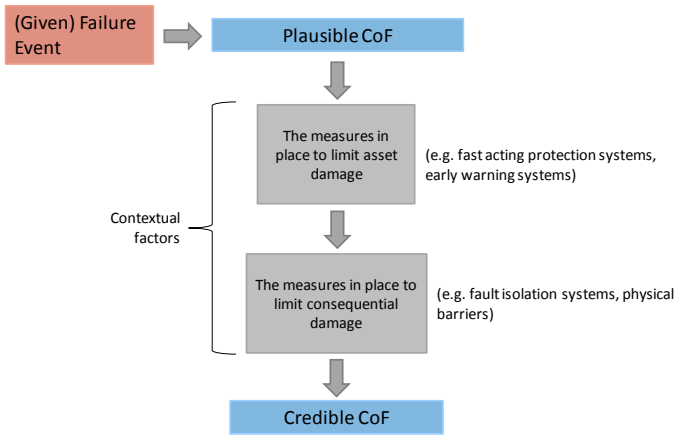
Plausible vs. Credible Consequences of Failure



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Criticality Grades

C4	Minor: Credible CoF is broadly tolerable and run to failure may be a valid strategy
C3	Typical: Asset failure would cause some disruption and inconvenience, but systems are already in place to anticipate and manage the outcomes
C2	Elevated: Asset failure would cause significant harm to personnel, assets, the business or the environment. The consequences are tolerable but should be avoided or mitigated if it is practicable to do so
C1	Extreme: The credible consequences of failure could not be tolerated

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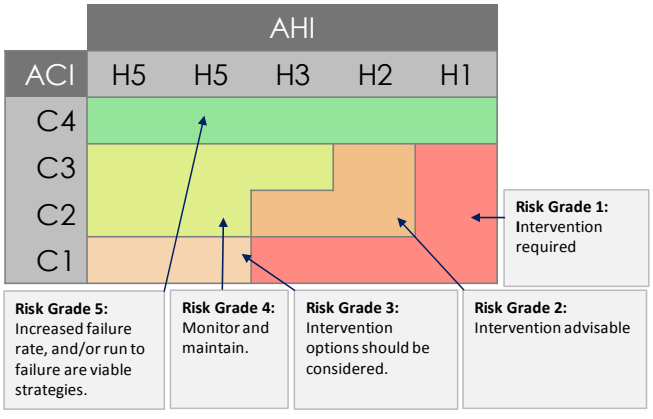
Risk Reporting Matrix



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Risk Grades

R5	Low relative consequences of failure. Interventions justified on cost-benefit considerations alone. Tolerating increased failure rates and/or running asset to failure may be viable management strategies.
R4	Typical asset, in useful life phase. Interventions justified on cost-benefit considerations alone. Predominant strategy to monitor and maintain.
R3	Healthy but highly-critical assets. Operating context would need to be changed if consequences of failure are to be reduced; for example re-design to provide redundancy.
R2	Combination of high criticality and declining health indicates elevated risk. Appropriate intervention measures should be devised and timetabled, and current risks prudently managed in the interim.
R1	Combination of high criticality and reduced health indicated high risk. Immediate intervention required.

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Reporting Formats

Pre-intervention Numbers

ACI \ AHI	H5	H4	H3	H2	H1
C4	14	25	34	19	5
C3	12	23	46	21	11
C2	18	15	24	10	9
C1	11	21	16	6	3

Post-intervention Numbers

ACI \ AHI	H5	H4	H3	H2	H1
C4	21	28	41	22	8
C3	19	27	51	12	0
C2	28	26	24	8	0
C1	9	19	0	0	0

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Generalised Criticality Categorisation

Criticality	Public Safety	Workplace Safety	Direct Cost	Service Levels	Environment
Plausible CoF	Event resulting in death or injury to member of public.	Event resulting in death or injury to staff.	Substantial repair cost and/or secondary damage.	Loss of primary supply for extended period causing significant customer impact.	Release of SF6 or oil into the environment.
Applicable Contextual Factors	• Physical location • Access Restrictions • Enclosure design • Fire suppression	• Physical location • Access Restrictions • Enclosure design • Fire suppression • Safe work practices • Arc flash controls	• Protection systems • Enclosure design • Fire suppression • Arc flash controls	• Redundancy (N-1) • Fault response • Automation • Back feed cap. • Critical spares • Contingency plans	• Physical location • Hazardous material containment • Fire suppression
C1	No mitigating contextual factors. Plausible CoF not moderated to any significant extent.				
C2	Selected mitigating contextual factors. Plausible CoF moderated to some extent.				
C3	Typical mitigating contextual factors. Plausible CoF moderated to a significant extent.				
C4	No plausible CoF or Plausible CoF completely mitigated.				

