|  |
| --- |
|  |
| ONR Technical Assessment Guide  Asset management |



ONR Technical Assessment Guide (TAG)

Asset management

**Head of Profession**: Mechanical Engineering and Structural Integrity specialism

**Authored by**: Nuclear Safety Inspector (MESI)

**Approved by**: Deputy Head of Profession - Mechanical Engineering and Structural Integrity

**Issue**: 2.2

**Published**: October 2024

**Next scheduled review**: October 2029

**Document reference**: NS-TAST-GD-098

**Record reference**: 2020/139061

Revision commentary

|  |  |
| --- | --- |
| Issue | Description of update(s) |
| 1 | Includes additional guidance on obsolescence, configuration management, ISO 55000 and environmental legislation.  Minor editorial changes. |
| 2 | Review period updated. |
| 2.1 | Minor update to remove extant URLs from the document to mitigate potential configuration control issues arising because of changes to third-party web domains. |
| 2.2 | Minor update to update review period, format of document, references and editorial changes throughout. |

Contents

[1. Introduction 4](#_Toc181609164)

[2. Purpose and scope 5](#_Toc181609165)

[3. Relationship to licence and other relevant legislation 7](#_Toc181609166)

[3.1. Licence conditions 7](#_Toc181609167)

[3.2. Environmental legislation 9](#_Toc181609168)

[4. Relationship to SAPs, WENRA Reference Levels, IAEA Safety Standards and other international standards 10](#_Toc181609169)

[4.1. SAPs 10](#_Toc181609170)

[4.2. WENRA Reference Levels 12](#_Toc181609171)

[4.3. IAEA Safety Standards 12](#_Toc181609172)

[4.4. International standards 13](#_Toc181609173)

[5. Advice to inspectors 14](#_Toc181609174)

[5.1. AM scope 15](#_Toc181609175)

[5.2. Policy 16](#_Toc181609176)

[5.3. Planning 17](#_Toc181609177)

[5.4. Implementation and operation 19](#_Toc181609178)

[5.5. Assurance 21](#_Toc181609179)

[5.6. Resourcing 23](#_Toc181609180)

[References 24](#_Toc181609181)

[Glossary 26](#_Toc181609182)

# Introduction

1. ONR has established its [Safety Assessment Principles](http://www.onr.org.uk/saps/saps2014.pdf) (SAPs) [1] which apply to the assessment by ONR specialist inspectors of safety cases for nuclear facilities that may be operated by potential licensees, existing licensees, or other dutyholders. The principles presented in the SAPs are supported by a suite of guides to further assist ONR’s inspectors in their technical assessment work in support of making regulatory judgements and decisions. This technical assessment guide (TAG) is one of these guides.
2. TAGs primarily provide guidance to ONR inspectors on the interpretation and application of the SAPs. They also contain guidance relevant to principles underlining the enforcement of licence condition compliance which supplements the technical inspection guides (TIGs). Thus, the TAGs have relevance to all inspectors within ONR, regardless of function. The guides also provide information to licensees regarding ONR’s expectations of the nature and content of relevant technical elements of licensees’ submissions.
3. Asset management has been identified by ONR as a key strategic factor to the safe and secure management of the UK’s new and existing nuclear infrastructure [2]. ONR considers asset management to be important for dutyholders in order to effectively manage all assets on a nuclear licensed site that have the ability to result in significant consequences to safety, security or the environment. ONR understands the need to support UK dutyholders in applying asset management effectively.
4. This guide sets out what ONR considers relevant good practice (RGP) taken from national and international guidance. This guidance may be used for assessment of activities and safety submissions such as: periodic reviews of safety cases, construction or installation of new plant, modification or experiment on existing plant or changes to examination, inspection, maintenance and testing.

