Appendix 1.3: Asset management objectives

Regulatory proposal for the ACT electricity distribution network 2019-24
January 2018

evoenergy

Asset Management Objectives

Version 5.0 Date: 25 January 2018

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1 Purpose

This document forms the Asset Management Objectives for ActewAGL Distribution. It outlines how the policies, principles and strategies from the Asset Management Policy and Strategy align with the Asset Specific Plans that form the overall Asset Management Plan. It also shows the decision making criteria that results in the applied maintenance strategies for the different asset categories.

2 Scope

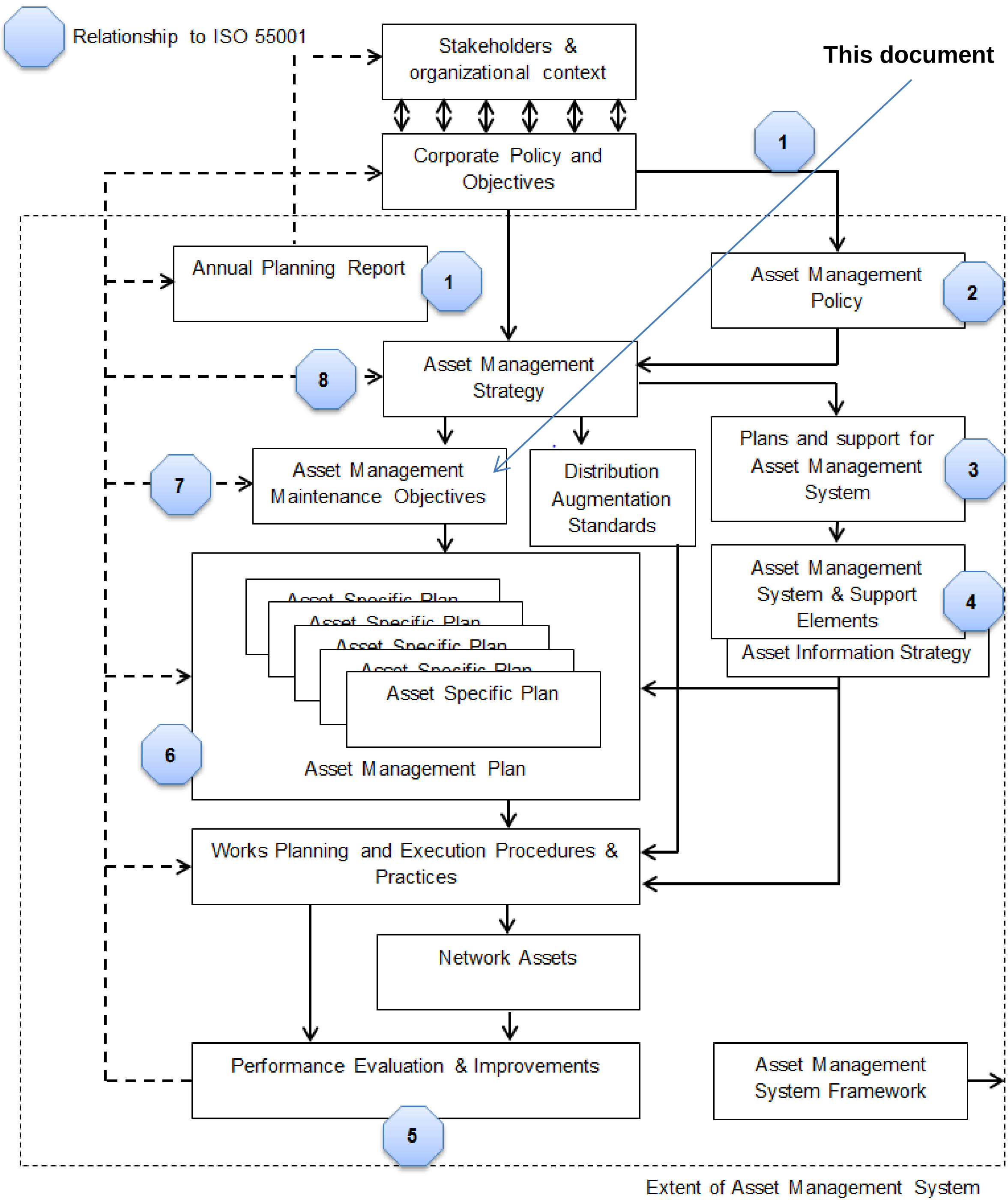
The overall objectives of asset management are to optimise the service delivery potential of assets and to minimise lifecycle risks and costs. Good governance and deployment of business systems, processes and human resources in compliance with ISO 55001 are key aspects of this endeavour. The scope of this document is limited to outlining the maintenance and replacement objectives for the *key* ActewAGL Distribution assets required for the sustainable operation of the business. These objectives are based on Risk Centred Maintenance (RCM) principles, and are guided by a defined list of asset attributes. These asset attributes will be assessed for each of the key distribution assets and used to validate the current maintenance and replacement regime and will aid in identifying the necessary adjustments. These key assets are prioritised with respect to their network criticality and analysed in the same order.

