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| ONR Technical Assessment Guide  Examination, Inspection, Maintenance and Testing of items important to Safety |



ONR Technical Assessment Guide (TAG)

Examination, Inspection, Maintenance and Testing of items important to Safety

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# 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 duty-holders. 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. Nuclear processes are designed on the premise that the facility and equipment in use will retain the reliability claimed in the facility Safety Case, thus ensuring that the hazard presented by, and the risk associated with the process is kept at an acceptably low level. The reliability of the facility will only be assured through the facility's full lifecycle by a process of maintenance which may include refurbishment or replacement of structures, systems and components (SSCs). This process is based upon a sound understanding of the facility, the identification of SSCs important to safety, knowledge of the equipment's ageing mechanisms and the support of a programme of examination, inspection, maintenance and testing (EIMT).

# Purpose and Scope

1. This TAG directly addresses those ONR SAPs [1] which relate to EIMT which are SAPs EMT.1 to EMT.8. It has been written primarily in general terms so that it applies to all engineering disciplines. It should also be noted that EIMT is considered to be an integral part of the operation of a nuclear facility.
2. The ONR SAPs [1] and this TAG address the need to ensure adequate arrangements are (or will be) in place for the EIMT of items important to safety.
3. These arrangements should address the need to plan, specify, implement, monitor and review the EIMT activities. Additionally, where changes are made to either the facility, equipment or the EIMT regime, these should not result in a lowering of the level of nuclear safety defined in the safety case.
4. This TAG contains guidance to assist and inform ONR inspectors in the exercise of their professional regulatory judgement.

# Relationship to Licence and other Relevant Legislation

1. Site Licence Condition (LC) 28: Examination, Inspection, Maintenance and Testing requires the licensee to make and implement adequate arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant which may affect safety.
2. The need for, or performance of, EIMT is considered to be an integral part of the life-cycle of a nuclear facility, so other Licence Conditions are also of relevance. A table of applicable Licence Conditions is available in Appendix 1**.**
3. Other relevant statutory provisions create duties to carry out EIMT, or to ensure these activities are carried out safely. ONR enforces these provisions on nuclear sites in Great Britain. Table 1 below gives examples of relevant statutory provisions relating to EIMT.

Table 1 – Examples of relevant statutory provisions relating to examination, inspection, maintenance and testing (this is not an exhaustive list)

|  |  |
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| Provision: | Notes: |
| Provision and Use of Work Equipment Regulations 1998 (PUWER) | The scope of ‘work equipment’ is extremely wide. It means any machinery, appliance, apparatus, tool or installation for use at work.  Reg 5 requires work equipment to be maintained in an efficient state, in efficient working order and in good repair.  Reg 6 – When work equipment is first installed, and when it is moved or relocated, it must be inspected to make sure that it has been correctly installed and is operating safely. Where it is possible that the equipment is exposed to conditions that could cause it to deteriorate, it must be inspected regularly.  The purpose of an inspection is to identify whether the equipment can be operated, adjusted and maintained safely and that any deterioration (for example, any defect, damage or wear) can be detected and remedied before it results in unacceptable risks.  ACOP: <https://www.hse.gov.uk/pubns/priced/l22.pdf> |
| Construction (Design and Management) Regulations 2015 (CDM) | Many EIMT activities are included within the definition of ‘construction work’.  Reg 9 requires designers to eliminate, reduce or control foreseeable risks through design. This includes risks to people carrying out maintenance.  Guidance: <https://www.hse.gov.uk/pubns/priced/l153.pdf> |
| Control of Major Accident Hazards Regulations 2015 (COMAH) | Reg 5 requires operators to take all measures necessary to prevent major accidents and to limit their consequences for human health and the environment.  Reg 8 – Safety reports for upper tier establishments should demonstrate that adequate safety and reliability has been taken into account in maintenance.  Guidance: <https://www.hse.gov.uk/pubns/priced/l111.pdf> |
| Electricity at Work Regulations 1989 | Reg 4(2) requires electrical systems to be maintained so as to prevent danger.  Reg 4(3) requires that work activities associated with an electrical system (including maintenance), should be carried out in a way which does not give rise to danger.  Guidance: <https://www.hse.gov.uk/pubns/priced/hsr25.pdf> |
| Lifting Operating and Lifting Equipment Regulations 1998 (LOLER) | Regulation 9 puts in place requirements for all lifting equipment to be subject to ‘thorough examination’ at various points.  ACOP: <https://www.hse.gov.uk/pubns/priced/l113.pdf> |
| Pressure Systems Safety Regulations 2000 (PSSR) | Reg 8 – Requirement for Written Scheme of Examination.  Reg 9 – Examination in accordance with written scheme.  Reg 12 requires pressure systems to be properly maintained in good repair, so as to prevent danger  ACOP: <https://www.hse.gov.uk/pubns/priced/l122.pdf> |

