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<b>FCA</b>  PLANT ENGINEERING	<b>ALARA REVIEW</b>  NO	<b>SUPERSEDES</b> KSM-017, Rev 1a dd. 1999-03-29 FULL REVIEW
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## PAGE STATUS INDEX

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	<b>CONTENTS</b>	<b>PAGE</b>
1.0	PURPOSE.....	4
2.0	SCOPE.....	4
3.0	DEFINITIONS AND ABBREVIATIONS .....	4
4.0	REFERENCES.....	5
5.0	REQUIREMENTS .....	7
6.0	ATTACHMENTS .....	11
	Appendix 1 – The Relationship between Maintenance Terms .....	12
	Appendix 2 – Justification .....	13

## 1.0 PURPOSE

- 1.1 This standard establishes the approach to preventive maintenance and defines the requirements and controls for management of the Maintenance Bases at Koeberg Nuclear Power Station.

## 2.0 SCOPE

- 2.1 This standard applies to the Preventive Maintenance Programme for all plant systems and components.
- 2.2 Non-plant equipment is excluded from this standard.
- 2.3 This standard covers the following:
- Establishing the Preventive Maintenance Programme
  - Documenting the basis for maintenance
  - Change control of the Maintenance Basis
  - Implementing the Preventive Maintenance Programme

## 3.0 DEFINITIONS AND ABBREVIATIONS

### 3.1 Definitions

- 3.1.1 **Activity** - Any work performed in the maintenance, inspection or testing of systems, sub-systems or components.
- 3.1.2 **Breakdown** - Failure in which there is complete loss of function.
- 3.1.3 **Component** - Any piece of equipment whose position on the plant is uniquely identified by a trigramme (unit identifier, system-trigramme, numerical identifier and bigramme).
- 3.1.4 **Condition Monitoring activity** - An activity aimed at detecting the onset of a failure or failure symptom.
- 3.1.5 **Corrective maintenance** - Actions that restore by repair, overhaul, or renewal, the capability of a failed component to function within acceptance criteria.
- 3.1.6 **Failure** - Inability or interruption of ability of a system, sub-system or component to function within acceptance criteria.
- 3.1.7 **Failure finding activity** - An activity aimed at discovering a hidden failure before an operational demand.

- 3.1.8 **Maintenance** - Aggregate of direct and supporting actions that detect, preclude, or mitigate degradation of a functioning system, sub-system or component, or restore to an acceptable level the design functions of a failed system, sub-system or component.
- 3.1.9 **Maintenance Basis** - A document containing the basis for the maintenance regime applied to a specific system, sub-system or component.
- 3.1.10 **Preventive maintenance** - Actions that detect, preclude, or mitigate degradation of a functional system, sub-system or component to sustain or extend its useful life by controlling degradation and failures to an acceptable level.
- 3.1.11 **Reliability Centred Maintenance** - A process used to determine the maintenance requirements of any physical asset, in its operating context.
- 3.1.12 **System** - A collection of components identified by the same three letter code (system-trigramme) performing a function or part thereof.
- 3.1.13 **Time directed activity** - An activity aimed directly at failure prevention or retardation.

## **3.2 Abbreviations**

- 3.2.1 **AR** – Availability Related
- 3.2.2 **CSR** – Critically Safety Related
- 3.2.3 **FMEA** – Failure Mode and Effects Analysis
- 3.2.4 **KORC** – Koeberg Operations Review Committee
- 3.2.5 **NNR** – National Nuclear Regulator
- 3.2.6 **NSA** – Not Safety or Availability related
- 3.2.7 **RCM** – Reliability Centred Maintenance
- 3.2.8 **SR** – Safety Related

## **4.0 REFERENCES**

### **4.1 Referenced Documents**

- 4.1.1 10CFR 50.65: The NRC Maintenance Rule
- 4.1.2 EPRI TR-100844, November 1992: Nuclear Power Plant Common Ageing Terminology

