| Eskom | Procedure | Nuclear Engineering |
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Title: **Technological Obsolescence Programme**

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## 1. Introduction

Koeberg Nuclear Power Station (KNPS), like many ageing nuclear power plants, is facing increasing challenges related to obsolescence. These challenges put KNPS in a vulnerable position since continued plant safety and operations can be impaired if the obsolescence of Systems, Structures and Components (SSCs) are not identified in advance so that corrective actions can be taken before the associated decrease in the reliability and/or availability occurs. The Nuclear Operating Unit (NOU), as a whole, must thus address obsolescence to ensure KNPS's continued plant safety and operation.

The concept of obsolescence can be sub-divided into three categories (Table 1 refers):

- Technological
- Regulations, codes, and standards
- Knowledge

This programme concerns itself with the technological obsolescence of items important to safety.

Interim Regulatory Guide RG-0027 [12] provides the requirements set out by the National Nuclear Regulator (NNR) for the Ageing Management and Long-Term Operation of Nuclear Power Plants, including management of technological obsolescence. 331-146 addresses these requirements, as well as aligning itself to IAEA Specific Safety Guide No. SSG-48 [12] and the nine generic attributes of an effective Ageing Management Programme (AMP) listed in IAEAL 15-00965 [10]. This document bases the details within the nine attributes on work done by the power industry [7][8][9][11] and is tailored to reflect NOU terminology, processes and organisational structures. The sections in this document will begin with the requirements that the NOU needs to meet, and subsequently unpacks the details to give the reader context and guidance.

**Table 1: Types of obsolescence [12]**

| Subject of obsolescence | Manifestation | Consequences | Management |
|---|---|---|---|
| Technology | Lack of spare parts and technical support<br>Lack of suppliers<br>Lack of industrial capabilities | Declining plant performance and safety due to increasing failure rates and decreasing reliability | Systematic identification of useful service life and anticipated obsolescence of SSCs<br>Provision of spare parts for planned service life and timely replacement of parts<br>Long term agreements with suppliers<br>Development of equivalent structures or components |
| Regulations, codes, and standards | Deviations from current regulations, codes and standards for structures, components, and software<br>Design weaknesses (e.g., in equipment qualification, separation, | Plant safety level below current regulations, codes, and standards (e.g., weaknesses in defence in depth or higher risk of core damage [frequency]) | Systematic reassessment of plant safety against current regulations, codes, and standards (e.g., through periodic safety review) and appropriate upgrading, back fitting, or modernization |

| Subject of obsolescence | Manifestation | Consequences | Management |
|---|---|---|---|
| | diversity or capabilities for severe accident management) | | |
| Knowledge | Knowledge of current regulations, codes and standards and technology relevant to SSCs not kept current | Opportunities to enhance plant safety missed | Continuous updating of knowledge and improvement of its application |

## 2. Supporting Clauses

### 2.1.1 Scope

This document focusses on the technological obsolescence of equipment linked to Functional Locations that are classifies as important to safety in accordance with the scoping document 240-125839632 [4] and ageing management requirements 240-149139512 [3]. The document further details the scope in § 3.1 'Scope of the TOP based on the understanding of obsolescence'.

### 2.1.2 Purpose

To detail how the Technological Obsolescence Programme (TOP) identifies, prioritises and remedies obsolescence issues at the KNPS.

### 2.1.3 Applicability

This document applies to all activities relating to technological obsolescence management in the Nuclear Operating Unit (NOU).

### 2.1.4 Effective date

This procedure shall be effective from the date of its authorisation.

### 2.2 Normative/Informative References

The following documents are the normative and informative references applicable to this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

### 2.2.1 Normative

This document normatively references the following documents, in whole or in part, and they are indispensable for its application.

[1] 238-6 - Nuclear document and records management requirement.

[2] 238-8 - Nuclear Safety and Quality Manual.

[3] 240-149139512 - Ageing Management Requirements for Koeberg Nuclear Power Station

[4] 240-125839632 - Koeberg Long Term Operating (LTO) Scoping Methodology

[5] 331-2 - Nuclear Engineering Management Manual.

[6] 331-3 - Nuclear Engineering Documentation and Records Management Work Instruction.

[7] EPRI 1015391 - Plant Support Engineering: Obsolescence Management – A Proactive Approach. EPRI, Palo Alto, CA: 2007. 1015391.

[8] EPRI 1016692 - Plant Support Engineering: Obsolescence Management: Program Ownership and Development. EPRI, Palo Alto, CA: 2008. 1016692.

[9] EPRI 1019161 - Plant Support Engineering: Proactive Obsolescence Management: Program Implementation and Lessons Learned. EPRI, Palo Alto, CA: 2009. 1019161.

[10] IAEAL 15-00965 - Ageing management for nuclear power plants: International Generic Ageing Lessons Learned (IGALL)

[11] IAEA TOP401 - Technological Obsolescence Programme

[12] SSG–48 - IAEA Specific Safety Guide - Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants

[13] RG-0027 - Interim Regulatory Guide – Ageing Management and Long-Term Operations of Nuclear Power Plants.

### 2.2.2 Informative

The following documents are further sources of information cited in this document, e.g., laws, standards, codes, and procedures.

[14] 240-139089079 - Programmes Oversight Committee (POC)

[15] 240-163516799 – Guideline for the cannibalisation process of obsolete materials at the Nuclear Operating Unit.

[16] 32-1034 - Eskom Procurement and Supply Chain Management Procedure

[17] 331-86 - Design to Plant, Plant Structures or Operating Parameters

[18] 331-94 - Importance Category Classification Listing

[19] 331-143 - The Equivalency Process to Change the Plant

[20] 331-148 - Programme Engineers' Guide

[21] 331-275 - Process for Ageing Management at Koeberg Operating Unit

[22] ASME NQA-1-2008 - Quality Assurance Requirements for Nuclear Facility Applications

[23] EPRI 3002002852 - Advanced Nuclear Technology: Guidance and Methodologies for Managing Digital Instrumentation and Control Obsolescence

[24] EPRI 3002011678 - Guidance for the Use of Reverse-Engineering Techniques: Revision 1 to EPRI TR-107372. EPRI, Palo Alto, CA: 2018. 3002011678.

[25] EPRI TR-017218 - Guideline for Sampling in the Commercial-Grade Item Acceptance Process

[26] IAEAL 19-01239 - IAEA safety glossary: 2018 edition

[27] INUOG-2019/001 – Guideline for establishing Management of Obsolescence

[28] KAA-501 - Project Management Process for KPNS Modifications

[29] KAA-679 - Control and operation of the measuring and test equipment at KNPS

[30] KAA-688 - The Corrective Action Process

[31] KAA-738 - Management Review and approval of reverse engineering

[32] KAA-826 - Plant Health Committee (PHC) Constitution

[33] KAA-913 - Integrated Equipment Reliability Process

## 2.3 Definitions

This document defines the important concepts and terms hereunder. The document strives to align definitions to industry standards such as [26] as far as possible.

2.3.1 **Critical Component (Equipment Reliability (ER) Classification Category):** Critical components are those that can affect nuclear safety, plant reliability or power generation and therefore every effort must be made to maximise the reliability of these components. These components will have the most aggressive Preventive Maintenance (PM) Strategies.

2.3.2 **Design extension conditions:** Postulated accident conditions that are not considered for design basis accidents, but that are considered in the design process of the facility in accordance with best estimate methodology, and for which releases of radioactive material are kept within acceptable limits.

2.3.3 **Equipment (SAP):** a movable object in the SAP Plant Maintenance (PM) system - an individual, physical object that is maintained as an autonomous unit. This is an instance of a Reference Equipment class that the NOU can usually identify with a serial number.

2.3.4 **Equivalent Item:** An item which replaces an original or installed item for which Specification Engineering perform an equivalency evaluation to ensure that the item has an acceptable fit, form and function.

2.3.5 **Functional Location:** An organizational unit in Logistics that structures the maintenance objects of a company according to functional, process-oriented, or spatial criteria. In SAP it represents the place at which the NOU performs a maintenance task. At KNPS, it is typically an eleven-digit code that uniquely identifies the plant location of Equipment. KNPS may interchangeably use one or more Equipment in a single functional location.

2.3.6 **Important to safety:** An item that is part of a safety group and/or whose malfunction or failure could lead to radiation exposure of the site personnel or members of the public.

2.3.7 **Information System:** Digital system with a user interface where users can read/write/modify data and have that data automatically stored in a backend database. At the NOU, these systems would typically be SAP, DevonWay, SharePoint, COMSY and IQReview.

2.3.8 **Item:** An instance of equipment, derived from the Reference equipment, installed at a Functional Location within the plant's Systems, Structures and Components (SSCs).

2.3.9 **Material (SAP):** The goods that are the subject of a business activity (The goods are consumed in the case of KNPS). The process of describing the goods is a standardised, consistent manner and assigning the material a unique number in SAP.

2.3.10 **Non-physical ageing:** As defined by the IAEA, this is the process of becoming out of date (i.e., obsolete) owing to the evolution of knowledge and technology and associated changes in codes and standards. This document also uses the term technological obsolescence.

2.3.11 **Obsolescence:** See technological obsolescence.

2.3.12 **Obsolescence Issue:** A need (or logical grouping of needs to facilitate development of a comprehensive solution) associated with obsolete plant equipment, where an equivalent or alternate item could not be identified through other processes.

2.3.13 **Obsolete Equipment:** Equipment (derived from parent Reference Equipment) in plant service that is no longer manufactured or supported by the original manufacturer or is otherwise difficult to procure and qualify.

2.3.14 **Obsolescence Management Service:** An external service provided to facilitate and supplement the work of identifying, prioritising and remedying obsolescence issues.

2.3.15 **Proactive obsolescence:** Identification, prioritisation and remedying of an obsolescence issue before there is a plant demand for the obsolete equipment.

2.3.16 **Physical ageing:** Also known as material ageing, is the ageing of structures, systems, and components due to physical, chemical and/or biological processes (ageing mechanisms).

2.3.17 **Reactive obsolescence:** Identification, prioritisation and remedying of an obsolescence issue only after the fact that there is a plant demand for the obsolete equipment.

2.3.18 **Reference Equipment/Item of Supply (SAP):** A class of equipment from which a specific instance can be linked to a Functional Location and Material.

2.3.19 **Safety group:** The assembly of equipment designated to perform all actions required for a particular *initiating event* to ensure that the *limits* specified in the *design basis* for *anticipated operational occurrences* and *design basis accidents* are not exceeded. Also see 2.3.6.

2.3.20 **Single Point Vulnerability:** A single component whose failure will result in an immediate automatic reactor trip, or an immediate production loss of greater than 20% power (components with an ER Classification of ‘Critical’, where the C1 or C2 criteria are met).