# Purpose and scope

1. This guide presents additional information to support SAPs that relate to asset management. This guidance seeks to highlight the need to expand dutyholder’s thinking and planning to take account of whole-of-life risks in respect to physical assets. It sets out regulatory expectations beyond those covered by routine examination, inspection, maintenance and testing (EIM&T).
2. This guidance is underpinned by existing standards and relevant good practice, including the international standard for asset management,   
   ISO 55001 [3].
3. This guidance discusses issues ranging from initial design to decommissioning in order to drive proportionate consideration of long-term issues. These issues include supply-chain, contract management and diversity and control of spares. The guidance also considers the need for through-life asset management, comprising strategies, plans and programmes for effective delivery. These include consideration of preservation plans as well as pro-active replacement projects, supply chain needs and their associated funding requirements.
4. This TAG has been developed to provide guidance to inspectors on assessing the adequacy of dutyholder’s asset management arrangements, and how they are applied to ongoing safe design and operations of assets.
5. ONR recognises that asset management can apply to intangible assets such as knowledge and information, however for the purpose of this guidance, only physical assets are included. This guidance applies to all physical assets with the ability to impact on safety[[1]](#footnote-2) and security. This includes assets that, through their failure, may increase the frequency of demand placed on plant protection equipment. These may include active and passive assets, not explicitly discussed within the safety case. They may however hold the potential to degrade existing lines of protection.
6. In considering physical assets only, reference within the guide is focused exclusively on nuclear activities. It is, however, recognised that dutyholder’s decision making is multifaceted, taking account of many commercial factors of which safety and security are but two.
7. The term ‘asset management system’ (‘AMS’) applies to any arrangements used to control and manage tasks associated with delivery of asset management activities. This maybe a stand-alone, bespoke system or a process by which existing systems are utilised to deliver asset management objectives. Where the AMS is a standalone system, it should integrate with other systems such as risk management, investment planning and project delivery in order to deliver asset management objectives.
8. The guide contains additional advice to assist inspectors in applying their professional judgement and was developed in line with industry standards [4]. The guidance provides information to support regulatory decisions relating to assessment of licensees’ safety submissions. The guidance provides a summary of RGP [5] taken from national and international standards. ONR published guidance and commissioned research has also been included. Links back to the relevant source material are included throughout the guidance in IEEE format (for example, ‘[#]’).
9. The guide is applicable to all assets, new and existing. The guidance should be applied to all stages of an asset’s life-cycle, through the design, construction, commissioning, operation and decommissioning. Due to on-going development of safety standards, existing assets may not meet the expectations within the SAPs. Dutyholders should develop appropriate ‘as low as reasonably practicable’ (‘ALARP’) arguments to demonstrate safe design and operation of assets. Its arguments should take account of factors such as the age of the facility and projected lifetime, including decommissioning.
10. This guide considers the claims made on Identified Assets that have the potential to affect Safety, Security or Environmental (SSoE) functions.   
    These claims can be in respect to the support or delivery of SSoE functions through normal and fault conditions. The guide takes account of the changing modes of operation that a facility may undergo during its life-cycle.

# 

# Relationship to licence and other relevant legislation

## Licence conditions

1. Under the Nuclear Installations Act 1965, ONR is required to attach license conditions (LCs) to each nuclear site license [6]. ONR has developed a set of 36 standard LCs to attached to each nuclear site licence.   
   These conditions cover the facility lifecycle from design, construction, and operation through to decommissioning and include management oversight and reviews. They require licensees’ or dutyholders to implement arrangements to ensure compliance. The LCs considered applicable to this TAG are presented below.

* **LC 10 Training**: The licensee shall make and implement adequate arrangements for suitable training for those on site who have responsibility for and operations which may affect safety.
* **LC 11 Emergency Arrangements**: The licensee shall make and implement adequate arrangement for dealing with any accident or emergency arising on the site and their effects.
* **LC 12 Duly authorised and suitably qualified and experienced persons**: The licensee shall make and implement adequate arrangements to ensure that only suitably qualified and experienced persons perform any duties which may affect the safety of operations on the site, or any other duties assigned by or under these conditions or any arrangements required under these conditions.
* **LC 15 Periodic review**: The licensee shall make and implement adequate arrangements for the periodic and systematic review and reassessment of safety cases.
* **LC 17 Management Systems**: Without prejudice to any other requirements of the conditions attached to this licence, the licensee shall establish and implement management systems which give due priority to safety.
* **LC19 Construction or installation of new plant**: Where the licensee proposes to construct or install any new plant which may affect safety the licensee shall make and implement adequate arrangements to control the construction or installation.
* **LC 20 Modification to design of plant under construction**;   
  The licensee shall ensure that no modification to the design which may affect safety is made to any plant during the period of construction except in accordance with adequate arrangements made and implemented by the licensee for that purpose.
* **LC 22 Modification or experiment on existing plant**: The licensee shall make and implement adequate arrangements to control any modification or experiment carried out on any part of the existing plant or processes which may affect safety.
* **LC 23 Operating rules**: The licensee shall, in respect of any operation that may affect safety, produce an adequate safety case to demonstrate the safety of that operation and to identify the conditions and limits necessary in the interests of safety. Such conditions and limits shall hereinafter be referred to as operating rules.
* **LC 24 Operating Instructions**: The licensee shall ensure that all operations which may affect safety are carried out in accordance with written instructions hereinafter referred to as operating instructions.
* **LC 25 Operational records**: The licensee shall ensure that adequate records are made of the operation, inspection and maintenance of any plant which may affect safety.
* **LC 27 Safety mechanisms, devices and circuits**: The licensee shall ensure that adequate records are made of the operation, inspection and maintenance of any plant which may affect safety.
* **LC 28 Examination, inspection, maintenance and testing**:   
  The licensee shall ensure that adequate records are made of the operation, inspection and maintenance of any plant which may affect safety.
* **LC 34 Leakage and escape of radioactive material and radioactive waste:** The licensee shall ensure, so far as is reasonably practicable, that radioactive material and radioactive waste on the site is at all times adequately controlled or contained so that it cannot leak or otherwise escape from such control or containment.
* **LC 35 Decommissioning:** The licensee shall make and implement adequate arrangements for the decommissioning of any plant or process which may affect safety.
* **LC36 Organisational capability:** The licensee shall provide and maintain adequate financial and human resources to ensure the safe operation of the licensed site.