Key assets are defined as those assets critical to the day to day operation of ActewAGL's distribution network.

3 Corporate Alignment

This Asset Management Objectives document forms a key role within the overall ActewAGL Asset Management System ensuring a clear alignment between the company's activities on the ground, including asset interventions. This alignment with other documents and ISO 55001 is represented in Figure 1

Figure 1: Corporate Alignment of Asset Management Objectives



Clause numbers are references to ISO 55001

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6.2.1 Asset management objectives

The Asset Management Objectives form a bridging document between the Asset Management Strategy and the Asset Specific Plans, within the Asset Management System, and provide alignment with ActewAGL Distribution's Asset Management Policy and with the overall Organisation Strategic Plan.

ActewAGL Distribution has extended its Asset Management Objectives from the Asset Management Strategy as we consider the two elements to be inherently linked and to ensure integration between the objectives and the strategy.

3.1 Reliability

The target network reliability to be achieved by implementation of the asset management system is to maintain unplanned SAIDI and SAIFI at the same level as the historical average.

	Historical average	Target
Unplanned SAIDI (minutes/customer/year)	32.12	32.12
Unplanned SAIFI (interruptions/customer/year)	0.619	0.619

3.2 Expenditure

Within each asset class, the objective is to choose an option that minimises the overall net present cost of expenditure and economic risk. Net present cost may be calculated over 10-year and 30-year timeframes, with preference given to options that minimise the risk of assets being stranded by disruptive technologies. That is, medium-term (10-year) benefits are prioritised over long-term (30-year) benefits.

4 Maintenance Related Objectives

Maintenance related objectives are to develop justifiable and prudent maintenance tasks for all current and future assets. This will involve identifying assets that are receiving non-optimal amounts of maintenance, whether inappropriate frequency of maintenance or incorrect maintenance procedures. It will also involve identifying assets that are over maintained leading to unnecessary expenditure on that asset's operation. This over maintenance can be reduced by investigation into whether the frequency can be reduced, or by, investigation into whether aspects of the maintenance can be omitted.

A secondary maintenance related objective is to align maintenance programs as to create a more consistent and efficient maintenance regime. See "Maintenance Task Scheduling" under section 6.4 of this document.

5 Replacement Related Objectives

The main replacement related objectives are to identify the optimal use of the given assets functional life span and optimal life cycle costs. This will involve identifying assets that are in need of replacement due to obsolescence, that are in critical danger of operational failure or have exceeded their optimal life cycle costs. It will also involve investigation into current replacement programs and what benefits can be gained from either lengthening or shortening the asset's functional life.

6 Application of RCM to Achieve Asset Management Objectives

In alignment with the Asset Management Strategy, the Asset Management Objectives are directed at maintaining assets according to the principles of Reliability Centred Maintenance (RCM). The governing factor of RCM analysis is the impact of a functional failure at the equipment level, and tasks are directed at a limited number of significant items - whose failure might have safety, environmental or economic consequences. These items are subjected to intensive study, first to classify them according to their failure consequences and later to determine whether there is some form of mitigation in the form of an optimised maintenance program to prevent these consequences.