2.3.21 **Technological Obsolescence:** see *non-physical ageing*. Non-physical ageing is further defined by the NNR in [13] and [12] as the lack of spare parts, technical support, suppliers and/or industrial capabilities. Technological obsolescence is simply referred to as obsolescence in this document.

2.3.22 **T-week schedule:** Task or work week schedule. A T-week schedule typically identifies tasks that must be completed to support successful execution of scheduled work and identifies the time period before execution of the tasks that must be completed. For example, if the schedule for a maintenance task indicates “all parts must be requested by T-6,” it means that all parts required for the maintenance task must be requested no later than six weeks prior to execution of the task to ensure successful execution of the work.

The following additional definitions relate to organisation parlance for clarity.

2.3.23 **Accountable (RACI model)**: The individual ultimately answerable for the correct and thorough completion of a deliverable or task, the individual who ensures the prerequisites of the task are met and who delegates the work to those responsible. There must be only one accountable individual specified for each task or deliverable.

2.3.24 **Can**: indicates a possibility or a capability.

2.3.25 **Consulted (RACI model)**: Individuals whose opinions are sought, typically subject-matter experts; and with whom there is two-way communication.

2.3.26 **Informed (RACI model):** Individual(s) who are kept up to date on progress, often only on completion of the task or deliverable; and with whom there is just one-way communication.

2.3.27 **May**: indicates a permission.

2.3.28 **Responsible (RACI model):** Individual(s) who do the work to complete the task. There is at least one role with a participation type of responsible, although others can be delegated to assist in the work required.

2.3.29 **Shall**: indicates a requirement.

2.3.30 **Should**: indicates a recommendation.

## 2.4 Abbreviations

| Abbreviation | Explanation |
|---|---|
| AMP | Ageing Management Programme |
| BOM | Bill Of Material |
| CAP | Corrective Action Programme |
| CGD | Commercial Grade Dedication |
| CGI | Commercial Grade Item |
| COMSY | Condition Orientated ageing Management System |
| COTS | Commercial Off The Shelf |
| EDF | Électricité de France |
| EPRI | Electric Power Research Institute |
| ER | Equipment Reliability |
| FLOC | Functional LOCation |
| GA | General Action |
| IAEA | International Atomic Energy Agency |
| INPO | Institute of Nuclear Power Operations |
| INUOG | International Nuclear Utility Obsolescence Group |
| KNPS | Koeberg Nuclear Power Station |
| KPI | Key Performance Indicator |
| LOPP | Life of Plant Plan |
| NOU | Nuclear Operating Unit |
| NNR | National Nuclear Regulator |
| OE | Operational Experience |
| OEM | Original Equipment Manufacturer |
| OES | Original Equipment Supplier |
| OIRD | Obsolete Items Replacement Database |
| OSC | Obsolescence Steering Committee |
| OWG | Obsolescence Woking Group |
| PHC | Plant Health Committee |
| PSR | Periodic Safety Review |
| SALTO | Safety Aspects of Long-Term Operation |
| SAP | Systems, Applications and Products in Data Processing |
| SME | Subject Matter Expert |
| SPV | Single Point Vulnerability |
| SSG | Specific Safety Guide |
| SSC | System, Structure and Component |
| TOP | Technological Obsolescence Programme |

## 2.5 Roles and Responsibilities

Nuclear Engineering shall develop a TOP (with a bias toward proactive obsolescence management) to deal with technological obsolescence and incorporate it into regular business. Although the NOU must appoint a TOP owner, an effective TOP is a cross-functional endeavour that involves exchanging information and collaborating with several key plant organisations [9]. To achieve this, the following key organisations and structures have a responsibility for supporting the TOP. The following sections are predominantly based on [8], with adjustments made to align with the NOU terminology and organisational names.

### 2.5.1 General Manager - Nuclear Engineering

The NE General Manager (GM) is responsible for obtaining commitment from the management of other NOU organisations (including KNPS and Nuclear Commercial) to ensure that they support the TOP and integrate it into regular business.

### 2.5.2 Plant Health Committee (PHC)

- The PHC (Strategic) provides oversight and direction for the TOP as per their constitution [32].
- Provides support to resolve long outstanding spares issues, in particular those related to Top ER Issues, non-conformances (NC), temporary alterations (TAFs), equivalencies and obsolescence to improve plant health.
- Receives information from Programmes Engineering Manager of obsolescence related issues that require PHC-S oversight.
- Periodically discusses obsolescence issues.
- Drives the relevant organisations within the NOU to implement obsolescence solutions.

### 2.5.3 Programme Oversight Committee (POC)

- The Programme Oversight Committee (POC) has been established as a sub-committee of the Plant Health Committee (PHC) as per POC Terms of reference (ToR).
- POC provides management oversight (including driving sustainable excellence in order to enhance equipment and material reliability and plant performance.
- Effectively manages plant efficiency and ensuring the long-term operation and integrity of the plant.
- Ensures monitoring of the Programme Health and Key Performance Indicators (KPIs)) of the existing engineering programmes (including future and under-development) programmes.
- POC further facilitate and monitor the progress of the implementation of new and revised programmes and address any delays or constraints.

### 2.5.4 Obsolescence Steering Committee (OSC)

The OSC is the governance body for the management of technological obsolescence at the NOU. The high-level responsibilities of the OSC, as per 240-129906353, are to provide direction, support, oversight, and approval of the work executed for the TOP, including:

- Direction on:
  - Obsolescence issues that have reached a standstill.
- Support on:
  - Obsolescence issues that need to be escalated to other committees or senior management.
  - Work done by organisations not represented in the OSC.
- Oversight on:
  - The implementation, upkeep, and continuous improvement of the TOP.
  - The progress of obsolescence solution strategies and their linked actions.
  - Contracts.
- Approval of:
  - Members appointed to Obsolescence Working Groups (OWGs), who will be responsible and accountable for work done on obsolescence issues.
  - Obsolescence solution strategies for all obsolescence issues.
- Assessing the needs for:
  - Obsolescence strategies for identified obsolescence issues.
- Concurrence on:
  - SAP material(s) that are identified as obsolescence issues.
  - Obsolescence issues to be presented at POC (in line with POC ToR).
  - Accuracy of OSC meeting minutes.
- Discuss and determine the inputs to:
  - Obsolescence solution strategies.
  - Formal requests to contractors.

### 2.5.5 Obsolescence Working Group (OWG)

The OWG is a cross functional team of Subject Matter Experts (SMEs) assigned by the OSC to work on specific obsolescence issues. Representation varies depending on the nature of work that is required at any particular phase of the TOP process. The OSC directs and guides the required work and the OWG executes and provides feedback on this work.

### 2.5.6 Materials Reliability Group Manager

In addition to roles and responsibilities outlined in the Programme Engineers' Guide [20], the Materials Reliability Manager:

- Identifies and appoints the TOP owner and backup programme owner.
- Provides support to the TOP owner for developing, implementing, monitoring, and maintaining this programme.
- Identifies resources within the Materials Reliability Group (MRG) to support the programme owner and the TOP.

### 2.5.7 TOP Owner

In addition to roles and responsibilities outlined in the Programme Engineers' Guide [20], the TOP owner:

- Is responsible for effectively developing, implementing, monitoring, and maintaining the TOP.
- Performs typical management oversight functions, including governance of the programme, and coordinates activities between different plant organisations.
- Drives alignment of the plant's other existing programmes and processes (e.g., Equivalency, Modification, Replacement, etc. see § 3.3.4).
- Assesses programme effectiveness, improvement opportunities and resources required.
- Manages the obsolescence database.
- Is the end user for contracts required for the TOP.

### 2.5.8 Maintenance Execution and Maintenance Work Management

**Decisions and Processes**

The Work Management organisation in conjunction with Maintenance Execution are likely to be the first to identify obsolete equipment (reactively) in the process of preparing and executing maintenance. Maintenance Execution and Maintenance Work Management should make the NOU aware of the potential problem by way of CRs. Other decisions and processes affecting TOP implementation are as follows:

- Input to the overall maintenance philosophy regarding whether certain types of equipment are typically repaired with replacement parts or replaced in their entirety.
- Identification and/or correction of inaccurate or incomplete equipment data in plant information systems.
- Work week management.

**Obsolescence Information Input to Maintenance**

- Identification of obsolete equipment.
- Requests that obsolete equipment be retained or preserved after they are uninstalled, for future use in activities such as reverse engineering.

**Prioritisation Information Provided by Maintenance**

- Maintenance strategy (repair vs. replace) for a given piece of equipment (to determine what equipment will be needed).
- As-found information relating to obsolete equipment including condition information and remaining life.
- When notified of obsolete equipment, Maintenance must include obsolescence information in the pre-job brief and document the actual condition of obsolete equipment and parts during the post-job review (and in information systems) for use in prioritisation efforts.

**Involvement in Development of Obsolescence Management Tools and Solutions**

- Identify reports or information that might be useful to Maintenance in prioritising obsolete equipment needed.

- Identify where information should be available in plant information systems typically used by Maintenance personnel.
- Assist in the development of a mechanism for projecting replacement of obsolete equipment well in advance of the normal T-week schedule for work anticipated on obsolete equipment.
- Assist in the development of a mechanism for notifying the supply chain organisation when items required for work on obsolete equipment are not in stock well in advance of the T-week schedule (for example, based upon scheduled PMs and existing inventory).
- Contributing to the development of the site repair vs. replacement policy or philosophy.
- Implementation of proposed solutions for obsolete equipment in an effective and timely manner, i.e., repair, rebuilding and/or replacements.
- Maintain any indicators that are used for the ongoing monitoring of the TOP.

### 2.5.9 System/Component Engineering

**Decisions and Processes**

Information developed as part of the following processes should provide useful input into a TOP:

- Condition-based/predictive maintenance.
- System reliability meetings.
- System documentation.
- Alert the NOU when obsolete equipment is identified via plant information systems.

**Obsolescence Information Input to System/Component Engineering**

- List of obsolete equipment/reference equipment.
- Available solutions for obsolete equipment (see § 3.7.2).

**System/Component Engineering output for Use in Prioritisation of Obsolescence Issues**

- Identification of high-risk obsolete equipment (for example, near end of life, poor performance, upcoming major maintenance, and so on).
- System/component health reports (that is, identification and tracking of obsolescence issues associated with a given system/component). This should be integrated into relevant processes as per § 3.3.4.
- Impact of obsolescence and recommendations to address equipment reliability gaps.
- Information gathered from owners' groups regarding the performance and reliability of particular equipment.
- Changes to PM activities so they are evaluated for impact on inventory.
- Obsolescence value rankings (i.e., prioritisation) to determine system vulnerability.
- Life of Plant Plans (LOPPs)
- Top ER Issues

**Involvement in Development of Obsolescence Management Tools and Solutions**

- Recommending design modifications/maintenance (sponsoring solutions for system/component level obsolescence issues and those requiring design

modification/maintenance) in accordance with “Project Management Process for Koeberg Nuclear Power Station” [28].