## Environmental legislation

1. Under the Environment Act 1995 and The Environmental Permitting Regulations 2016, nuclear sites in England and Wales require an environmental permit. Similarly, nuclear sites in Scotland require an environmental permit under The Environmental Authorisations (Scotland) Regulations 2018. Environmental permits require the application of Best Available Techniques (BAT) (or Best Practicable Means (BPM) in Scotland), and that equipment meeting certain conditions of the permit be maintained in a good state of repair.

# 

# Relationship to SAPs, WENRA Reference Levels, IAEA Safety Standards and other international standards

## SAPs

1. The SAPs directly addressed by this TAG are:

* SC.3 - For each lifecycle stage, control of the hazard should be demonstrated by a valid safety case that takes into account the implications from previous stages and for future stages.
* SC.7 - A safety case should be actively maintained throughout each of the lifecycle stages, and reviewed regularly.
* EKP.4 - The safety function(s) to be delivered within the facility should be identified by a structured analysis.
* ECS.3 - Structures, Systems or Components (SSCs) that are important to safety should be designed, manufactured, constructed, installed, commissioned, quality assured, maintained, tested and inspected to the appropriate codes and standards.
* ECS.5 - In the absence of applicable or relevant codes and standards, the results of experience, tests, analysis, or a combination thereof, should be applied to demonstrate that the structure, system or component will perform its safety function(s) to a level commensurate with its classification.
* ERL.1 - The reliability claimed for any SSC should take into account its novelty, experience relevant to its proposed environment, and uncertainties in operating and fault conditions, physical data and design methods.
* ERL.2 - The measures whereby the claimed reliability of systems and components will be achieved in practice should be stated.
* ERL.3 - Where reliable and rapid protective action is required, automatically initiated, engineered safety measures should be provided.
* ERL.4 - Where safety-related systems and/or other means are claimed to reduce the frequency of a fault sequence, the safety case should include a margin of conservatism to allow for uncertainties.
* EMT.1 - Safety requirements for in-service testing, inspection and other maintenance procedures and frequencies should be identified in the safety case.
* EMT.2 - SSCs should receive regular and systematic examination, inspection, maintenance and testing as defined in the safety case.
* EMT.3 - SSCs should be type tested before they are installed to conditions equal to, at least, the most onerous for which they are designed.
* EMT.4 - The continuing validity of equipment qualification of structures, systems and components should not be unacceptably degraded by any modification or by the carrying out of any maintenance, inspection or testing activity.
* EMT.5 - Commissioning and in-service inspection and test procedures should be adopted that ensure initial and continuing quality and reliability.
* EMT.6 - Provision should be made for testing, maintaining, monitoring and inspecting SSCs (including portable equipment) in service or at intervals throughout their life, commensurate with the reliability required of each item.
* EMT.7 - In-service functional testing of structures, systems and components should prove the complete system and the safety function of each functional group.
* EMT.8 - Structures, systems and components should be inspected and/or re-validated after any event that might have challenged their continuing reliability.
* EAD.1 - The safe working life of structures, systems and components that are important to safety should be evaluated and defined at the design stage.
* EAD.2 - Adequate margins should exist throughout the life of a facility to allow for the effects of materials ageing and degradation processes on structures, systems and components.
* EAD.3 - Where material properties could change with time and affect safety, provision should be made for periodic measurement of the properties.
* EAD.4 - Where parameters relevant to the design of plant could change with time and affect safety, provision should be made for their periodic measurement.
* EAD.5 - A process for reviewing the obsolescence of structures, systems and components important to safety should be in place.
* ENC.2 - The design of non-metallic components or structures should include the ability to examine the item through life for signs of degradation.
* ECE.3 - It should be demonstrated that structures important to safety are sufficiently free of defects so that their safety functions are not compromised, that identified defects can be tolerated, and that the existence of defects that could compromise safety functions can be established through their lifecycle.
* ECE.2 - For structures requiring the highest levels of reliability, multiple independent and diverse arguments should be provided in the safety case.
* DC.1 - Facilities should be designed and operated so that they can be safely decommissioned.

## WENRA Reference Levels

1. This TAG considers the Western European Nuclear Regulators’ Association(WENRA) for specific applicability. Whereas the WENRA Reactor Safety Reference Levels [7]are intended for existing reactors, the SAPs are intended for all existing and new nuclear assets. However, there is little difference between the general requirements of each. The WENRA and IAEA documents considered in this TAG are focused on nuclear reactor power plants. For this reason, they do not have the same breath of scope and intent of the SAPs and this TAG. Section 4 of ONRs TAG on ALARP identifies the WENRA Reference Levels as RGP for existing civil nuclear reactors [8].
2. WENRA Reference Level ‘I’ is dedicated to “Ageing Management”. It is considered within this TAG that ageing management is a sub-set within the broader scope of asset management. The main themes discussed within the ageing management reference levels, are encompassed by the asset management points in section ‎5 of this TAG.
3. WENRA Reference Level Issue ‘K’ is dedicated to “Maintenance, In-service inspection and Functional Testing”. The dutyholder shall prepare and implement documented programmes of maintenance, testing, surveillance, and inspection of SSCs important to safety to ensure that their availability, reliability, and functionality remain in accordance with the design over the lifetime of the asset.