- 4.1.3 GGM 0908, Rev 1: Quality Management Manual for the Generation Nuclear Cluster
- 4.1.4 IAEA Safety Series  
No 50-SG. 07: Maintenance of Nuclear Power Plants
- 4.1.5 KAA-500, Rev 7a: The Process for Controlled Procedures
- 4.1.6 Koeberg Safety Analysis Report, Part III, Chapter 1, Section 02, Rev 4:  
Quality Assurance During Operation
- 4.1.7 KSA-011, Rev 5: The Requirements for Controlled Documents
- 4.1.8 KSM-LIC-001, Rev 0: Requirements for the Control of Maintenance
- 4.1.9 LD 1023, Rev 4: Quality Management Requirements for  
Koeberg Power Station
- 4.1.10 LD 1091, Rev 3: Requirements for Licences of Nuclear Installations  
regarding Risk Assessment and Compliance with the  
Safety Criteria of the NNR
- 4.1.11 Reliability-Centered  
Maintenance: Anthony M. Smith, McGraw-Hill Inc, 1993
- 4.1.12 Reliability-centred  
Maintenance: John Moubray, Butterworth Heineman, 1997
- 4.2 Applicable Documents**  
N/A

## **5.0 REQUIREMENTS**

### **5.1 Preventive Maintenance Policy**

5.1.1 A Maintenance Programme shall be established and implemented, in order to prevent or minimise the probability of system or component functional failure, where the consequences of such failure would be unacceptable in terms of:

- nuclear safety impact;
- personnel safety impact;
- breach of environmental standard/s;
- production/operational impact;
- economic impact.

5.1.2 The Preventive Maintenance Programme shall be focused on maintaining the specified functional capabilities of plant systems and components.

5.1.3 Furthermore, the objectives of the programme will be as follows:

- Maintain the required equipment Reliability/Availability.
- Effectively utilise skilled maintenance resources by focusing them on critical activities.
- Maintain the operational and physical condition of the plant to the inherent design, safety and reliability levels.
- Optimise the cost of plant maintenance.
- Establish a technical basis for each maintenance activity.
- Reduce maintenance induced failures by eliminating unnecessary tasks.
- Utilise predictive techniques where possible, rather than intrusive ("disturbance") activities.
- Reduce radiation exposure associated with maintenance.
- Provide a flexible and dynamic programme, facilitating continuous improvement.

5.1.4 The following maintenance shall be practised at Koeberg, as depicted in Appendix 1:

- Preventive Maintenance;
- Corrective Maintenance.

5.1.5 The major objectives of Preventive Maintenance tasks are:

- to prevent failure;
- to detect the onset of failure;
- to discover hidden failures.

Preventive Maintenance activities are selected from four task categories. They are:

- Time Directed;
- Condition Monitoring;
- Failure Finding;
- Run-to-failure (Breakdown maintenance).

**NOTE:** *“Run-to-failure” is a conscious decision not to perform any preventive maintenance on specific equipment, where the consequences of it’s failure as determined during formal analysis, is deemed not to be severe. The equipment is only maintained on breakdown (i.e. Corrective Maintenance only).*

5.1.6 The objective of a Corrective Maintenance task is to restore failed or degraded equipment to an acceptable condition, in order to meet the required performance standard.

## **5.2 Establishing the Preventive Maintenance Programme**

5.2.1 Studies shall be undertaken to establish the most applicable and effective maintenance regime for all plant systems and major components.

5.2.2 The Preventive Maintenance Programme shall be established using Reliability Centred Maintenance (RCM) principles.

5.2.3 The Preventive Maintenance Programme shall be based upon the impact of component functional failure, in terms of Nuclear Safety, Personnel Safety, Environmental Standards, Statutory Requirements, Production and Cost.