- Identifying the need for enhanced maintenance activities.
- Identifying and documenting the impact obsolescence had on recovering from equipment failures during failure analysis.
- Identifying and documenting the impact obsolescence had on equipment failure due to deferred maintenance during failure analysis.
- Reviewing of planned solutions to ensure that they are in line with overall plans for the system (include in recommendations to PHC and other committees involved in changes). This includes reviewing of bridging strategies.
- Maintaining any indicators that are used for the ongoing monitoring of the TOP (§ 3.6).
- Support the implementation of proposed solutions for obsolete equipment.

### 2.5.10 Reliability Engineering

**Decisions and Processes**

- The PM Basis process, including PM Basis development and control and PM Basis changes.

**Obsolescence Information Input to Reliability Engineering**

- List of obsolete equipment/reference equipment.

**Reliability Engineering output for Use in Prioritisation of Obsolescence Issues**

- ER classification information.

**Involvement in Development of Obsolescence Management Tools and Solutions**

- Maintaining any indicators that are used for the ongoing monitoring of the TOP (§ 3.6).

### 2.5.11 Design Engineering

**Decisions and Processes**

Decisions and processes performed by design engineers that affect TOP implementation include:

- Implementation of plant-specific design modifications for obsolete equipment.
- Identification of potential obsolete equipment through supplier interface to evaluate emergent plant issues.
- Consideration of subcomponent obsolescence when specifying reference equipment to support a new design.
- Selection of a new or standardised design that has a low likelihood of future obsolescence issues.

**Obsolescence Information Input to Design Engineering**

The TOP should provide the following types of information to the appropriate design engineers within the engineering organisation:

- List of obsolete equipment/reference equipment in the system.
- Available solutions for obsolete equipment.

- Applicable design, procurement, equipment, and material specifications, updated to include current requirements.
- Plant design as-built information (for example, vendor manuals, as-built drawings, bills of materials, and so on).
- Maintain any indicators that are used for the ongoing monitoring of the TOP.

**Design Engineering Output for Use in Prioritisation of Obsolescence Issues**

Design engineering should provide the following types of information to the TOP to facilitate the effective prioritisation of obsolescence issues:

- Selection of the optimum change process (design change vs. equivalency) after consultation and coordination with the specification engineering organisation.
- Obsolescence issues learned through other design modification activities.

**Involvement in Development of Obsolescence Management Tools and Solutions**

Design engineering should contribute in the following way to the development of obsolescence management tools:

- Scoping anticipated design modifications/maintenance in a manner that may simultaneously address obsolescence issues.

The design engineers should contribute to developing obsolescence management solutions in the following manner:

- Perform design modifications for major components that will be replaced or those that will be repaired in accordance with “Design to Plant, Plant Structures or Operating Parameters” [17].
- Perform reverse engineering as per “Management Review and approval of reverse engineering” [31] and commercial grade dedication as required.
- Ensuring the design modification generically considers similar equipment (that is, extent of condition) to possibly reduce the number of obsolete components in the plant.
- Ensuring solutions are captured in industry databases to share OE with the international community.
- Provide information for the prioritisation matrix.

### 2.5.12 Specification Engineering

**Decisions and Processes**

Decisions and processes performed by Specification Engineering that affect a proactive TOP implementation include the following:

- Perform equivalency evaluations for obsolete equipment in accordance with “The Equivalency Process to Change the Plant” [19].
- Identification of obsolete equipment through supplier interface during day-to-day resolution of procurement/restocking issues.
- Determining the most appropriate and cost-effective obsolescence options and solutions.
- Identifying other plant applications for an obsolete equipment (that is, being proactive and replacing other like equipment within the extent of condition simultaneously).

**Obsolescence Information Input to Specification Engineering**

The TOP should provide the following types of information to the specification engineering organisation:

- List of obsolete equipment/reference equipment in the system.
- Available solutions (replacements/equivalents) for obsolete Equipment that may be obtained from external sources.
- A list of top priority equipment that require solutions.

**Specification Engineering Output Used for Prioritisation of Obsolescence Issues**

The specification engineering organisation should provide the following information to the obsolescence process to facilitate the effective prioritisation of obsolescence issues:

- Information obtained from tracking the number of procurement requests that were/are for obsolete equipment.
- Equipment that will require an equivalency evaluation in order to be replaced (typically flagged electronically in the materials management information system).
- New vendor capabilities with respect to resolving obsolescence issues.
- Information gained as a result of involvement in industry efforts targeted at collaborative development of obsolescence solutions.

**Involvement in Development of Obsolescence Management Tools and Solutions**

The specification engineers contribute to developing obsolescence management tools in the following manner:

- Identifying equipment obsolescence through supplier interface during day-to-day resolution of procurement/restocking issues.
- Performing equivalency evaluations for obsolete Reference Equipment.
- Ensuring internally developed solutions are uploaded/captured in industry databases.
- Provide information for the prioritisation matrix.
- Maintain any indicators that are used for the ongoing monitoring of the TOP.

### 2.5.13 Procurement

**Decisions and Processes**

Decisions and processes performed by the purchasing/contracts and vendor quality organisations that can impact a proactive TOP include the following:

- Keeping current with suppliers who may be going out of business, reorganising, or merging
    - For auditors, this can be determined during the conduct of an audit.
    - For buyers, this can be determined as a purchase requisition is initially processed.
- Implementing purchases of replacement equipment for obsolete equipment.
- Developing commercial procurement requirements to minimise future obsolescence concerns with the supplier (for example, continued support, provisions for obtaining design information, and so on).

**Obsolescence Information/input to Procurement**

The obsolescence process should provide the following types of information to the purchasing/contracts and vendor quality organisations:

- List of suppliers associated with equipment determined to be obsolete.
- List of high-priority product lines that require support due to obsolescence.
- Lists of replacement equipment that should be purchased to support the life of the plant when a supplier communicates that it is discontinuing support to a product line.

**Procurement Output for Use in Prioritisation of Obsolescence Issues**

The purchasing/contracts and vendor quality organisations should provide the following types of information to the TOP owner to facilitate the effective prioritisation of obsolescence issues:

- Information regarding anticipated or emergent supplier changes (that is, reorganisation, mergers, going out of business, and so on).
- Current/accurate lead times based on recent purchases of other similar replacements.
- Information/feedback regarding supplier current capabilities to support certain product lines.

**Involvement in Development of Obsolescence Management Tools and Solutions**

The purchasing/contracts and vendor quality organisations should contribute to developing obsolescence management tools in the following manner:

- Development of an automated means of learning about and reporting emergent component/part obsolescence issues through supplier interface during day-to-day resolution of purchasing issues and periodic surveys of suppliers or commercially available information regarding the viability of supplier organisations.
- Communicating information regarding supplier changes (that is, reorganisation, mergers, going out of business, and so on) to the TOP owner.
- Sharing information/feedback regarding supplier current capabilities.
- Determine if equipment in the TOP scope are still supported by the original or other approved vendor.
- Raise CRs for equipment that is identified as obsolete.
- Provide information for the prioritisation matrix.
- Maintain any indicators that are used for the ongoing monitoring of the TOP.

### 2.5.14 Materials Management

**Decisions and Processes**

Supply chain management play a key role in an effective obsolescence management programme by considering obsolescence in the following types of processes:

- Supply chain organisations can develop a means to flag obsolete stock codes in information systems and establish measures to prompt action when inventory of obsolete equipment falls below established levels.
- Supply chain organisations can develop means to link obsolete equipment stock codes with recommended replacement equipment stock codes in information systems.
- Obsolete equipment can be electronically cross-linked to known existing solutions using industry tools or “stage” solutions to potential obsolescence issues prior to their occurrence.

- Supply chain organisations identify and address emergent obsolescence issues using available tools and industrywide sources of data.
- Supply chain personnel have good opportunities to gain insight into upcoming changes in suppliers' organisations that might impact continuing support of current product lines.
- Reports that show parts and equipment required for scheduled work on obsolete equipment can be used to screen upcoming work to determine or identify near-term obsolescence issues and may also be used to predict future long-term demand (quantities). This information can be used to predict when existing inventory will be depleted so that solutions can be implemented before depletion.
- Solutions to obsolescence issues by suppliers, such as new product lines or recommended replacements, may be taken into consideration.

**Obsolescence Information Input Provided to Supply Chain**

The obsolescence process should provide the following types of information to the inventory and supply chain organisations:

- Obsolete stock codes or catalogue identification numbers in plant information systems.
- Notifications provided by the vendor quality organisation when serious quality issues arise (for example, a supplier having audit findings precluding the procurement of safety-related equipment).
- New obsolescence solutions by others (for example, suppliers, other licensees, captured in the Obsolete Items Replacement Database [OIRD], and so on).

**Output Used for Prioritisation of Obsolescence Issues**

The supply chain and inventory management organisations should provide the following types of information to the obsolescence process to facilitate the effective prioritisation of obsolescence issues:

- Suppliers that have recently experienced management or facility changes, mergers, or acquisitions.
- Notification to the obsolescence process when made aware of obsolete equipment by suppliers.
- Communication of possible solutions.
- Communication of optimum and current stocking levels for replacement equipment.
- Provide information for the prioritisation matrix.

**Involvement in Development of Obsolescence Management Tools and Solutions**

The supply chain and inventory management organisations should contribute to developing obsolescence management tools in the following manner:

- Physical and electronic identification of inventory equipment identified as obsolete to prevent unintended sale or disposal.
- Identifying and recommending suppliers of replacement equipment for obsolete equipment.
- Recommending optimum stocking levels for replacement equipment.
- Identifying the need to procure alternate equipment.
- Identifying the need to perform equivalency evaluations for obsolete components and piece parts.

- Providing obsolescence issues (and in some cases obsolescence solutions) to OIRD.
- Raise CRs for equipment that is identified as obsolete.
- Maintain any indicators that are used for the ongoing monitoring of the TOP.
- Updating plant inventory systems to reflect new information and requirements applicable to equipment identified as obsolete, even in cases when they are not being procured.

**Average Historical Usage over a Period of Time (Supply Chain)**

A key source of information that should be considered as prioritisation criteria is the average historical usage of replacement equipment over a designated period. This should provide the quantities and intervals at which replacement equipment has been required to perform both preventive and corrective maintenance activities. The organisation should also look for trends indicating changes in the frequencies between maintenance activities, or the quantities/types of equipment needed.

**Predicted Future Demand for Replacement Equipment (Supply Chain/Planning)**

When provided with historical usage of the replacement equipment, the team should be able to extrapolate and predict what the demand will be for the remaining life of the equipment. Again, trending should be factored into this estimate, as well as any industry data available regarding adverse trends in equipment performance as it ages.