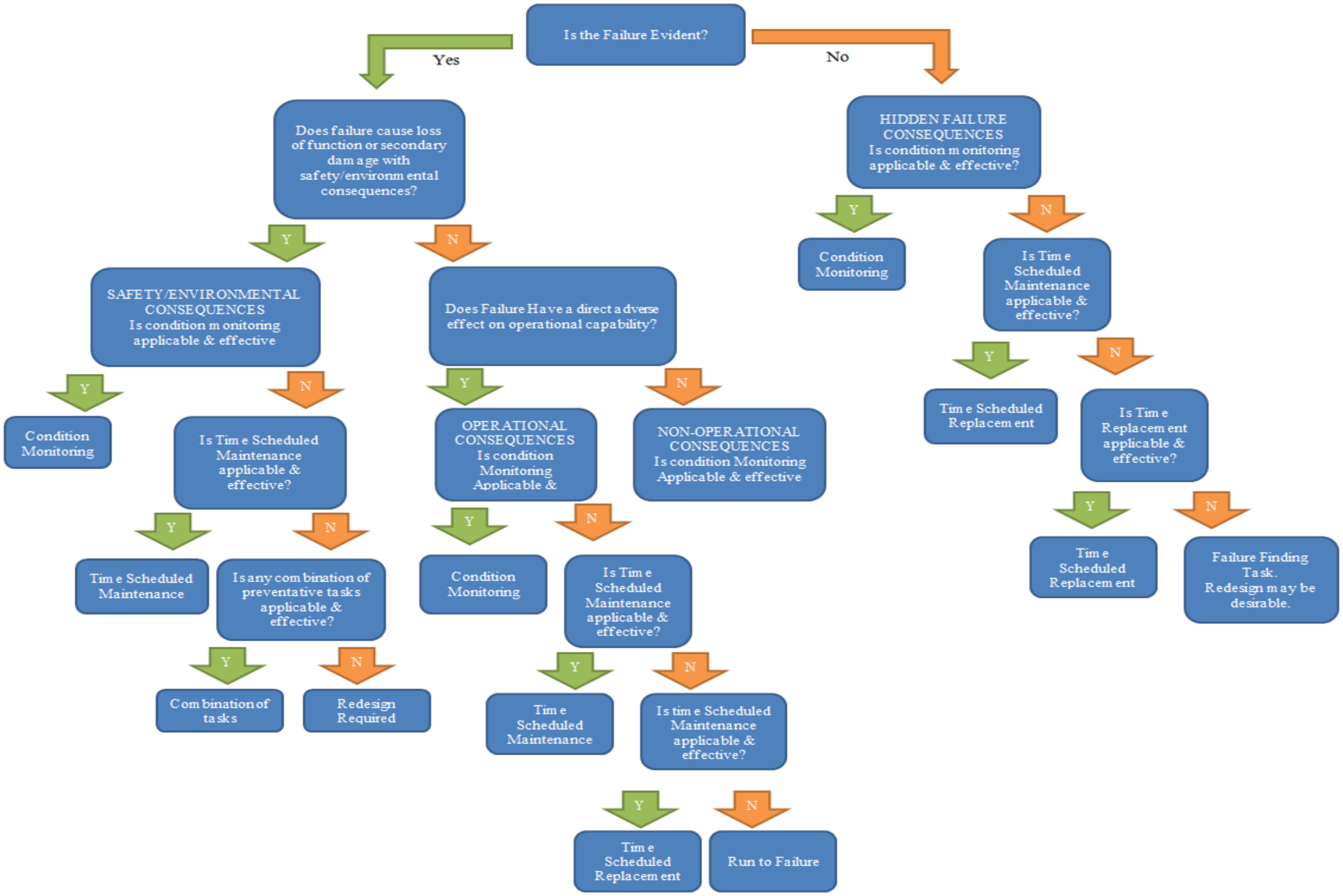
The first step in this process is to classify the equipment into asset classes according to areas of engineering expertise. Within each of these areas the equipment is further partitioned in decreasing order of complexity to identify:

- significant items (those whose failure may have serious safety, environmental, financial or operational consequences);
- items with hidden functions (those whose failure will not be evident and might therefore go undetected); and
- non-significant items (those whose failure has no impact on operating capability).

This last group (non-significant items) encompasses many thousands of items, however this document focuses the problem of analysis on those items whose functions must be protected to ensure safe and reliable operation.