5.2.4 The analysis process shall be documented and authorised.

5.2.5 Where a full study is judged not to be the most appropriate approach, one or more of the following shall be utilised to motivate a Preventive Maintenance Programme:

- equipment manufacturer’s maintenance recommendations;
- information obtained from the equipment manufacturer or large user of similar equipment;



- industry practice;
- Koeberg operating/maintenance experience;
- maintenance history;
- Koeberg specific reliability information;
- industry reliability information;
- EDF experience (RCM analyses/failure history/FMEAs/maintenance programmes, etc)

5.2.6 All statutory activities resulting from an interpretation of the Nuclear Licence, NL-1, Occupational Health and Safety Act, Operating Technical Specifications, and the various applicable codes and regulations, documented in the various Koeberg programmes, shall be considered when establishing the Preventive Maintenance Programme.

Where possible, credit shall be taken for these activities when determining the Preventive Maintenance Programme Requirements.

Statutory requirements shall be adhered to, unless official waivers have been approved by the regulatory authority.

Changes to statutory programmes impacting on the Preventive Maintenance Programme shall be controlled in accordance with the relevant authorised process.

### **5.3 Documenting and Change Control of the Maintenance Basis**

5.3.1 Maintenance Bases shall be established and detailed in controlled documents for all CSR and SR plant systems and major components.

5.3.2 Should a Maintenance Basis be compiled for systems and components which are not CSR or SR, an electronic database shall be acceptable for the storage thereof.

5.3.3 Responsibility for the control & updating of Maintenance Bases shall be assigned.

5.3.4 The Maintenance Basis, as a minimum, will consist of the following:

- scope identification (Boundaries);
- a list of maintenance tasks to be implemented, with their periodicities;
- a document which explains the rationale for each task (typically: RCM Analysis; Manufacturer's Recommendations, Codes and Regulations, etc.).

- 5.3.5 Establishing of and changes to the Maintenance Bases, shall be controlled in accordance with an authorised process.
- 5.3.6 The issue & storage of Maintenance Bases shall be controlled.
- 5.3.7 All maintenance programme changes shall be clearly documented.
- 5.3.8 Maintenance Basis changes shall be supported by an appropriate justification.
- 5.3.9 Each justification shall be retained as part of the Maintenance Basis Document.
- 5.3.10 The Preventive Maintenance Programme shall reflect the requirements of the Maintenance Bases.
- 5.3.11 Where a Preventive Maintenance regime has been previously established, but the basis is unrecorded, the validity of the regime shall be accepted and no basis will be required until such time as a new basis is established and documented. Should any change to the intent or frequency of the tasks be required however, a new Maintenance Basis shall be established and documented.
- 5.3.12 The adherence to these requirements shall be periodically audited in accordance with Koeberg's Quality Assurance programme and any adverse findings submitted to KORC.
- 5.3.13 Maintenance Bases shall be reviewed as appropriate during the life of the plant to take into account plant modifications and operational experience.

#### **5.4 Implementing the Preventive Maintenance Programme**

- 5.4.1 As a minimum, the implementation of a new or revised Preventive Maintenance Programme shall be completed promptly, following the authorisation of the revised Maintenance Basis.
- 5.4.2 Preventative Maintenance activities on systems and components classified as CSR or SR shall be listed in a controlled document. As a minimum, this listing shall define the following:
- unit, trigramme;
  - equipment description;
  - description of the activity;
  - periodicity of the activity;
  - applicable working procedure;
  - document revision number of the implementation of, or the last change to, the activity.

Any changes to this listing shall be timeously communicated to the NNR.