## IAEA Safety Standards

1. There are several IAEA publications with direct relevance to asset management. The following documents are of particular note in respect to assessing licensees’ asset management arrangements.

* IAEA Safety Guide SSG-48 [4] - Provides recommendations on meeting the IAEA’s requirements for the management of the ageing of SSCs important to plant’s safety. It is intended for use by nuclear power plant operators establishing ageing management programmes and for regulators in setting standards and verifying that ageing is being effectively managed.
* IAEA Technical Report - Methodology for the Management of Ageing of Nuclear Power Plant Components Important to Safety [9].
* IAEA Nuclear Energy Series – Asset Management for Sustainable Nuclear Power Plant Operation [10]

1. This TAG has taken account of the above IAEA guidance which is reflected within the high-level asset management principles and the supporting detailed guidance.

## International standards

1. The following International Standards were included in the development of this TAG

* ISO 55000 [11] - This document specifies the overview, concepts and terminology in Asset Management.
* ISO 55001 [3] - This document defines the requirements for a "management system" for Asset Management.
* ISO 55002 [12] - This document provides interpretation and implementation guidance for such a management system.

1. ISO 55000 describes the benefits of asset management. This recognises that asset management can enable demonstration of compliance with legal and regulatory requirements. The guidance in ISO 55001 is grouped into key themes including organisational context, leadership, planning, support, operation, performance evaluation and improvement.

# 

# Advice to inspectors

1. Asset management is the through life approach to effectively manage risks that may challenge an identified asset’s capability to support or deliver a safety, security or environmental (SSoE) function.

* **Through life:** Management of Identified Assets should begin at the time of initial design. It should continue through to the final decommissioning of the facility. The IAEA ageing management guidance [4] breaks the facility lifecycle down into eight stages: design; fabrication and construction; commissioning; operation; long-term operation; suspended operation; and, decommissioning.
* **Effectively manage risks:** An appropriate risk-informed approach should be utilised to evaluate the importance of Identified Assets.   
  The approach should recognise and address the on-going ability to source replacement parts and services. It should recognise the reliance a facility places on Identified Assets, and how these may change with time. Early identification of Identified Asset allows their condition to be accurately tracked. This provides pro-active opportunities to identify long term resolution activities such as contract management, thus minimising future risks and resource demands.
* **Challenge:** Identified Assets that support or deliver SSoE functions should be identified with clear links back to any safety case reference. All reasonably foreseeable failure modes that can affect the Identified Asset’s capability to support or deliver an SSoE function should be identified. Appropriate activities should be put in place to monitor each Identified Asset’s condition and minimise potential impact.
* **SSoE function:** This guidance is written such that it may be applied universally across ONR and other regulatory bodies such as the EA. The guidance recognises that Identified Assets may be identified due to their requirement to support or deliver an SSoE function.

1. Asset management may also manage risks to an organisation’s product delivery. Whilst this is not strictly of regulatory interest, it can be used to influence improvements in asset management.
2. The Institute of Asset Management, and ISO 55000 define asset management as “the co-ordinated activity of an organisation to realise value from its assets.” In the context of this TAG, ‘value’ can be interpreted as delivering the SSoE function, at the required performance and reliability through life.
3. The advice in this guidance has been broken down into ten key ‘Asset Management’ (‘AM’) points. ONR considers these points to be fundamental to delivering an effective AMS.
4. A separate TAG has been produced to cover ageing and degradation management (NS-TAST-GD-109) [13]. This guide explains what ONR considers RGP when looking at ageing, degradation and obsolescence (A&D).
5. To understand the difference between asset management and aging management the IAEA definitions can be used. [10]

* ‘Asset management’ is defined as "coordinated activity of an organization to realize value from assets. Realisation of value will normally involve a balancing of costs, risks, opportunities and performance benefits".
* ‘Ageing management’ is defined as "engineering, operations and maintenance actions to control within acceptable limits the ageing degradation of structures, systems and components".

These definitions highlight the links between the programmes and the relationship between them. Ageing management is often seen as a sub-set of asset management, but in practice they inform each other to achieve the desired outcome of an organisation. For instance, asset management may define the operational objectives of SSCs, including the operational life or desired goals for safety. These factors will influence several factors such as design principles, material selection, etc. (top-down approach).   
Ageing management programmes are then developed to support the desired goals and operational objectives (bottom-up approach). However, the output from the ageing programmes, such as actual condition of SSC or identification of obsolescence, can inform the asset management processes, for instance the identification of investment needs.