The next step is a detailed analysis of the failure consequences in each case. Each function of the item under consideration is examined to determine whether its failure will be evident to system operations or consumers. If the failure is not evident, a scheduled maintenance task is required to find and correct hidden failures. Each failure mode of the item is then examined to determine whether it has safety, environmental or other serious consequences. If safety or environmental risk is evident, scheduled maintenance is required to avoid the risk of a critical failure. If there is no direct risk related to safety or the environment, but a second failure in a chain of events would have safety/environmental consequences, then the first failure must be corrected at the first instance however it has operational consequences. In this case the consequences are economic, but they include the operational cost i.e. loss of operating capability as well as the cost of repair. The application of the appropriate RCM activity for each potential or actual failure is summarised in Figure 2. To achieve consistency, the severity of failures is determined by the Severity Matrix table.

Figure 2 RCM activities for potential or actual failures



6.1 Criticality Ranking

To ensure the objectives are completed with the most important assets being assessed before less important assets, assets are ranked accordingly for their criticality, the most important being subjected to analysis within this document. As a result of consultation with industry experienced personnel and asset managers, the following three factors are deemed imperative to the differentiation of assets.

1) Complex system – number of dependent/control sub-assemblies
2) Cost
3) Criticality – location within the network

The combination of these three factors provides a criticality assessment for assets considered for analysis.

6.2 Scheduled Maintenance

Scheduled maintenance may be desirable on economic grounds, provided that its cost is less than the combined costs of failure modes. The consequences of a non-operational failure are also economic, however this involves the direct cost of repair.

Classification by failure consequences establishes the framework for evaluating proposed maintenance tasks.

- Critical failures - those with direct safety/environmental consequences - a task is considered effective only if it reduces the likelihood of a functional failure to an acceptable level of risk.
- Hidden failures - no direct impact on safety or operating capability - a task qualifies as effective only if it ensures adequate protection against the risk of a multiple failure.
- Operational and non-operational failures - a task may be applicable if it reduces the failure rate (and hence the frequency of the economic consequences), but it must also be cost-effective - that is, the total cost of scheduled maintenance must be less than the cost of the failures it prevents.

6.3 Time/Usage-Based Maintenance Vs Condition-Based Maintenance Tasks

Where the criterion for task effectiveness depends on the failure consequences the task is intended to prevent, the applicability of each form of preventive maintenance depends on the failure characteristics of the item itself. For a condition-based task to be applicable there must be a definable potential failure condition and a reasonably predictable age interval between the point of potential failure and the point of functional failure. For a time or usage scheduled task to be applicable the reliability of the item must in fact be related to operating age or some usage criterion; the age-reliability relationship must show an increase in the conditional probability of failure (hazard rate) at some identifiable age (wear-out) and most units of the item must survive to that age. The applicability of discarding/replacing assets depends on the age-reliability relationship, except that for safe-life items the life limit is set at some fraction of the average age at failure. Failure finding tasks are applicable to all hidden-function items not covered by other tasks.

The process of developing an RCM program depends on selecting scheduled tasks that are both applicable and effective for a given asset. The fact that failure consequences govern the entire decision process makes it possible to use a structured decision diagram approach, both to establish maintenance requirements and to evaluate proposed tasks. The binary form of a decision diagram allows a clear focus of engineering judgment on each issue. It also provides the basic structure for a default strategy, the course of action to be taken if there is insufficient information to answer the question or if the maintenance team is unable to reach a consensus. Thus if there is any uncertainty about whether a particular failure might have safety/environmental consequences, the default answer will be yes; similarly, if there is no basis for determining whether a proposed task will prove applicable, the answer, at least in an initial maintenance program, will be yes for condition-based tasks and no for time scheduled replacement tasks. It is important to realize that the decision structure itself is specifically designed for the need to make decisions even with minimal information. For example, if the default strategy demands redesign and this is not feasible in the given timetable, then one alternative is to seek out more information in order to resolve the problem. However, this is the exception rather than the rule. In most cases the default path leads to no scheduled maintenance, and the correction, if any, comes as real and applicable data come into being as a result of actual use of the equipment in service.

The decision logic also plays the important role of specifying its own information requirements. The first three questions assure us that all failures will be detected and that any failures that might affect safety, the environment or operating capability will receive first priority. The remaining steps provide for the selection of all applicable and effective tasks, but only those tasks that meet the criteria are included. Again, real data from operating experience will provide the basis for adjusting default decisions made in the absence of information. If operational data is not available, then the program will follow the default decisions. As information is gathered to evaluate age-reliability relationships and actual operating costs, maintenance and replacement tasks are gradually added to the program where they are justified. The net result of this careful development of the decision process is a scheduled maintenance program that is based at every stage on the known reliability characteristics of the equipment in the operating context in which it is used.