**Current Inventory Levels**

The supply chain organisation can assess the adequacy of current inventory levels to determine if anticipated demands will be able to be met with stock or if additional supplier sources will be needed. Inventory data can be gleaned from the following sources:

- Site-level inventory.
- Industry levels captured in obsolescence products available to the industry.
- Site inventory levels of subcomponent parts—information that should be considered because depending on the scope of subcomponent parts in inventory, it may be feasible to rebuild a whole component if the necessary parts are available.

A graded approach to establishing inventory levels should be adopted. The graded approach considers risk associated with not having a given spare, anticipated demand for the equipment, and costs associated with obtaining it. Additional guidance regarding the development of an effective critical spares programme is provided in EPRI report 1011861, Considerations for Developing a Critical Parts Programme at a Nuclear Power Plant.

### 2.5.15 Miscellaneous Role and Responsibilities

- The CAP team assists the OSC in managing the data on DevonWay and providing support with the CAP process.
- The IT organisation assists the OWG with extracting and updating information to plant information systems at scale.

## 2.6 Process for Monitoring

This is detailed in the section ‘Quality Management’ (§ 3.9).

The Implementation of the processes described in this document will be monitored through self-assessments, independent assessments and during audits as appropriate.

### 2.7 Related/Supporting Documents

- Obsolescence solution strategies
- Memorandums
- Appointment letters
- Self-assessments
- Meeting minutes

## 3. Technological Obsolescence Management

The NOU shall manage technological obsolescence of equipment (and hence reference equipment) in the plant through a dedicated plant programme with foresight and anticipation and should resolve obsolescence issues before any associated decrease in reliability and availability occur [12]. This document aligns sections herein with the nine generic attributes of an effective Ageing Management Programmes [10]. The content of each section is then based directly on industry best practice [7][8][9][11] and, where needed, adapted to match the NOU definitions, processes and organisational structures. Appendix A shows the overview of the TOP process map suggested by EPRI [9], which this programme emulates.

At a high level, the TOP identifies, prioritises, and implements solutions for obsolescence issues by making use of the available resources and interfacing with the appropriate organisations at the NOU, as is seen in Figure 1.

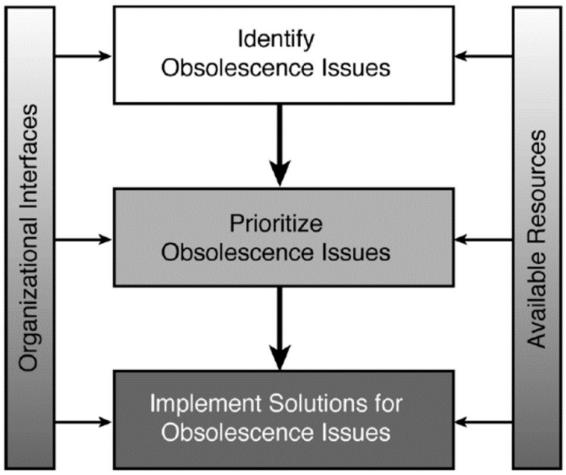


**Figure 1: Basic elements of the generic obsolescence process [9].**

Additionally, the NOU should [12]:

- exchange information.
- participate in collaboration within the nuclear industry. The International Nuclear Utility Obsolescence Group (INUOG) is one such organisation with which the NOU may choose to participate.
- make use of industry tools to identify and resolve common occurrences of technological obsolescence.

### 3.1 Scope of the TOP based on the understanding of obsolescence

This programme shall cover all items (i.e., equipment/reference equipment linked Functional Locations) important to safety (see Figure 2 below) from a *Technological* obsolescence perspective. The focus of the TOP is on *proactive* obsolescence, such that issues can ultimately be anticipated instead of reacted to.

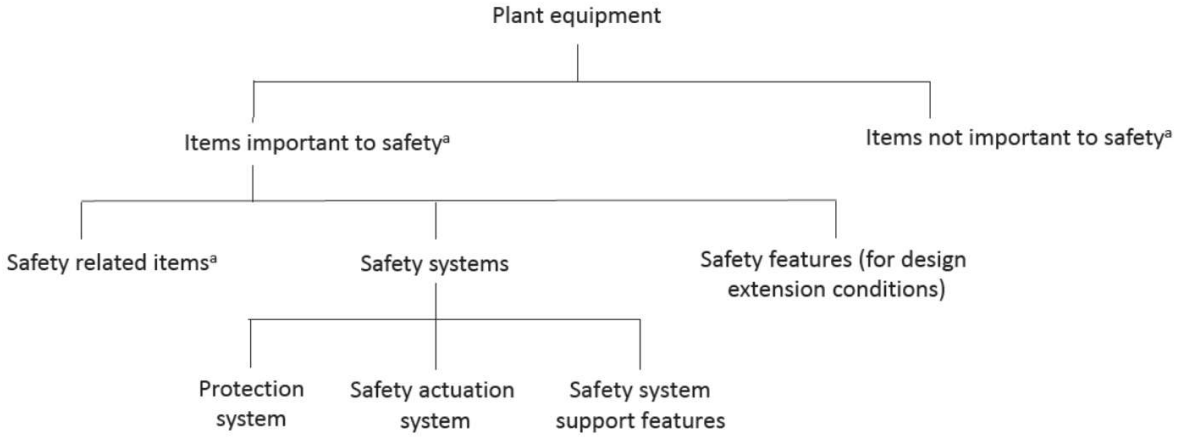


**Figure 2: IAEA breakdown of items important to safety [26]**

The NOU identified a complete list of items important to safety at KNPS as part of the SALTO Assessment Project, in accordance with the Scoping Methodology 240-125839632. The NOU will use this list as the baseline TOP scope.

Also included is equipment that is used in the realisation of activities that are mandated as part of the Koeberg license requirements. This is limited to equipment that has long replacement lead times; where replacement requires regulatory approval; and where replacement requires capital funding and investment approvals.

Equipment that falls under Radiation Protection, Emergency Planning, Security, Environmental and Chemistry Monitoring, and Training (simulator) is managed by their respective organisations and only equipment that those organisations request the TOP to process in accordance with this procedure will be included in the TOP scope.

The following is excluded from the scope of this programme:

- Obsolescence of compliance with current regulations, codes, and standards – the NOU covers this as part of the 10 yearly PSR.
- Knowledge obsolescence (i.e., matters relating to knowledge management and human resources) – the NOU covers this as part of the knowledge management programme.
- Physical ageing – the NOU covers this under its Ageing Management Standard.
- Tools and test benches that are utilised as part of a maintenance, test or monitoring process – the NOU covers this under [29] 'KAA-679 - Control and operation of the measuring and test equipment at KNPS'

### 3.2 Preventive actions to minimise and control obsolescence

A manufacturer's production lines are not, in general, within the NOUs control and thus preventive actions to minimise and control what reference equipment the manufacturers determine to be obsolete are generally not practical to implement. However, the NOU can implement preventive actions to minimise and control reactive obsolescence (i.e., the equipment it finds to be obsolete when there is already plant demand for it) by biasing the TOP to look at proactive obsolescence.

Actions include identifying equipment that has become obsolete before its lack of availability impacts plant reliability (process step 4 of Appendix A). Early warning tracking/precursors to obsolescence, such as significant increases in prices or lead times are typically used for this. Using this or similar data, buyers are able to identify equipment that is being bid at a purchase price significantly higher than the average unit price and/or equipment for which the quoted lead time is significantly longer than the average lead time in the system.

### 3.3 Detection of obsolescence effects

The NOU detects obsolescence effects via Condition Reports on DevonWay as per the CAP process. Additionally, the obsolescence status of equipment within the scope of this programme should be determined to pre-empt future lack of spares.

In order to determine obsolescence status, the equipment covered by this programme's scope first needs to be identified; that equipment then processed to determine its obsolescence status; the status captured on the plant information systems and; relevant station processes updated to facilitate the collection of this information. These four activities are detailed below.

#### 3.3.1 Collect equipment data

In line with process step 1 of Appendix A, the TOP owner should generate a list of equipment that is deemed to be within the scope of the programme.

The TOP takes credit for the work done by the SALTO Assessment Project which identified items (i.e., equipment/reference equipment linked to Functional Locations) on plant that are important to safety. The NOU manages the data from the SALTO Assessment Project with the Condition Orientated ageing Management System (COMSY). In order to determine equipment's obsolescence status, the TOP requires additional information , including:

- Original Equipment Manufacturer (OEM)
- Original Equipment Supplier (OES) – if different from OEM
- Model, part number, or serial number
- Any other data relevant to the equipment such as specification documents, maintenance manuals, etc.

The aforementioned data is obtained via software queries of plant information systems (SAP, Specifications, Maintenance Manuals, DSEs, IQReview, maintenance spares lists, etc.). Data will be collected in a graded approach.

The NOU should perform a data clean-up effort to identify/correct missing/inaccurate information, including:

- Validating equipment manufacturer and model data from plant documentation.
- Cleaning up the data by cross referencing between databases.
- Physical walk-down of the equipment.

If the NOU identifies discrepancies between existing data sources, it should raise corrective actions to update the information system.

Once the NOU gathers all the minimum required information, it should determine the vendor support for the reference equipment.

### 3.3.2 Determination of Vendor Support for equipment

Once the NOU has collected all the prerequisite information, it should determine if the original manufacturer still supports the product by providing replacement equipment [9]. If not, it has to be confirmed that the responsibility has not been transferred to another vendor.

There are at least six routes that the NOU can use to determine the vendor support for equipment.

1. Obsolescence Management Service

   This requires a contract to be placed to secure the services of an external vendor who will facilitate the proactive determination of the obsolescence status of equipment on behalf of the NOU. The contractor will be expected to periodically contact all vendors in order to pre-empt the identification of obsolete equipment – this process will be done perpetually. This contract will also cover the facilitation of obsolescence prioritisation and solution development.

2. EDF information exchange

   Through benchmarking and the use of partnering agreements between Eskom and Électricité de France (EDF).

   EDF uses the following strategies to manage obsolescence:

   - Protocol/Pérennité Contracts

   To ensure the availability and operation of the stations for their intended life, EDF entered into long term agreements with major vendors.

   The suppliers guarantee EDF of the

   - Maintenance interventions on site,
   - technical assistance,
   - supply and repair of the equipment and/or spares for the duration of the contract,
   - Training
   - Obsolescence management

   The agreement between EDF and a supplier is governed by a co-operation (protocol) contract. The validity of which, for example, is for 25 years and renewable 10 yearly.

   To govern the practical aspects of each activity of partnership, the protocol contract is complemented by specific operational contracts referred to as “contrats applicatifs”. The IA/CA study the solution in terms of Form, Fit and Function and agrees or disagrees with the manufacturer solution:

   - If agreed, EDF instructs the manufacturer to treat as suggested, otherwise
   - Propose another solution or instruct manufacturer to research other solutions

   - Task Force

   All the equipment not covered by Pérennité contracts are dealt with under the Obsolescence Task Force. The Task Force is co-ordinated by the Obsolescence Group. The Obsolescence Group itself does not solve any obsolescence issues but rather

mobilises the engineering teams to solve the problems. The main purpose of the Task Force is to analyse and propose solutions to the obsolescence problems identified as important and urgent by the nuclear stations. There are various task force teams according to the disciplines: Task Force Instrumentation, Task Force Electrical, etc.