## AM scope

**AM1**: Asset management should be applied proportionately to the lifecycle of all Identified Assets.

* Effective asset management requires that ageing and degradation mechanisms are properly understood. Single point vulnerabilities should be suitably understood and identified. The dutyholder should be undertaking appropriate monitoring, trending and analysis of degradation rates and mechanisms. This information should be taken into account at each stage of the plant’s lifecycle [5, 4].
* The life-cycle should include the following stages: design; manufacture; fabrication; construction; commissioning; operation (including long-term operation and extended shutdown and inactive state); and, decommissioning through to final site clearance [5, 4].
* The AMS should be adapted to reflect changes in a facility’s operational mode, throughout the lifecycle. This is required to ensure the functional service provided by Identified Assets is not degraded, as many of the Identified Assets in operation will at some point need to be maintained. This may require partial, progressive or complete replacement. Managing the ageing of nuclear assets, means ensuring the availability of the required SSoE functions, throughout the service life of the facility. This should take account of changes that occur with time and use and not fully catered for by routine EIM&T [5].
* The AMS should consider all Identified Assets in a proportionate manner. This should reflect the importance to the activity been undertaken. The risks associated with the asset’s SSoE significance should be recorded. An appropriate method of prioritising should be clearly defined [5].
* Key stakeholders should be identified to support the success and longevity of the AMS; they will be the owner or responsible person for: activities, decision making, emergency responses, site security issues, maintenance, operations and regulatory interfaces [5].

## Policy

**AM2**: The purpose of the asset management system should be defined by strategic objectives, underpinning the delivery of safety, security or environmental functions.

* The principles and framework by which the dutyholder intends to develop an AMS to achieve its objectives should be defined including ALARP justification. The categorisation and classification definition should be explicit within the AMS policy. It should be unambiguous, and not open to interpretation [5].
* Commitments and expectations for senior leadership should be set out. The AMS should define the processes for decisions, activities and appropriate behaviours concerning management of the Identified Assets [14, 15]. Responsibilities and accountabilities should be clearly assigned to appropriate positions within the dutyholder’s arrangements, acting as intelligent customer if the AMS is managed by a contractor [5, 16].
* The AMS should have a clear line of sight back to the relevant safety cases, and provide details of: SSoE functional requirements; required asset life; engineering and plant maintenance schedules and consider legal and other regulatory obligations [16].
* The AMS should outline the whole of life approach to the management of the Identified Assets [5].

**AM3**: The asset management system should detail the organisation required for the management of assets.

* The AMS should define its organisational structure. It should include details of authority, accountabilities, roles and responsibilities.   
  The AMS should define the terms of reference associated with each role, to ensure they are filled by suitably qualified and experienced people [3].
* The AMS should be appropriately integrated with other systems.   
  It should deliver a comprehensive programme for the overall management of Identified Assets. This may include financial governance, supply chain, and resourcing. There should be direct inputs from operational areas such as condition monitoring, quality assurance (QA) and other operating experience [5].
* The AMS should support the dutyholder’s Identified Asset’s management activities. It should provide sufficient information and context to assist in the decision-making process [5, 4, 9].
* The AMS should identify all end users (board members, senior leadership, operations, engineering etc.) that require AMS information. It should include the purpose for which information is being provided (for example, senior leadership receiving intelligence applied summaries and engineering staff receiving less processed data for analysis). The AMS should detail the most appropriate method and frequency of communication, providing fit for purpose reports [3].
* The AMS should include links out to the supply chain function. It should have strategies for the delivery of services and spares.   
  Appropriate contract management and funding plans should be developed and maintained through the life of the facility[4, 3].   
  These should be updated regularly to reflect any changes to the needs of the organisation or to the specific Identified Assets. Reviews and their associated changes should be recorded to develop an auditable trail of decision making.

## Planning

**AM4:** Asset management planning should record all system, structures and components that deliver a safety, security or environmental function.

* The AMS should include identification of all Identified Assets that support or deliver SSoE functions. The method for categorising functions should be referenced within the AMS. Conclusions from the evaluation of the consequences of an Identified Asset failing to support or deliver the SSoE function should be stated within the AMS [1, 5].
* All Identified Assets should have appropriate classification [17] applied to them. The classification should be linked to the Identified Asset’s significance, with a description of all of its functional requirements and any associated categorisations. Where applicable this should be directly linked to the safety case [5].
* The dutyholder should collate all the knowledge, skill, expertise and experience available. This should include different perspectives to ensure comprehensive coverage of all hazards and failure modes.   
  The approach should also promote consistency [4, 9, 5, 16].

**AM5**: The asset management system should define the arrangements for managing Identified Assets through the facility’s life-cycle.