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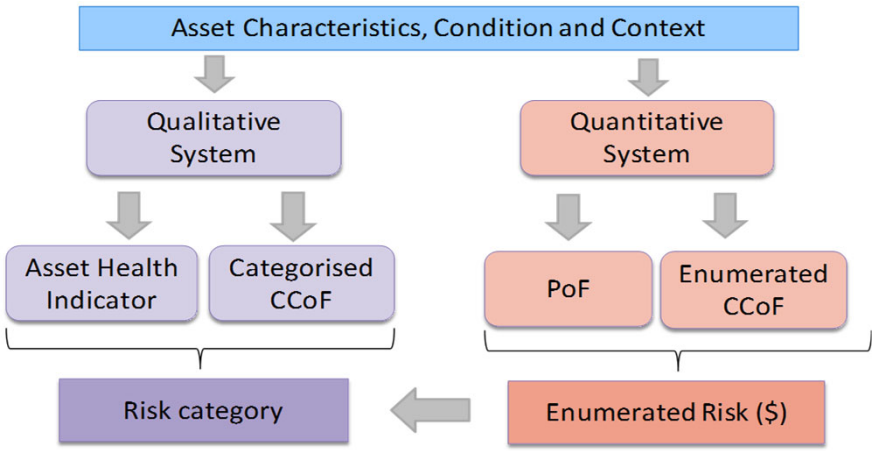
Dual Approach



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Generalised Criticality Enumeration

Criticality	Public Safety	Workplace Safety	Direct Cost	Service Levels	Environment
Plausible CoF	Event resulting in death or injury to member of public.	Event resulting in death or injury to staff.	Substantial repair cost and/or secondary damage.	Loss of primary supply for extended period causing significant customer impact.	Release of SF6 or oil into the environment.
Cost of Plausible CoF **C0**	Based on Statistical value of Lost Life, Cost to Prevent a Fatality or similar measure of societal cost		Based on the cost to replace the asset, and/or restore equipment directly or indirectly damaged to service. Also includes the cost to temporarily restore supply while repairs are undertaken.	Based on the economic value that a consumer places on electricity it needs but does not receive due to power interruption; commonly referred to as Value of Lost Load (VoLL), or Value of Unserved Energy	Based on potential fines, environmental clean-up costs, and cost of repairing consequential damage
Applicable Contextual Factors	• Physical location • Access Restrictions • Enclosure design • Fire suppression	• Physical location • Access Restrictions • Enclosure design • Fire suppression • Safe work practices • Arc flash controls	• Protection systems • Enclosure design • Fire suppression • Arc flash controls	• Redundancy (N-1) • Fault response • Automation • Back feed cap. • Critical spares • Contingency plans	• Physical location • Hazardous material containment • Fire suppression
Credible CoF **CQ**	For each category, CQ = C0 x CF, where CF is a consolidated factor reflecting the applicable contextual factors				
C1	No mitigating contextual factors. Plausible CoF not moderated to any significant extent. CQ = 0.8-1.0 x C0				
C2	Selected mitigating contextual factors. Plausible CoF moderated to some extent. CQ = 0.5-0.8 x C0				
C3	Typical mitigating contextual factors. Plausible CoF moderated to a significant extent. CQ = 0.1-0.5 x C0				
C4	No plausible CoF or Plausible CoF completely mitigated. CQ <0.1 x C0				

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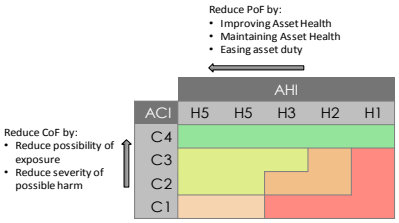
Risk-based Renewal Planning



	To Reduce PoF	To Reduce CoF
Prevention Measures	Improve Asset Health: • Renew • Refurbish Maintain Asset Health: • Preventative maintenance • Condition monitoring / early warning systems • Protection from the elements • Mechanical protection measures (e.g. enclosures)	Prevent asset damage: • Choose safe insulating materials • Arc flash detection / containment /diversion systems • Reduce available fault energy • Mechanical protection Prevent consequential harm or damage: • Locate away from public or environmentally sensitive areas • Explosion barriers • Oil interception facilities • Remotely monitor and control
Limitation Measures	Ease asset duty: • Reduce loading • Reduce switching frequency	Limit magnitude of harm: • Fault crew response times • Network automation • Critical spares • Asset redundancy • Back feed options • Fast-acting protection systems • Early warning systems Limit exposure: • Security barriers

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Questions?

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