3. Existing Eskom obsolescence contracts with OEM/OES

   This is the contractual soliciting of obsolescence information directly from OEMs/OESs, either by way of efficiently making use of clauses in existing contracts or setting up new supply contracts. The supplier should proactively alert the NOU when equipment that they supply is obsolete. This will lead to faster procurement times, reduce the in-storage stock, maximise shelf life, reduce the maintenance burden of the in stores stock, and align with Just In time (JIT) philosophy for outages and periodic maintenance. Such information is generally of a high quality as it comes directly from the source. Another approach is to set up contracts for a given period where the contract establishment gives the NOU the assurance that the equipment will be available for that timeframe. Generally, OEMs have the sole source for the equipment but procurement has to test the whole market if this documentation is not available and that is a cumbersome and often difficult process.

4. NOU internal feedback

   Internal feedback relating to obsolescence is obtained from the following sources:

   - Life of Plant Plans (LOPPs).
   - System, Programme, and/or Component health reports and assessments.
   - Engineering or Maintenance personnel from interaction with manufacturers.
   - Proactive vulnerability reviews (targeted reviews of plant equipment to identify obsolescence problems in advance through equipment failure or the daily procurement process).
   - Supply chain/procurement process, following an unsuccessful sourcing of spares.
   - Plant personnel who identify issues during daily plant activities; and
   - Reduced spare inventory.

5. External feedback

   - Interaction with industry groups and committees.
   - Information from other plants.
   - Bulletins, notifications, and communications from OEMs/OESs.
   - Supplier contact reviews.

6. Proactive vulnerability reviews

   - Proactive vulnerability reviews (targeted reviews of plant equipment to identify obsolescence problems in advance of discovery through equipment failure or through the daily procurement process).

All information gathered should be centrally and securely stored such that the NOU has access to it. This is described next.

### 3.3.3 Updating of Obsolete equipment/issues in Plant Information Systems

Success of the TOP is largely dependent on the good management of data and the NOU and should therefore input and maintain obsolescence related information on the plant information

systems as per process step 3 in Appendix A. The NOU should strive to keep this data CARAT (Complete, Accurate, Relevant, Accessible and Timely).

Examples of information that needs to be input and maintained includes the raising of identified obsolescence issues on DevonWay and flagging confirmed obsolete reference equipment on SAP. This should be done via the relevant processes and workflows for each of the information systems. Where the processes do not cater for the obsolescence workflows, the existing processes should be enhanced as per § 3.3.4. Batch uploading/updating is done with the support of IT.

### 3.3.4 Enhanced Processes to Incorporate Obsolescence

All plant organisation involved with the TOP should enhance their existing work processes (or create new ones) to incorporate relevant obsolescence workflows into their business. This should be done via a change management plan where processes are identified, and the changes actioned.

Robust integration of obsolescence processes enables plant organisation to flag or elevate the importance of known obsolescence issues so that they will be prioritised accordingly. This is based directly on [9] and is shown in process step 5 of Appendix A. Existing work processes can be enhanced when obsolescence information is readily available to plant organisations and workers (§ 3.3.3). Similar to the way in which the supply chain might identify equipment that has increased in price or lead time (§ 3.2), each plant organisation involved in the TOP can identify opportunities to feed obsolescence information back to the TOP.

For example, if maintenance is aware that the equipment that they are assigned to work on is obsolete, processes can be adjusted accordingly. The fact that the equipment is obsolete can be included in the pre-job briefing. Work Management can include prompts for the maintenance personnel to assess the condition of the equipment and provide an estimate of remaining life in a post-job briefing. In addition, if maintenance personnel are aware that a replacement might be difficult to obtain and that the equipment is obsolete, this can be considered in the maintenance approach to minimise the work impact on the equipment.

## 3.4 Monitoring and Trending of Obsolescence Effects

The NOU should compile, measure and trend Key Performance Indicators (KPIs) for the TOP. Ultimately, the unavailability of spares for equipment due to obsolescence (i.e., the effect of obsolescence) is the KPI that measures the functioning of the TOP but finer-grain KPIs are needed to capture the programme details with sufficient resolution.

Examples of KPIs to be considered include:

- Number of INPO and regulatory issues.
- Number of deferred or late PM work orders due to obsolescence.
- Amount of expediting costs due to obsolescence issues.
- Number of proactive resolutions of known obsolescence issues.
- Number of instances of power reduction due to obsolescence issues.
- Having the needed replacement equipment when you need it.
- Request for resolution backlog.
- Operations focus index.
- Support equipment reliability programme.

- Number of critical components that fail without a replacement available.
- Number of priority obsolete equipment in the backlog.
- Number of days priority equipment has existed in the backlog.
- Percentage of reference equipment with incomplete data.
- Number of reactive obsolescence incidents per year during operation/outage.
- Total number of plant systems or components queries received.
- System health issues due to obsolescence.
- The size of the backlog.
- Average closure time, i.e., the time between obsolete equipment identification and positive evidence of a solution.
- Preventive Maintenance deferrals (Cancelled or deferred maintenance activities due to obsolescence).
- Number of temporary modifications (or non-conformity) in order to solve obsolescence problems; and
- Long lead times and high price.
- Percentage of obsolete components;
- Percentage of unidentified components;
- Percentage of components with incomplete data;
- Number of reactive obsolescence incidents per year during operation/ outage;
- Total number of plant systems or components reviewed or un-reviewed (proactive approach);
- Number of priority obsolete components in the backlog of obsolescence issues;
- Number of days priority components have existed in the backlog;
- Generation loss due to obsolescence;
- Cancelled or deferred maintenance activities due to obsolescence;
- Number of temporary modifications (or non-conformity) undertaken in order to solve obsolescence problems;
- Number of days to implement a solution for an obsolete component.

In addition to the above, other KPIs would address critical component and SPV exposure, monitoring the total number of unidentifiable pieces of equipment (equipment for which the OEM or OES cannot be determined) and the number of pieces of equipment for which no solution exist. KPIs would be periodically benchmarked against industry best practices.

The OSC should trend KPIs. Figure 3 illustrates an example KPI that could monitor the percentage or total quantity of unknown equipment IDs and stock codes (for example, catalogue IDs, material numbers) for which actual manufacturer and model or part number information is not available, resulting in the inability to determine the obsolescence status for these equipment IDs and stock codes. The percentage of unknowns should decrease over time.

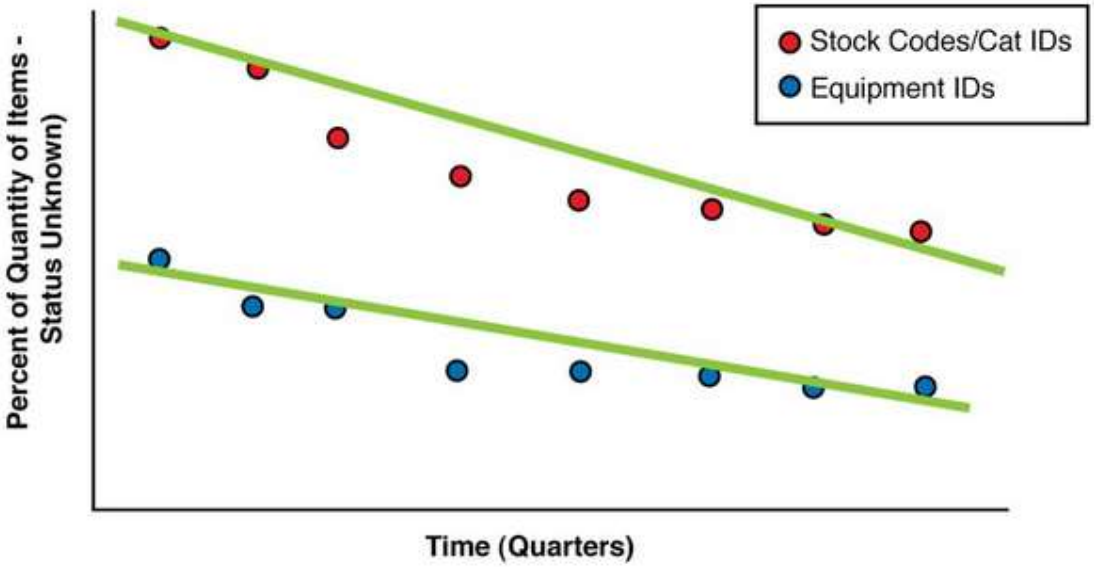


**Figure 3: Percentage of unknown equipment and stock codes [9]**

Figure 4 illustrates an example KPI that could monitor the percentage of obsolete stock codes for inventory that remains on hand, no inventory, and inventory that has a known solution. Over time, the percentage of obsolete stock codes for inventory that remains on hand will likely decrease and the percentage of stock codes for inventory with known solutions should gradually increase.

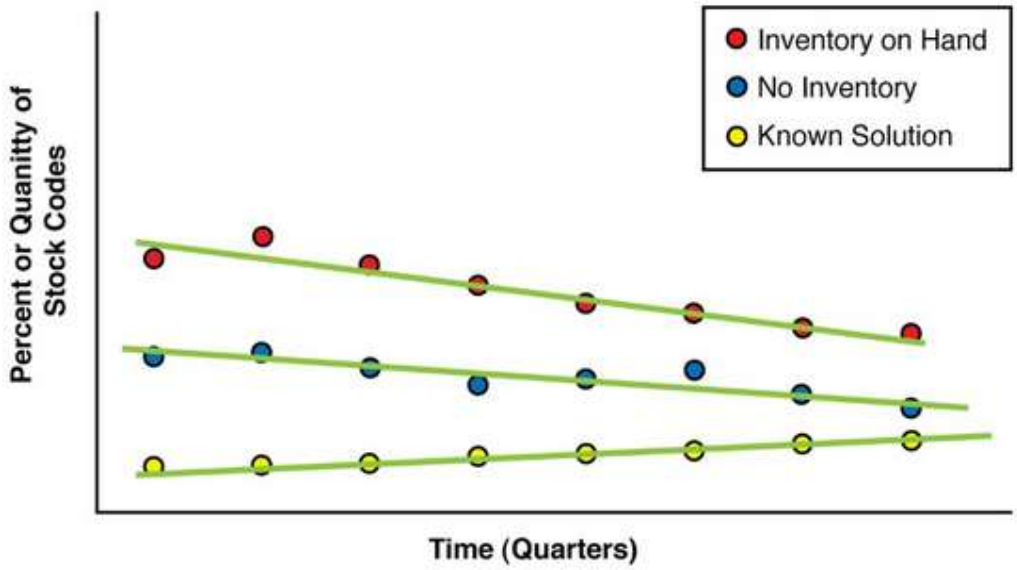


**Figure 4: Overall availability of solutions for Obsolete Equipment [9]**

Obsolescence can also be incorporated as a parameter of system health. If a system has many outstanding obsolescence issues that could impact the reliability of the system, the health report reflects the increased risk due to obsolescence.