* The AMS should represent a whole of life view of the facility. It should reflect all SSoE functions, as well as the Identified Assets that support and deliver those functions [5].
* Consideration should be given at concept, design and manufacture stages of a facility as to how the Identified Assets will operate and degrade over time. Suitable consideration of design, process and material selection should be given with respect to the facility life-cycle [4, 9, 5].
* The dutyholder should establish a process for reviewing the obsolescence of Identified Assets. Obsolescence management should be applied throughout an asset’s life-cycle [18].
* Changes of function, operation and stages of care and maintenance should be specifically recorded. Appropriate arrangements should be set out for preparation of care and maintenance activities during these stages. Plans should be prepared for periods of care and maintenance or outage (for example, cranes that may be required for decommissioning, but not plant operations) [4, 9, 5].
* The dutyholder should establish long-term AMS strategy and short/ medium-term AM plans that are ALARP. These should recognise and reflect the changing state of the Identified Assets and their significance in terms of SSoE functions [4, 5].
* AM plans should consider whole-of-life risks. They should reflect the operational limits, external requirements as well as extant EIM&T arrangements and whole-of-life supply chain requirements for the Identified Assets [5].
* AM plans should apply a proportionate approach to ensure that a higher level of rigour is applied to Identified Assets assessed to be most important. These should be identified and prioritised against their potential to impact on SSoE functions [5, 16].
* The AM plans should be informed by, and regularly reviewed against asset condition. The frequency of these reviews should be established and documented. The frequency should consider the significance of the SSoE function, the current condition of the Identified Assets and observed rate of degradation, including mechanism and cause   
  (for example, environment, operation, etc.). Dutyholders should supplement this position through operational experience where available. Details should be recorded within the AMS, and early reviews should be considered [4, 5, 16].
* The AMS should be unambiguous, providing details of Identified Asset’s location, ownership and current condition of the Identified Assets. Dates of the previous and next review period should be recorded.
* An appropriate programme of self-assessments and peer reviews should be conducted to maintain confidence in the effectiveness of the AMS. Where possible, this should be based on information and intelligence gathered from EIM&T. Where this is not practicable, engineering judgment should be applied based on operational experience [5].
* AMS strategies and plans should hold sufficient levels of detail relating to resource requirements necessary to successfully deliver the activity [4, 9, 5].
* Activities should take specific account of whole-of-life risks. This should include consideration and identification of long-term supply chain requirements. Identification of alternate and diverse suppliers of services and/or equipment should be included. Suitable funding should be identified and secured to deliver this.
* Changes or re-prioritisation of part, or all of the AMS resource allocation (i.e., people, money and time) should be recorded with clear justification for the decision [4, 9, 5].

## Implementation and operation

**AM6**: The asset management system should contain details of the safety, security and environmental functions of the Identified Assets.

* There should be appropriate levels of detail recorded within the AMS outlining the operation of Identified Assets under both normal and fault conditions. Prioritisation should be based on a risk informed approach. This should recognise unmitigated consequences relating to the function of the Identified Assets.
* Demonstration of an Identified Asset’s ability to deliver its functional requirement should, so far as is reasonably practicable, be undertaken according to written arrangements and technical instructions.   
  These should be undertaken commensurate with safety significance and consequence in a proportionate manner. Reviews of these instructions should highlight practices that are detrimental or beneficial to the condition of the Identified Assets [5].
* Where SSoE functions are delivered or supported by human interactions, these interfaces should be specifically identified. Associated risks should be understood and assessed [5].
* Operating histories of Identified Assets should be reviewed by suitably qualified and experienced persons in a way that is proportionate to their SSoE significance. These reviews should include transient records, maintenance histories, periods of normal operation and operating experience from similar Identified Assets. Ideally this information should be collated into a database such that information can be used   
  (for example, inputs to safety cases or as an aid for processes such as reliability centred maintenance). This approach will accurately reflect the current condition, effectiveness of AMS and inform future AMS plans [4, 9, 5].

**AM7**: The asset management system should ensure that all modifications to Identified Assets are adequately specified and controlled.

* The AMS should be linked to a process for tracking all Identified Asset modifications. It should include their design function, operational use, special tools & test equipment. Special note should be made to any modification to the interface between Identified Assets. Modifications to Identified Assets should include consideration of changes necessary to the AMS and place appropriate actions to resolve. These changes should be assessed within the AMS, with changes to AMS plans   
  (and strategies) if so required [4, 5]. Attention should be paid to cumulative effects of modifications and impact these may have holistically.
* Identified Assets should be subject to configuration control arrangements throughout their lifetime in the plant application, to ensure compliance with the operating limits and conditions derived from the safety case [19]. According to the IAEA definition [20], configuration management is ”the process of identifying and documenting the characteristics of a facility’s structures, systems and components (including computer-based systems and software), and of ensuring that changes to these characteristics are properly developed, assessed, approved, issued, implemented, verified, recorded and incorporated into the facility documentation.”
* The Identified Asset AMS plans should be reviewed by suitably qualified and experienced individuals to consider changes to documentation, operations and/ or physical plant. Periodicity of the reviews should be defined and undertaken on a risk informed approach based on safety significance and consequences. These reviews and any subsequent changes should be adequately recorded and managed [4, 5].
* The requirement to modify an Identified Asset, its SSoE function or operation may be prompted by any of the following [4, 5]:
  + LC15 periodic review;
  + Relevant good practice;
  + Changes in operational requirements;
  + Environment conditions;
  + Ageing and obsolescence; or
  + Events or incidents

## Assurance

**AM8**: The asset management system should monitor and record the performance of the Identified Assets and identify corrective actions as necessary.