6.4 Maintenance Task Scheduling

All tasks require some level of access to the electrical network and need to be scheduled to create sensible work packages. In order to minimise cost and network outages, there is a need to rationalise the number of times access is granted to the system to achieve a practical program of work. The level of system access can be categorised into three different levels:

1. Sub feeder level – requiring access to part of a feeder, for example a distribution substation.
2. Feeder level – requiring access to a feeder or multiple feeders.
3. Zone substation or transmission level – requiring access to part or all of a zone substation, or a transmission line.

When grouping tasks, the level of system access should be taken into account, not only to minimise customer outages, but also to minimise the number of load transfer operations required to avoid customer outages. If tasks are grouped that require different levels for their execution they will have to be carried out at the deepest level which may not be a good use of time and resource.

Creating a task schedule involves three basic steps:

1. Grouping tasks. Our objective for the first step is determining what tasks can be grouped and assigning these to a package or task list.

2. Scheduling intervals between groups of tasks. The next step in establishing an efficient schedule of preventive tasks involves determining allowable task intervals and assigning an interval value to each package of grouped tasks and any remaining stand-alone tasks. Determining the range of allowable intervals needs to be done in conjunction with the first step of grouping tasks. The objective is to assign an interval to each group of tasks that is close to the average interval of the individual tasks included in the group.

3. Determining the phase relationship between the scheduled cycles for the different tasks. This step requires setting the phase relationship between the cycles for each group of tasks to control the labour demand. Groups of work tasks should be programmed in order to avoid excessive peaks in labour demand and to take advantage of common setup requirements such as a planned outage of part of a feeder.

7 Application of Risk Tolerance

The risk management process described within procedure The Risk Management Process - PR4660 is to be followed by all workers undertaking risk management activities, including the assessment of whether there is sufficient risk to warrant undertaking asset management activities. Potential asset management activities are to be tested for risk tolerance by following the Risk Management Process.

The process refers to Risk Assessment Tables, the table applicable to the Asset Management Objectives is table Risk Assessment Tables (Energy Network) - PR4660.2 for use below executive level. The table provides a methodology for scoring on the basis of likelihood and consequence against the following risks:

- Health and safety
- Damage to the environment
- Damage to reputation/competitive position
- Legal/compliance breach
- Financial losses
- Disruptions to emergency planning
- Staff competence
- Disruption to program or project

If the rating for any of the above risks falls into the high or very high category, then the risk exceeds corporate tolerance, and an activity must be undertaken to bring the risk within corporate tolerance.

8 Application of Objectives to Key Assets

The application of these objectives to each asset class is detailed in Asset Specific Plan documents.

8.1 Primary Systems

Primary Systems Objectives are met through employing the asset management techniques as described in sections 4, 5 and 6 of this document to the distribution assets which are sorted into a number of asset classes. A detailed asset specific plan is then produced for the assets in each asset class. Asset specific plans can be accessed through the following links:

Distribution Assets

Transmission Assets

8.2 Secondary Systems

The Secondary Systems Strategy document describes the strategy for the development and implementation of secondary systems assets over the Regulatory Period 2019-2024 and beyond. It covers ActewAGL Energy Networks protection, SCADA and communications systems, usage of leased communications bearers, and communications requirements for B2B and customer installation operation. It describes the current state of the assets and systems deployed in the network, the expected impacts from disruptive technologies, the impacts of the next phase of NER Regulations, the steps to address the Regulatory Requirements, and the development of secondary systems required to support the ActewAGL vision and strategy.

Link to Secondary Systems Asset Specific Plans

9 Linking Asset Management Objectives with Peak Demand Reduction

Asset Management objectives are set to prudently and efficiently maintain network capacity, which is required to cater for the daily demand peaks that occur for relatively short periods of time, and then further capacity required to meet annual peaks which only occur on a limited number of days each year. The supply side tactical objectives outlined in this document are complemented with demand side reduction strategies articulated in the "Peak Demand Reduction Strategy"

The peak demand reduction strategies will have an effect on our demand forecasts, and these in turn will influence our asset management plans. The design of the Asset Management System is such that the Asset Management Objectives and Peak Demand Reduction Strategies work in parallel to produce an asset management plan which prudently caters for network demand that has been shaped through effective demand management.