The OSC should also compile reports for the KPIs and status of the TOP. The following example performance indicators shown in Table 2 and Table 3 are taken directly from [9] and are provided as an example how KPIs may be reported.

**Table 2: Example [9] of legend for TOP KPIs table**

| Colour | Performance | Score | Action |
|---|---|---|---|
| Green | Excellent | ≤9 | Requires no additional attention at this time |
| White | Acceptable | 10-12 | Current performance and /or activities are acceptable |
| Yellow | Needs improvement | 13-15 | Needs additional attention |
| Red | Not acceptable | >16 | Risks high and/or requires excessive resources to maintain |

**Table 3: Example [9] of KPIs for Obsolescence Programmes**

| Category | Green | White | Yellow | Red |
|---|---|---|---|---|
| Possible points score | 0 | 1 | 2 | 3 |
| INPO and regulatory health obsolescence process | No open issues, violations, or findings | One violation or INPO AFI with an approved action plan in place | N/A | ≥ One violation or INPO AFI with no action plan in place |
| Obsolescence programmatic health | 0 Investigation request (IR) written against programmatic obsolescence issues | 1 IR written against programmatic obsolescence issues | 2 IRs written against programmatic obsolescence issues | >2 IRs written against programmatic obsolescence issues |
| Corporate self-assessments (Performed annually) | Corporate self-assessment performed annually with ≤6 open items | Corporate self-assessment performed annually with 7–12 open items | Corporate self-assessment performed annually with ≥13 open items | Corporate self-assessment not performed annually |
| System health report obsolescence ratings Measuring health of obsolescence in systems using the Ship reports. | ≤ 10 system health monitoring report with rating yellow or red ratings | 11–20 system health monitoring report with rating yellow or red ratings | 21–25 system health monitoring report with rating yellow or red ratings | ≥26 system health monitoring report with rating yellow or red ratings |
| Operator Workaround due to obsolescence | 0 | 1 | 2 | 3 |
| Number of elective orders on obsolete equipment | 25 | 50 | 75 | 100 |

| Category | Green | White | Yellow | Red |
|---|---|---|---|---|
| Number of obsolete orders rescheduled between T5 and T0 average over the last 3 months (work week stability) | 0 | 1 | 2 | 3 |
| Number of corrective orders on obsolete equipment | 0 | 1 | 2 | 3 |
| Number of critical component PMs closed deep in grace (>50% grace) over the past month on obsolete equipment | <2% | <4% | <6% | <8% |
| Deferred/late preventive maintenance (PM), due to obsolescence | 0 | 1 PM missing critical dates | 2 PMs missing critical dates | ≥ 3 PMs missing critical dates |
| Expediting cost of procured items/services due to obsolescence issues (includes expediting across fleet plants) | ≤ $5k | <$15k | <$25k | >$35k |
| Age of site Top-10 obsolete list items | 0–5 items Greater than 1 year old online and 2 yrs. outage | 6–7 items Greater than 1 year old online and 2 yrs. outage | 8–9 items Greater than 1 year old online and 2 yrs. outage | 10 or more items Greater than 1 year old online and 2 yrs. outage |
| Number of proactive resolved issues out of the number of critical top 10 open items | ≥ 2 (different critical manufacturer model number) out of the [number of critical open items] | 1 (different critical manufacturer model number) out of the [number of critical open items] | N/A | 0 |
| 13-week template impacted due to obsolescence | 0 or 1 work items impacted due to reactive obsolescence | 2 work items impacted due to reactive obsolescence | 3 work items impacted due to reactive obsolescence | ≥ 4 work items impacted due to reactive obsolescence |
| | | | | Total Score |

### 3.5 Mitigating Obsolescence Effects

To mitigate a lack of available spares of equipment for maintenance (due to confirmed obsolescence) an interim strategy (i.e., obsolescence bridging strategy) should be devised and implemented as far as is practical until a final solution (obsolescence elimination strategy), § 3.7, is implemented. This is done to mitigate the interim risk to the organisation, particularly when there is a long lead time for solution implementation. An extent of condition analysis should also be done.

The following are considerations for mitigation strategies:

- Increased maintenance and/or improving maintenance to allow the lifetime extension of obsolete equipment.
- Performance monitoring.
- Enhancing the spares stock based on experience of spares consumption in the early stages itself.
- Sharing information and solutions with other plants can lead to actions to mitigate the effects.
- Improving engineering support to analyse if a substitute can be applied.
- The correct analyses regarding spare parts and stock levels mitigate the obsolescence issue. When possible, advanced procurement process can ensure operation for extended periods despite obsolescence issues.
- Keeping a database with information about which, where and how many parts are obsolete. It must be constantly updated.
- Using standard equipment rather than customised or unique designs.
- Identifying key components which are likely to become obsolete before the end of SSC lifetime and procurement of sufficient spare parts.
- Keeping sufficient capacity to accommodate future need.
- Getting access to the OEM specifications and procedures.

### 3.6 Acceptance criteria

The NOU should develop acceptance criteria against which the need for corrective action is evaluated. Criteria include:

- The Original Equipment Manufacturer (OEM) / Original Equipment Supplier (OES) of the equipment no longer exists, and there is no alternative new manufacturer because of mergers or take-overs nor any new representative/agent of the manufacturer.
- The OEM/OES formally informs Eskom that they will no longer manufacture, support and supply the equipment that meets the original specifications and classification and confirms the following:
    - There is no spare equipment in stock for the remaining life of the plant, and/or such spares can no longer be procured.
    - They will no longer guarantee or commit to repair the equipment or any sub-component thereof.
    - They will no longer guarantee or commit to supply skills and expertise to support the equipment.

- The OEM/OES may commit to continue its support of equipment which they have declared obsolete, but at a cost higher than replacing the equipment with a new one.

- The OEM/OES no longer provides the model with adequate qualification documentation.
- The OEM/OES changes only the model or commercial denomination of equipment.

If equipment is no longer deemed to meet the acceptance criteria and is therefore deemed to be obsolete, corrective actions are to be devised and implemented. This is detailed next.

### 3.7 Corrective actions

This section describes what needs to be done if equipment fails to meet the acceptance criteria detailed in § 3.6. This is divided into two sections, the prioritisation of issues so that it is managed in a graded approach and the solutions themselves.

Reported obsolescence issues and events that do not meet acceptance criteria will be entered into the corrective action process in line with KAA-688, “The Corrective Action Process” [29].

#### 3.7.1 Prioritisation of Obsolescence

The NOU should prioritise based on the nuclear safety and criticality significance of the obsolete equipment (i.e., its impact on the plant safety) [12], and refine this further with subsequent suitable criteria.

Several factors should be considered and can be arranged into the following categories:

- Importance of the equipment to the plant, including classifications such as:
  - Equipment Reliability classification
  - Safety classifications
  - Procurement quality classification
  - Environmental qualification
  - Seismic qualification
  - Fire protection
  - In-service inspection and testing requirements
  - Probabilistic risk analysis (done by PSA) classification
  - ASME Section XI considerations
  - Redundancy configuration of the equipment
  - Precursors to obsolescence
- Plant demand for equipment, including considerations such as:
  - Consumable history
  - Work order information
  - Future demand
  - Historical lead times
  - Failure rate (history) of equipment

- Reliability of the equipment
- System/Component health
- Stock history
- Number of identical equipment in operation in the plant
- Maximum and minimum stock revision
- Upcoming demand for maintenance

- Spare equipment availability in the stores, including considerations such as:
  - Current inventory levels in the warehouse
  - Final stock remaining with the manufacturer
  - Ageing of equipment in stock
  - Uncertainty (spare parts with insufficient data)
  - Availability of an existing solution

These can be entered into a weighted prioritisation algorithm/matrix, the output of which will be a prioritisation score upon which other obsolete equipment can be ranked. The prioritisation scheme changes over time as the programme matures to incorporate lessons learned [27]. As of the authorisation of this document, the NOUs prioritisation matrix is that seen in Table 4.

**Table 4: NOU obsolescence prioritisation matrix**

| Parameter | Parameter weight (must total to 100%) | Points Associated with Parameter | | | | |
|---|---|---|---|---|---|---|
| | | 1 Point | 2 Points | 3 Points | 4 Points | 5 Points |
| Safety Classification | 20% | 1, 1E | 2 | 3 | | LS/NSF |
| Seismic Classification | 5% | 1A/1 | 1P | ND | | NC |
| Quality Level | 5% | Q1 | Q2 | Q3 | Q4 | NQL/Q5 |
| Environmental Category | 10% | 4 | 3 | 2 | 1 | 0 |
| Importance Category | 20% | CSR | SR | DER | AR | NSA |
| In TOP scope? | 40% | In | | | | Out |

One effective way to identify and manage obsolescence issues is to periodically publish the Top 10 list.

If the component/system is in service and working, a risk of failure assessment may be deemed necessary and should consider [27]:

- Critical component analysis.
- Risk of trip.
- Operability and availability.
- Historical data.

- Mitigation against failure i.e., increased maintenance, performance monitoring, etc.

Note: The TOP should group related obsolete equipment into *obsolescence issues* to facilitate processing.

### 3.7.2 Development and Implementation of Solutions

Once the NOU has determined which obsolescence issues take priority, the organisation should develop and implement solutions in an effective and timely manner.

Figure 5 was developed by EPRI [8] and captures a suite of obsolescence solutions typically available. One of the first aspects to be considered when developing a solution is to determine whether the obsolete equipment will be replaced in its entirety or repaired. The next step is to determine whether the required replacement component or part is available, or if an alternative item must be evaluated to determine its suitability.