* The AMS should identify appropriate performance indicators for each of the Identified Assets, linked to their SSoE function. The indicators should reflect significance, and classification. They should comprise leading and lagging indicators that define the operating effectiveness and efficiency of the Identified Assets [5].
* Operations associated with Identified Assets should involve the timely detection and characterisation of degradation. This should be achieved through a combination of inspection and monitoring of the Identified Assets. Assessment of the observed condition should be undertaken to determine the type and timing of any corrective actions. Any decision making that impacts Identified Asset care or the AMS should be evidence based. It should be supported by analysis and recorded in such a way that demonstrates an auditable trail [4, 9, 5].
* The visibility of an asset’s performance, functional and physical attributes should, where appropriate, be provided through pictorial representation (e.g. dated photographs, graphs and sketches).   
  This promotes consistency between different members of the organisation and / or third-party contractors, when determining plant condition over protracted periods of time. It also serves to provide accurate records for periods of change and handover [4, 9].
* A corrective action process should input into the AMS. It should provide up to date information on issues and plant abnormalities. This data should be trended to allow patterns to be identified, with learning applied to other similar systems and operations. The AMS should identify how investigation findings and recommendations, taken from failures, incidents and non-conformities are to be integrated in into the AMS. This should be supported by a time-frame for implementation [5].
* Operating experience should be applied to the AMS through the lifecycle of the Identified Assets. Experience from similar high-hazard, but non-nuclear industries should also be considered [4, 9, 5].
* Ageing and obsolescence strategies should be developed in conjunction with the supply chain in identification and tracking of mitigation and replacement options. Suitable arrangements should be developed for end-of-life replacement or refurbishment of Identified Assets. Supply chain management should be included within these arrangements and controlled by the AMS. Identified Assets that are identified as difficult to manage or replace should have enhanced monitoring applied with longer term risk mitigation strategies developed [4, 5, 18].
* The AMS should identify the Identified Asset monitoring regime, which should be based on a graded approach. Monitoring should be undertaken according to the associated risk level [4, 5].

**AM9**: The asset management system should be part of the organisation’s assurance process and contain a means by which its effectiveness can be monitored and measured.

* The AMS should be routinely reviewed by senior leadership to determine the continued suitability of the chosen strategy and policies. The results of an AMS review should be documented in an appropriate report. The report should address the understanding of the condition of the Identified Assets, its on-going monitoring and the mitigation effects. Any recommendations for improvements in AM from the review should include plant, process and procedures [5].
* A risk-based AMS audit programme should be established, led by suitably qualified and experienced people. The audit programme should be commensurate with the size and nature of the process or Identified Assets being audited and have appropriate controls and supervision [5].

## Resourcing

**AM10**: The asset management system should identify the organisational resources required for maintaining Assets.

* The senior leadership team should demonstrate their commitment by providing an enabling environment for AM. They should support delivery of AM tasks and actively seek information on the past, current and predicted future condition of Identified Assets [4, 9, 5].
* The AMS should consider the long-term funding required for the AMS.   
  This should be recognised through the development of resource achievable AMS plans derived from the high-level strategy.   
  These should be prioritised against the current Identified Asset condition, their SSoE function and classification [5].
* Removal of part or all scope, resource, equipment or plant associated with delivery of an AMS plan should be justified and recorded.   
  Suitable mitigation plans should be available, agreed with the identified Asset owner [4, 9, 5].
* The AMS should be integrated with supply chain. Outsourcing asset management to a third party should be effectively monitored and controlled. This should also include sharing of Identified Asset’s information between organisations [5].
* Impact of long-term storage of spares should be assessed to identify degradation mechanisms. This should be supported within suitable spares strategies. Specific attention should be paid to spares that have been in storage for extended periods, with suitable QA process in place to provide ongoing confidence in the condition of the asset.
* The AMS should consider the suitably qualified and experienced person roles, responsibilities and accountabilities for those persons who contribute to the effectiveness of the AMS throughout its life-cycle. Any specific training should be captured and linked with the relevant AMS plans [5].
* The AMS should demonstrate that the duly authorised, and other suitably qualified and experienced persons are part of the control and supervision across the AMS. The level of experience and qualifications required to maintain oversight and control should be clear. Responsibilities and authorisations should be set out [4, 9, 5].