# Relationship to Safety Assessment Principles, WENRA Reference Levels, and IAEA Safety Standards and Guides

1. The ‘Engineering Principles: Maintenance, Inspection and Testing (EMT) 1-8’ are the key SAPs directly addressed by this TAG.
2. Appendix 2 provides reference to other SAPs that are relevant to the assessment of EIMT.
3. The following ONR TAGs may be relevant to inspectors considering EIMT:

* NS-TAST-GD-005 Demonstration of ALARP
* NS-TAST-GD-016 Integrity of Metal Structures, Systems and Components
* NS-TASD-GD-017 Civil Engineering
* NS-TAST-GD-026 Decommissioning
* NS-TAST-GD-030 Probabilistic Safety Analysis
* NS-TAST-GD-050 Periodic Safety Reviews
* NS-TAST-GD-051 The Purpose, Scope and Content of Safety Cases
* NS-TAST-GD-057 Design Safety Assurance
* NS-TAST-GD-067 Pressure Systems Safety
* NS-TAST-GD-094 Categorisation of Safety Functions and Classifications of Structures, Systems and Components
* NS-TAST-GD-109 Ageing and Degradation Management

## WENRA Reference Levels (RLs) and IAEA Safety Standards and Guide

1. This TAG considers the Western European Nuclear Regulators’ Association [Ref [2]] (WENRA) and International Atomic Energy Agency [3] to [6] (IAEA) publications for specific applicability. It should be noted that the SAPs are intended for both existing and new facilities whereas the WENRA Reactor Safety Reference Levels are intended for existing reactors. However, there is little difference between the general requirements of each. The WENRA and IAEA documents considered in this TAG focus on nuclear reactor power plants and so do not have the same broad scope intent of the SAPs and this TAG. NS-TAST-GD-005 identifies the WENRA RLs as relevant good practice (RGP) for existing civil nuclear reactors.
2. WENRA Reference Level Issue K is dedicated to maintenance, in-service inspection and functional testing. The following is worthy of note during assessment of Licensees’ EIMT arrangements:

* The need for the preparation and implementation of documented programmes of EIMT of SSCs important to safety to ensure that their availability, reliability, and functionality remains in accordance with the design over the lifetime of the plant;
* The programmes should include periodic inspections and tests of SSCs important to safety in order to determine whether they are acceptable for continued safe operation of the plant or whether any remedial measures are necessary;
* The extent and frequency of preventative EIMT should be determined using a systematic approach;
* The impact of maintenance on plant safety is to be assessed using data from plant EIMT;
* SSCs important to safety are to be designed with ease of EIMT to demonstrate integrity and functional capability over the plant lifetime;
* Proven alternative approaches may be specified and other safety precautions taken to compensate for the potential for undiscovered failures where EIMT provisions are not attainable; and
* The need for configuration control to permit plant to be removed from service before testing and then for return to service.

1. The comprehensive EIMT requirements that are reflected in many of the ONR SAPs demonstrate that WENRA RL Issue K requirements are addressed in the UK approach to regulation. Indeed, many of the other RL Issues, not directly related to EIMT, mention the need for EIMT in much the same high-level way as in the SAPs.
2. The following IAEA Safety Standards and Guides refer to the need for EIMT as a means of gaining assurance that the design intent is maintained in all disciplines of nuclear engineering and safety assurance.