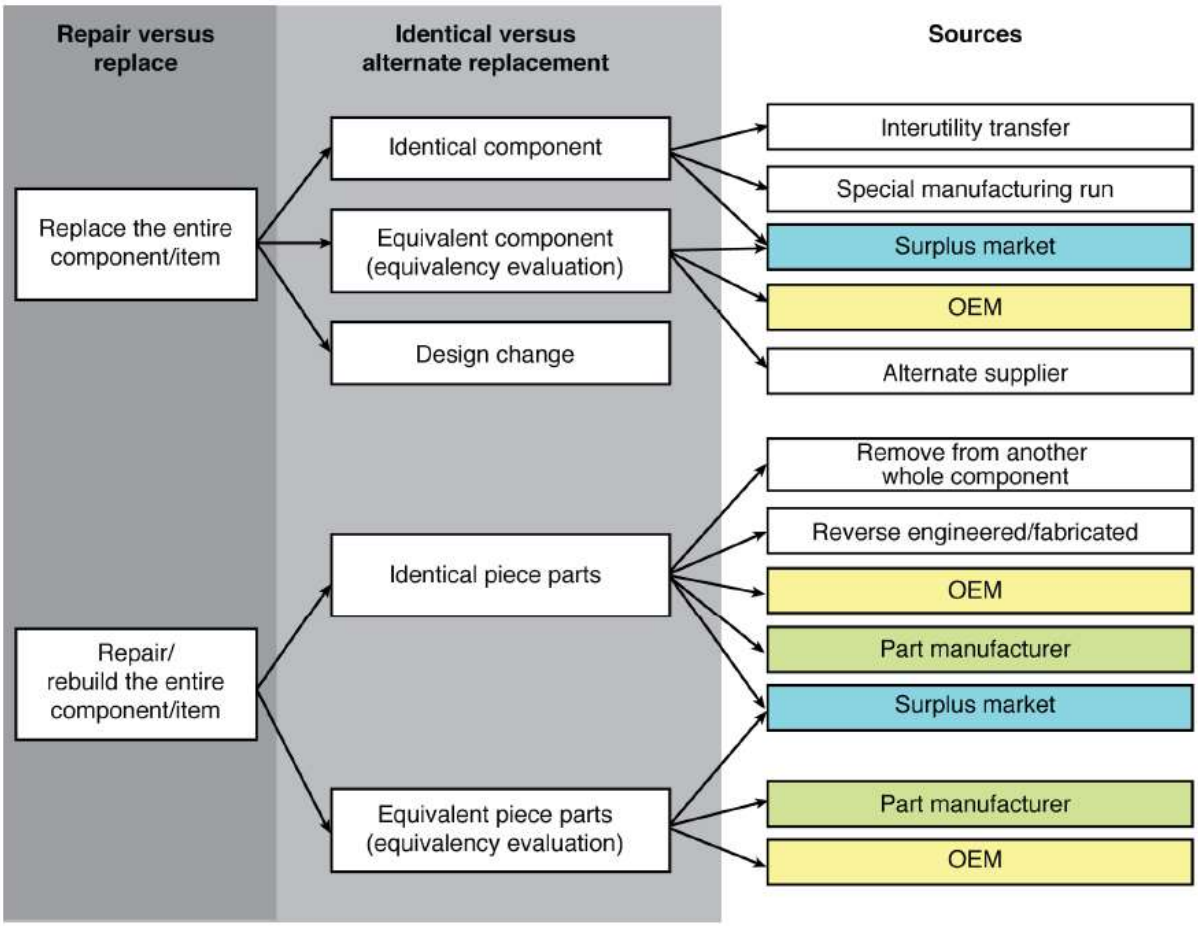


**Figure 5: Obsolescence solutions and options [8]**

It is the work of the OWG to study which solution would be best suited. Based on available response time, the least expensive solutions can be researched, and a parallel path approach can be taken until the issue is resolved [27]. The assigned lead researches and identifies one or several possible solutions and strategies to technically resolve the obsolescence issue. The solution paths are next listed in priority order, from the least to most complex.

**Surplus market**

Though the original equipment manufacturer no longer manufactures a piece of equipment, inventories of the equipment may exist, and the equipment may be available for purchase. There are suppliers who specialise in the purchase and resale of discontinued products or other power plants that have excess inventory. This is the least challenging solution as it provides identical components or parts to be procured to resolve the obsolescence issue. Actions that can be taken include:

- Stock piling “last buy order” until end of life or until a new technical solution.
- Contractor reparation to extend the operating life of the equipment.
- Sustainable long-term contract entered etc.

This would typically be done by Procurement as per 32-1034 “Eskom Procurement and Supply Chain Management Procedure” [14]

**Special Manufacturing Run**

Original equipment manufacturers are sometimes willing to manufacture the obsolete equipment for a specific quantity in order to provide a life-of-plant inventory of the obsolete equipment. By purchasing components manufactured to the original drawings and designs, the use of special manufacturing runs may provide the best economic impact, particularly when optimising the lot size by making life-of-the plant purchases. This would typically be done by Procurement. 32-1034 - Eskom Procurement and Supply Chain Management Procedure [14]

**Substitution/Equivalent Replacement**

Another equipment is identified as a replacement for the equipment no longer available and an engineering analysis is performed to validate the interchangeability and impact to system performance for the replacement. Requirements described in 331-144 “Standard for Performing an Equivalency Study” and 331-143 “The Equivalency Process to Change Plant” shall be followed. This would typically be done by Specification Engineering

**Rebuild/Repair**

Some equipment can be placed on a long-term service contract with a supplier or manufacturer that has the capability to provide spare parts to rebuild or repair equipment as necessary. When equipment replacement is not a viable option, some equipment lends itself to inclusion in a rebuild or repair programme. This may be a good strategy for both electrical and mechanical components, depending on the availability of repair parts and the condition of the equipment. Actions include:

- Rebuild or repair installed equipment,
- Organised recuperation of disposed equipment.

Maintenance Execution would typically be responsible for this and processes such as KAA-693 “Responsibilities for the in-house manufacture and repair of parts and components for Koeberg nuclear power station” used.

**Cannibalisation/Utilisation of Parts from Other Components/Systems**

Cannibalisation is a special case of the Rebuild/Repair option where in an emergency the site may obtain the required repair parts by scavenging from another component that is typically not operable. This solution effectively buys time until a long-term solution is found. The cannibalisation process is detailed in 240-163516799 [15].

**Reverse engineering**

This solution path is the process of developing product specifications sufficient to duplicate the equipment by reviewing technical information and conducting physical examinations of an original

specimen. Typically, a third-party supplier who is not the original equipment manufacturer performs this analysis and design with identical critical characteristics to re-manufacture the equipment. This process provides the preferred permanent solution when recurring needs are anticipated and typically requires only an equivalency evaluation. Reverse engineering is especially ideal for replacing parts of larger components as a cost-effective alternative to replacing an entire unit. Reverse engineering is also used as a basis for re-engineering, most commonly with complex electronic equipment. See KAA-738 “Management Review and approval of reverse engineering” [31] and “Guidance for the Use of Reverse-Engineering Techniques” [24]. This would typically be done by Design Engineering.

**Design change/modification**

This solution path refers to a plant modification to replace the equipment no longer available with different equipment. Requirements described in 331-83 “Standard for Plant Changes Affecting the Design of Koeberg Nuclear Power Station” and 331-86 “Design Changes to Plant, Plant Structures or Operating Parameters” to be followed, typically by Design Engineering.

**Commercial grade dedication**

Commercial Grade Dedication (CGD) is an acceptance process undertaken to provide reasonable assurance that a Commercial Grade item to be used as a basic (safety-related) component will perform its intended safety function. Generally, dedication is performed following guidelines established by the Electrical Power Research Institute (EPRI) and ASME NQA-1 requirements. The process begins with a “Technical Evaluation” and the selection of “Critical Characteristics”. Credible failure modes of the equipment in its operating environment and the effect of these failures on the safety function are considered in the technical evaluation and the selection of critical characteristics. The critical characteristics are then verified by one or a combination of the four industry accepted methods described in EPRI NP-5652, “Special Tests and Inspections.” For the most part, dedication is conducted in accordance with Method 1 of EPRI NP-5652 supplemented by method 2, “Commercial Grade Survey” of suppliers. When sampling is required for “Special Tests and Inspections”, EPRI document “TR-017218 R1, Guideline for Sampling in the Commercial-Grade Item Acceptance Process” is referenced. This would typically fall in the domain of Design Engineering.

The lead will also develop bridging strategies to mitigate the risk in the interim that the final solution is developed and deployed. The OWG will provide a proposal for available solutions, and this will be reviewed by the OSC. Once the OSC accepts the work, it will be presented to the PHC for acceptance and for the work to be done by the relevant organisation. Ad hoc dedicated teams can be formed to support in the development of the replacement solutions as directed by the PHC.

### 3.8 Operating experience feedback

The NOU should make use of mechanisms that ensure timely feedback of operating experience (both internal and external) and research and development results (if applicable). They should provide objective evidence that the aforementioned is taken into account in the TOP.

This should be done through procedure such as:

- 331-123, “Processing of Industry Operating Experience in Nuclear Engineering”, which describes the process and screening requirements that ensure that industry Operating Experience is incorporated into programme activities and is correctly addressed.
- KGA-035, “Processing of Experience Feedback received through the EDF Co-Operation Agreement”, defines how external operating experience information received from EDF and processed by the Koeberg Integrated Team.

### 3.9 Quality management

The NOU should periodically assess the effectiveness of the TOP in accordance with the Programme Engineer's Guide, 331-148 [20], and continuously seek to improve performance and efficiency.

Type of assessments may include:

- Quality Assurance department will perform audits on business areas within NOU to assess compliance to this procedure.
- The TOP will be reviewed as part of SF2 (Actual Plant Condition) and SF4 (Ageing) every PSR as per RG-0028.
- Periodic self-assessment in line with the Programme Engineers' Guide, 331-148 - following the process defined in KGA-053.

The following obsolescence questions should be considered when developing the programme self-assessment scope:

- Is there a TOP description or guideline describing implementation?
- Does it include roles and responsibilities?
- Is there a designated owner?
- Is there an obsolescence committee involving key departments such as Operating, Maintenance, Engineering and Procurement?
- Are obsolescence risk reviews performed to identify critical obsolescence issues?
- Are there tools/databases being utilised to support identification, prioritisation, and research of solution for obsolete components?
- Are there information exchanges or collaboration initiatives with other operating organisation?
- Do system and/or component health reports contain a section on obsolescence vulnerabilities?
- Are metrics used to monitor the programme and process health?
- Has the programme proactively resolved any obsolescence challenges?
- What lessons have been learned (what could have been done better) from the TOP development and implementation?
- How does the plant measure success? What are the key performance indicators?

The records generated from assessments shall be processed as per 238-6 Nuclear Document and Records Management Requirement", 331-3, "Nuclear Engineering Documentation and Records Management Work Instruction" and KAA-500' "The Process for Controlled Documents".

The requirements of RD-0034 shall be taken into account as per 331-2 and 240-89294359.

### 3.10 Training

Training on obsolescence should be conducted to educate personnel involved in understanding obsolescence management as well as on the use of tools (e.g., those provided by an obsolescence management service)..