# References

|  |  |
| --- | --- |
| [1] | ONR, “Safety Assessment Principles (SAPs) for Nuclear Facilities - 2014 Edition (Revision 1),” 2020. |
| [2] | ONR, “Chief Nuclear Inspector’s themed inspection on the management of aging facilities - Summary Report,” 2022. [Online]. Available: https://www.onr.org.uk/media/stdlyrl3/cni-themed-inspection-ageing-facilities-summary-report.pdf. |
| [3] | ISO, “ISO 55001:2024 - Asset management — Asset management system — Requirements (Edition 2),” 2024. [Online]. Available: https://www.iso.org/standard/83054.html. |
| [4] | IAEA, “Safety Standards Series No. SSG-48 - Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants,” 2018. [Online]. Available: https://www.iaea.org/publications/12240/ageing-management-and-development-of-a-programme-for-long-term-operation-of-nuclear-power-plants. |
| [5] | Frazer Nash , “Report – Establishment of Relevant Good Practice in the Area of Asset Management (FNC 45501/42258R, Issue 0.1) (Internal ONR record reference: 2016/240163),” 2015. |
| [6] | ONR, “Licence Condition Handbook,” 2017. [Online]. Available: https://www.onr.org.uk/media/gixbe2br/licence-condition-handbook.pdf. |
| [7] | WENRA, “Safety Reference Levels for Existing Reactors 2020,” 2021. [Online]. Available: https://www.wenra.eu/sites/default/files/publications/wenra\_safety\_reference\_level\_for\_existing\_reactors\_2020.pdf. |
| [8] | ONR, “NS-TAST-GD-005 - Guidance on the Demonstration of ALARP,” [Online]. Available: https://www.onr.org.uk/publications/regulatory-guidance/regulatory-assessment-and-permissioning/technical-assessment-guides-tags/nuclear-safety-tags/technical-assessment-guides-tags-nuclear-safety-full-list/. |
| [9] | IAEA, “Technical Reports Series No. 338 - Methodology for the management of ageing of nuclear power plant components important to safety,” 1992. [Online]. Available: https://www.iaea.org/publications/1442/methodology-for-the-management-of-ageing-of-nuclear-power-plant-components-important-to-safety. |
| [10] | IAEA, “IAEA NUCLEAR ENERGY SERIES No. NR‑T‑3.33 - Asset Management for Sustainable Nuclear Power Plant Operations,” 2021. [Online]. Available: https://www.iaea.org/publications/13630/asset-management-for-sustainable-nuclear-power-plant-operation. |
| [11] | ISO, “ISO 55000:2024 - Asset management — Vocabulary, overview and principles (Edition 2),” 2024. [Online]. Available: https://www.iso.org/standard/83053.html. |
| [12] | ISO, “ISO 55002:2018 - Asset management — Management systems — Guidelines for the application of ISO 55001 (Edition 2),” 2018. [Online]. Available: https://www.iso.org/standard/70402.html. |
| [13] | ONR, “NS-TAST-GD-109 – Ageing and Degradation Management,” [Online]. Available: https://www.onr.org.uk/publications/regulatory-guidance/regulatory-assessment-and-permissioning/technical-assessment-guides-tags/nuclear-safety-tags/technical-assessment-guides-tags-nuclear-safety-full-list/.. |
| [14] | Global Forum On Maintenance & Asset Management, “The Asset Management Landscape (Third edition),” March 2024. [Online]. Available: https://gfmam.org/sites/default/files/2024-06/GFMAM\_AM\_Landscape\_v3.0\_English\_2024.pdf. |
| [15] | HSE, “HSG65 - Managing for health and safety,” 2013. [Online]. Available: https://www.hse.gov.uk/pubns/priced/hsg65.pdf. |
| [16] | ICE, “ICE’s Guiding Principles of Asset Management,” July 2022. [Online]. Available: https://www.ice.org.uk/media/t4yddopv/guiding-principles-of-asset-management-3.pdf. |
| [17] | ONR, “NS-TAST-GD-094 – Categorisation of Safety Functions and Classification of Structures, Systems and Components,” [Online]. Available: https://www.onr.org.uk/publications/regulatory-guidance/regulatory-assessment-and-permissioning/technical-assessment-guides-tags/nuclear-safety-tags/technical-assessment-guides-tags-nuclear-safety-full-list/.. |
| [18] | BSI, “BS EN IEC 62402:2019 - TC - Obsolescence management,” 31 July 2019. [Online]. Available: https://knowledge.bsigroup.com/products/obsolescence-management?version=tracked. |
| [19] | IAEA, “Safety Standards Series No. SSG-71 - Modifications to Nuclear Power Plants,” 2022. [Online]. Available: https://www.iaea.org/publications/14902/modifications-to-nuclear-power-plants. |
| [20] | IAEA, “IAEA Nuclear Safety and Security Glossary (2022 Interim Edition) - Terminology Used in Nuclear Safety, Nuclear Security, Radiation Protection and Emergency Preparedness and Response,” 2022. [Online]. Available: https://www.iaea.org/publications/15236/iaea-nuclear-safety-and-security-glossary. |

# Glossary

ALARP As low as reasonably practicable

AMS Asset Management System

BAT Best Available Techniques

BPM Best Practicable Means

BS ISO British Standards International Standards Organisation

DAP Duly Authorised Person

EIM&T Examination, inspection, maintenance and testing

IAEA International Atomic Energy Agency

LC Licence Condition

NEDF Nuclear Engineering Directors Forum

PSR Periodic Safety Review

RGP Relevant Good Practice

SAP Safety Assessment Principle(s)

SDF Safety Directors Forum

SQEP Suitably Qualified and Experienced Person

SSC Structure, System or Component

SSoE Safety, Security or Environmental (function)

TAG Technical Assessment Guide(s)

TIG Technical Inspection Guide(s)

WENRA Western European Nuclear Regulators’ Association

1. The term ‘safety’ within this document refers to refers to the safety of persons whether on or off the site [6]. [↑](#footnote-ref-2)