10 Definitions - Asset Attributes and Asset Related Activities

Attribute/Activity	Definition
Asset Function	The purpose of the asset as required by the user
Asset Function Failures	The inability of a system to meet a specific performance standard.
Asset Failure Modes	The manner in which an asset or component failure can occur.
Failure Effects (local)	The impact that the defined failure will have on its immediate surroundings.
Failure Effects (system)	The impact that the defined failure will have on the wider network.
Failure Detection Method	The method in which the failure of the defined asset will be discovered.
Severity of Failure	A rating used to quantize the effects of the failure.
Maintenance Strategy	The current process used to maintain the asset.
Frequency of Maintenance activity	The rate at which the maintenance is currently carried out on the equipment.

Is Frequency Estimated or Scheduled	Shows how the frequency of maintained figure was obtained.
Justification for activities and frequency	Aligning the activity and its frequency with a corporate objective.
Age Exploration Tasks	Investigation into asset failure as the asset ages
Hidden Function	An asset function that is not apparent to an operator, with the consequence that it's failure is also not apparent to an operator
Failure	The inability of an asset to meet a specified performance
Critical Failure	A failure that has direct safety/environmental or economic consequences and which requires unscheduled remedial action.
Hidden Failure	A failure that is not detectable by the operator under normal operating conditions, but may lead to multiple failures

11 Appendix

11.1 Severity Matrix

SEVERITY of Effect	Ranking
Hazardous-without warning: Very high severity ranking, potential failure mode affects safety, noncompliance with policy and without warning.	10
Hazardous-with warning: Very high severity ranking, potential failure mode affects safety, noncompliance with policy with warning.	9
Item inoperable, with loss of primary function.	8
Item operable, but primary function at reduced level of performance.	7
Equipment operable, but with some functions inhibited	6
Operable at reduced level of performance.	5
Does not conform. Defect obvious.	4
Defect noticed by routine inspection.	3
Defect noticed by close inspection.	2
No effect	1

11.2 Probability of Failure Matrix

PROBABILITY of Failure	Failure Rates	Ranking
Very High: Failure is almost inevitable	**Very High:** Failure is almost inevitable Possible Failure Rate >=1 every week	10
	Very High: Failure is almost inevitable Possible Failure Rate 1 every month	9
High: Repeated failures	**High:** Repeated failures Possible Failure Rate 1 every 3 months	8
	High: Repeated failures Possible Failure Rate 1 every 6 months	7
Moderate: Occasional failures	**Moderate:** Occasional failures Possible Failure Rate 1 every year	6
	Moderate: Occasional failures Possible Failure Rate 1 every 3 year	5
	Moderate: Occasional failures Possible Failure Rate 1 every 5 years	4
Low: Relatively few failures	**Low:** Relatively few failures Possible Failure Rate 1 every 8 years	3
	Low: Relatively few failures Possible Failure Rate 1 every 15 years	2
Remote: Failure is unlikely	**Remote:** Failure is unlikely Possible Failure Rate <=1 every 20 years	1

11.3 Likelihood of Detection Matrix

Detection	Likelihood of DETECTION	Ranking
Absolute Uncertainty	Control **cannot** prevent / detect potential cause/mechanism and subsequent failure mode	**10**
Very Remote	**Very remote** chance the control will prevent / detect potential cause/mechanism and subsequent failure mode	**9**
Remote	**Remote** chance the control will prevent / detect potential cause/mechanism and subsequent failure mode	**8**
Very Low	**Very low** chance the control will prevent / detect potential cause/mechanism and subsequent failure mode	**7**
Low	**Low** chance the control will prevent / detect potential cause/mechanism and subsequent failure mode	**6**
Moderate	**Moderate** chance the control will prevent / detect potential cause/mechanism and subsequent failure mode	**5**
Moderately High	**Moderately High** chance the control will prevent / detect potential cause/mechanism and subsequent failure mode	**4**
High	**High** chance the control will prevent / detect potential cause/mechanism and subsequent failure mode	**3**
Very High	**Very high** chance the control will prevent / detect potential cause/mechanism and subsequent failure mode	**2**
Almost Certain	Control **will** prevent / detect potential cause/mechanism and subsequent failure mode	**1**