## 4. Acceptance

This document has been seen and accepted by:

| Designation | Name |
|---|---|
| TOP Owner | |
| Backup TOP Owner | |
| MRG Manager | |
| Programme Owner | |
| Programme Owner | |
| Programme Owner | |

## 5. Revisions

| Date | Rev. | Compiler(s) | Remarks |
|---|---|---|---|
| July 2023 | 4 | | Periodic review |
| June 2020 | 3 | | Addressing of comments made by the NNR and incorp sons learned since previous revision. |
| July 2019 | 2 | | Reviewed to align with requirements as set out in RG-0027 and SSG o provide more details on the |
| August 2017 | 1 | | Full Review to align with the IAEA Proactive Obsolesce elines TOP 401 (Technological P). |
| June 2014 | 0 | | Full Review Of TOP.<br>Reference Number change from KAA-813 to 331-146 as per 331-3 (NE Documentation and Records Management Work Instruction) |

## 6. Development Team

nior Engineer: Materials Reliability Group)

(Programme Engineer: Materials Reliability Group)

## Appendix A: Simplified Implementation Process

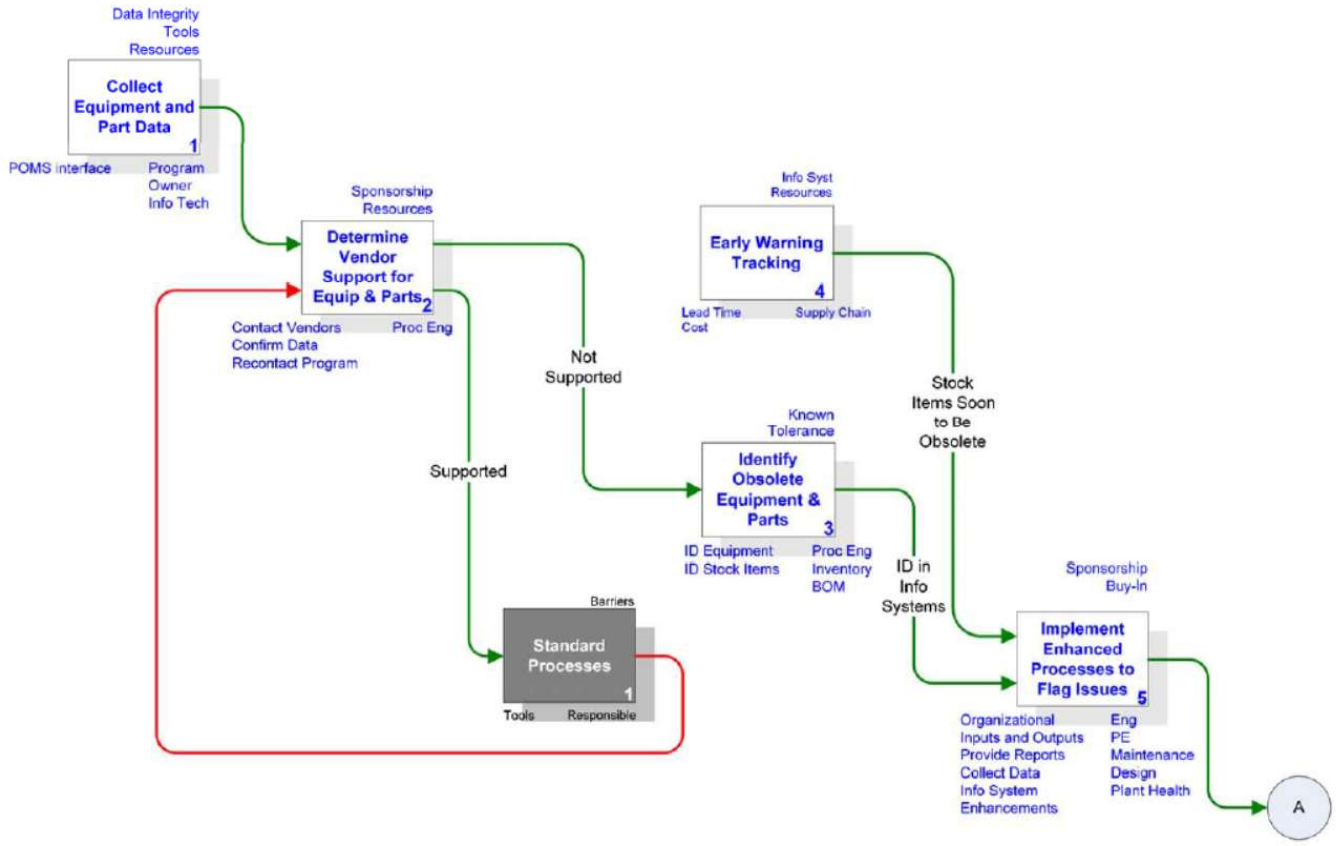


**Figure 6: TOP implementation process map, 1 of 2 [9].**

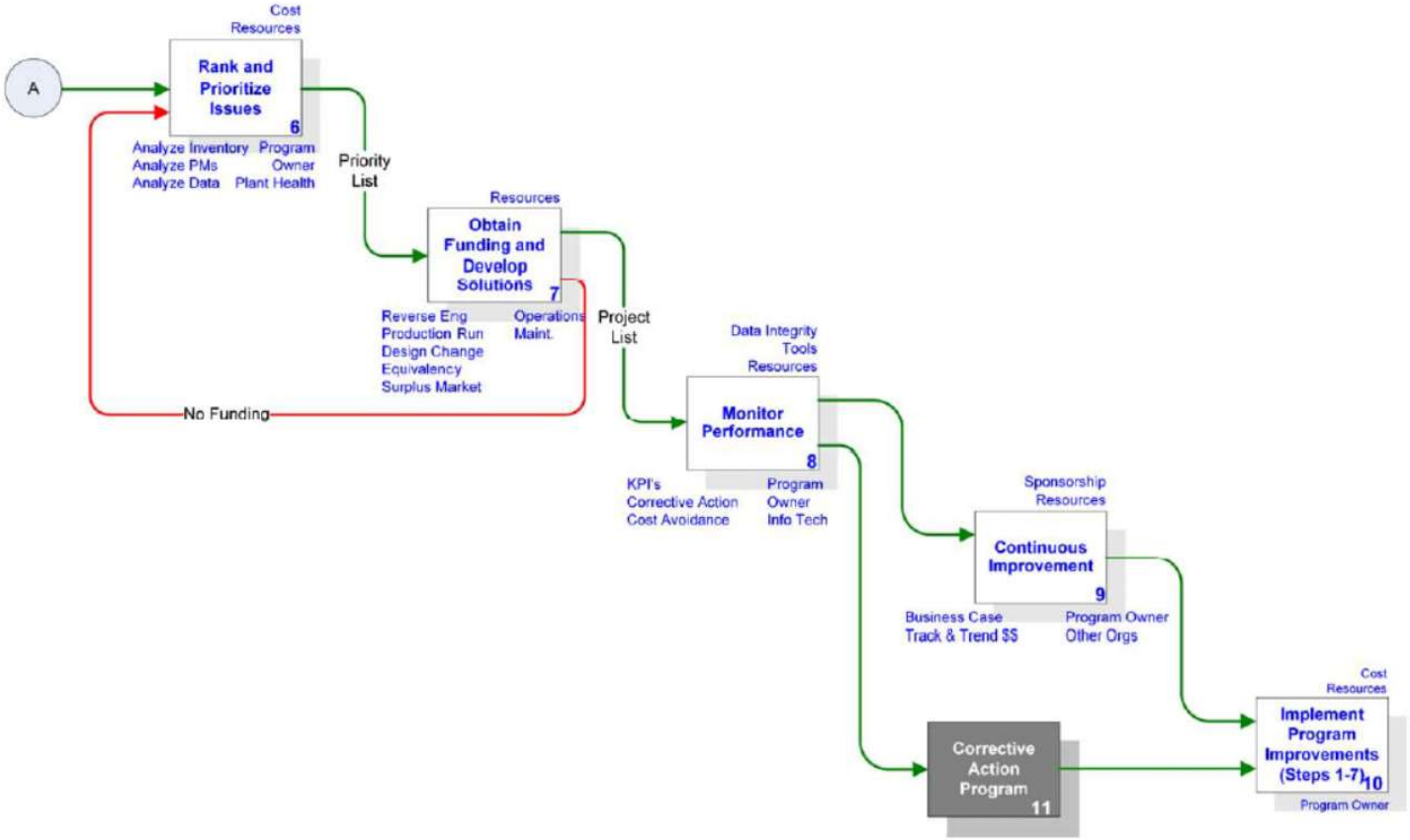


**Figure 7: TOP implementation process map, 2 of 2 [9].**

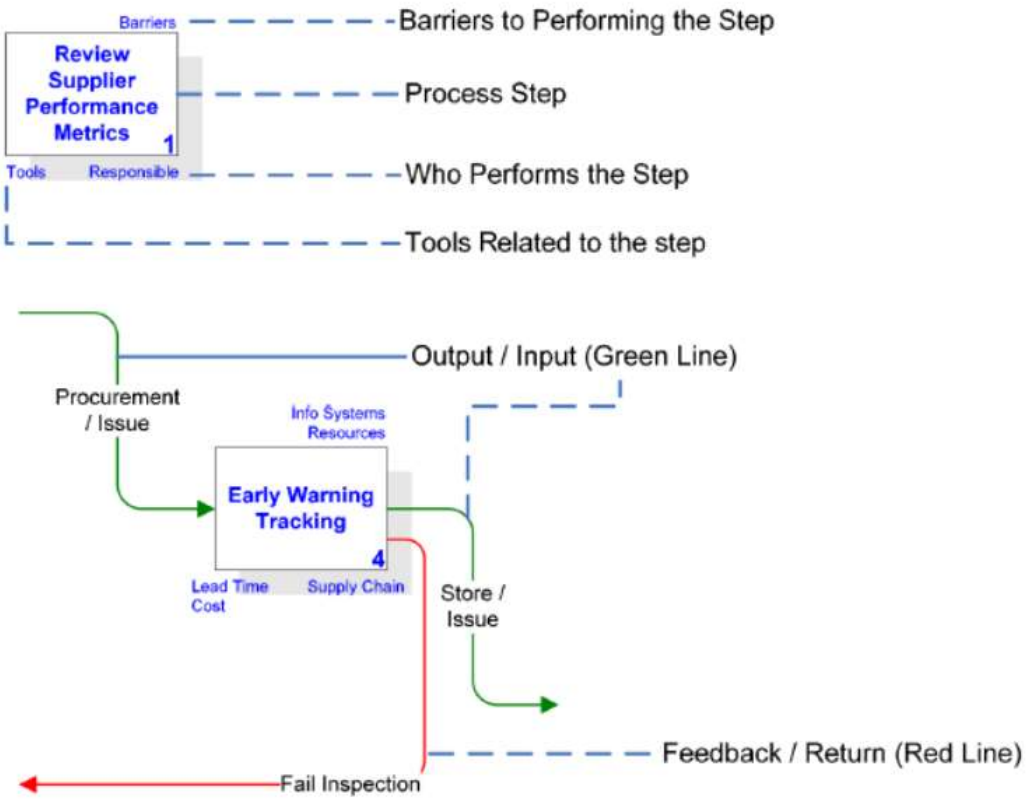


**Figure 8: Process Map Legend [9] for Figure 6 and Figure 7.**