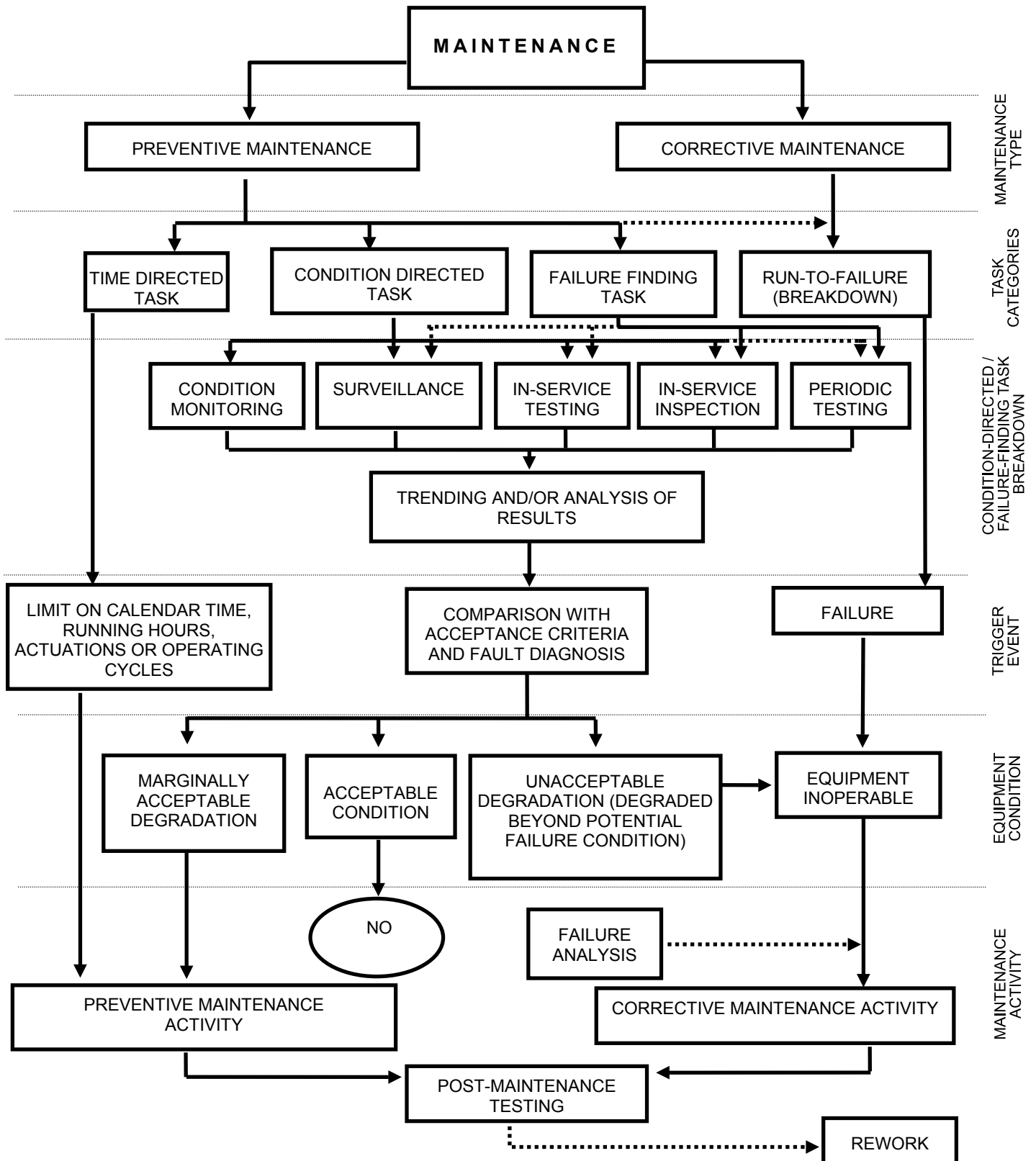
## **6.0 ATTACHMENTS**

Appendix 1 - The Relationship Between Maintenance Terms

Appendix 2 - Justification

## APPENDIX 1

## THE RELATIONSHIP BETWEEN MAINTENANCE TERMS



## **APPENDIX 2**

### **JUSTIFICATION**

#### **Revision 0**

1. Changed from a Maintenance Document (KSM-017) to a Plant Engineering Document (KSU-006), in line with the revised organisational responsibilities.
2. Full Review.