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| IAEA Guidance | Notes: |
| SSR-2/1 - Safety of Nuclear Power Plants: Design  [3] | **Requirement 29: Calibration, testing, maintenance, repair, replacement, inspection and monitoring of items important to safety:** Items important to safety shall be designed to be calibrated, tested, maintained, repaired or replaced, inspected and monitored as required to ensure their capability of performing their functions and to maintain their integrity in all conditions specified in their design basis.  **Requirement 31: Ageing management:**  The design life of items important to safety shall be determined. Appropriate margins shall be provided in the design to take due account of relevant mechanisms of ageing, neutron embrittlement and wearout and of the potential for age related degradation, to ensure the capability of items important to safety to perform their necessary safety functions throughout their design life |
| SSR-2/2 - Safety of Nuclear Power Plants: Commissioning and Operation  [5] | **Requirement 13: Equipment qualification**  The operating organization shall ensure that a systematic assessment is carried out to provide reliable confirmation that safety related items are capable of the required performance for all operational states and for accident conditions.  **Requirement 31: Maintenance, testing, surveillance and inspection programmes** The operating organization shall ensure that effective programmes for maintenance, testing, surveillance and inspection are established and implemented |
| SSG-28 – Commissioning for Nuclear Power Plants [6] | From construction to commissioning and finally to operation, the plant should be adequately monitored and maintained. The plant should be subject to the required inspection and periodic testing in order to protect equipment, to support the testing stage and to continue to comply with the safety analysis report and operational limits and conditions. |
| SSG-74: Maintenance, Testing, Surveillance and In-Service Inspection in Nuclear Power Plants [4] | This Safety Guide covers:   * the establishment and implementation of preventive and corrective maintenance programmes; * testing; * surveillance; * inspection; * the repair of defective plant equipment; * the provision of related facilities and equipment; * procurement; and * generating and retaining records of maintenance activities.   The maintenance programme for a nuclear power plant should include all the administrative and technical measures that are necessary to detect and mitigate the degradation of a functioning SSC or to restore to an acceptable level the performance of design functions of a failed SSC. |

1. The guidance for EIMT contained in the above IAEA documents is addressed in the UK approach to regulation of nuclear facilities.

# Advice to Inspectors

## EIMT Fundamentals

1. EIMT requirements, including specification of what is to be done and its periodicity, should be identified in the safety case taking account of any reliability claims.
2. There should be traceability of EIMT requirements from the safety case through the Plant Maintenance Schedule to Maintenance Instructions.

### Background to Nuclear Industry Examination, Inspection, Maintenance and Testing Practices and Operational Experience

1. In preparation for assessment of any nuclear safety related documentation on EIMT submitted to ONR, it is important to understand the evolution of the processes involved in developing such documents. Nuclear industry EIMT practices have evolved from when there were no nuclear facilities and hence no operational experience. Nuclear facility development, Research and Development (R&D) activities, pilot programmes and operational experience have all contributed to an improved understanding of nuclear safety and evolving operational practices including EIMT.
2. There is a likelihood that novel design features, modifications to existing facilities, and new build facilities will be encountered. Such novel features should require R&D programmes and pilot testing prior to consideration of deployment in an operational environment. Testing, Inspection and Examination is required during any installation and commissioning phase (SAPs ECM.1), and operation (SAPs EMT.7), coupled with maintenance, to confirm the adequacy of the facility in safety terms. (SAP para 281 is typical of the statements ONR makes about accepting sound engineering, or novel approaches backed by R&D, plus testing before service, and monitoring during service.)

## Examination, Inspection, Maintenance and Testing through Facility Life

1. The provisions of EIMT are relevant to the whole life cycle of a nuclear facility i.e. from ‘cradle to grave’. The nature and balance of these provisions, and hence the associated regulatory expectations, change during the various stages of the life cycle.
2. Inspectors should consider the following areas during a review of Licensee’s EIMT arrangements.

### Design & Safety Case Development

1. Inspectors should confirm that the developing safety case identifies the nature and periodicity of EIMT proposed and provides a justification for any long-term performance claimed without such EIMT. Whenever the latter claim is made, the inspector should confirm the adequacy of the additional design measures incorporated to justify the absence of EIMT or the alternative arguments cited in support of such a claim.
2. Inspectors should consider whether the EIMT being specified, and standards selected, for the various SSCs are to a level of quality commensurate with their safety classification (SAPs EKP.5, ECS.2 & ECS.3). The classification of SSCs, which is discussed further in NS-TAST-GD-094, is based on their nuclear safety significance.
3. Inspectors should consider the Licensee’s arrangements for developing a listing of all facility EIMT, selecting those items that will be undertaken as routine maintenance and those items important to nuclear safety that will be placed on the Plant Maintenance Schedule as required by Licence Condition 28(4).
4. A key element of the arrangements should be continuity from the identification of SSCs in the safety case through to the Plant Maintenance Schedule, to the maintenance instructions (which may be termed job plans). This continuity should include the ability to readily identify the SSC classification and safety functional requirement for an SSC from anywhere within the chain of documents, e.g. by clear SSC cross-references between the different layers of documents.
5. Inspectors should note that whilst the requirement for a Plant Maintenance Schedule in Licence Condition 28(4) is applicable to plant that may affect nuclear safety, Licensees’ may produce a Plant Maintenance Schedule that includes other plant. In such instances, the inspector should determine whether it clearly identifies those items that may affect nuclear safety. A Licensee may split the Plant Maintenance Schedule into sections such as:

* Plant (Nuclear Safety) Maintenance Schedule;
* Statutory Maintenance Schedule;
* Environmental Maintenance Schedule; and
* Residual Routine Maintenance Schedule.

1. A project manual, or equivalent, should be available defining a process whereby a group of SQEPs from the project team, the safety analysts, the Responsible Engineers and the Licensee’s operations staff meet regularly throughout the design, build and inactive commissioning phases to:

* Review the totality of the Maintenance Catalogue and populate the Plant (Nuclear Safety) Maintenance Schedule, any Statutory or Environmental Maintenance Schedules, and the Residual Routine Maintenance Schedule, based on a shared understanding of the importance of SSCs to nuclear safety, statutory requirements and environmental considerations;
* Document the reasons for accepting only condition monitoring, or operator surveillance with breakdown maintenance on some plant items; and
* Endorse maintenance instructions generated for all safety significant plant.

1. Inspectors should determine whether Licensee’s operations staff review the Safety Case Design Basis and Probabilistic Safety Analysis (PSA) to ensure that the worst plant configurations assumed allow for equipment outages for EIMT activities (SAP FA.6 (Fault sequences), ONR TAG NS-TAST-GD-036 (Diversity, redundancy, segregation and layout of mechanical plant)).
2. Inspectors should confirm that adequate provisions have been made during the design process for through-life EIMT of the facility with particular attention given to ensuring that radiation doses to EIMT operatives remain as low as reasonably practicable throughout the facility life and that adverse interactions with other SSCs are minimised, as described by SAP ELO.1 (Layout).
3. Inspectors should look for evidence that the proposed EIMT is adequate to maintain the equipment design intent in terms of the nuclear safety functions identified in the safety analysis.
4. Licensees should have a process for capturing project assumptions related to EIMT generated by the ongoing design and safety analyses, along with an auditable record of where these assumptions are discharged in operational documents.
5. Where appropriate, inspectors should look for evidence that PSA has been used in determining appropriate EIMT strategies. This may include identifying when it is acceptable for safety important equipment to be released for EIMT and the extent to which the proposed EIMT activities provide the required level of assurance that safety case reliability claims are met (SAP FA.14 (Use of PSA)).
6. Inspectors should look for evidence that adequate development work on novel systems or components is undertaken between concept design and manufacturing. Such work may have significant impact on the EIMT tasks defined within the evolving maintenance schedules.
7. For projects involving the design or modification of plant, the licensee’s maintenance and operations staff should be involved from an early stage. This is to ensure that adequate provisions are made for EIMT and that staff gain an appreciation of the design intent to support the Licensee’s Design Authority and Intelligent Customer roles.

### Manufacture and Works Tests (Factory Acceptance Tests)

1. Inspectors should look for evidence of the trialling of EIMT instructions during the manufacturer’s works tests / trial builds for more complex and large plant.
2. Works tests should be formally documented and captured in the Licensee’s operational documentation as the baseline for ongoing demonstration that the design intent of the facility is maintained.

### On Site Plant Installation, Site Acceptance Tests and Commissioning

1. Inspectors should look for evidence that plant changes during installation and testing are adequately assessed in terms of identifying commensurate effects on the proposed EIMT arrangements. Such changes may result in the need to modify the maintenance schedules and maintenance Instructions.
2. In some cases, it may not be possible for tests to confirm the ability to operate under the most onerous design conditions. In these instances, the inspector should look for justification of the components’ performance and reliability from additional analysis utilising available data from commissioning or rig testing. Reference data should be taken from type testing to establish a baseline for comparison against in-service performance (SAPs EMT.3 Type testing).
3. Inspectors should confirm that inactive commissioning includes the validation of Maintenance Instructions, particularly where access will be restricted once active commissioning has commenced.
4. Inspectors should confirm that human factors assessments of EIMT tasks are undertaken, as appropriate, during testing and commissioning. The inspector should consider error traps, and common cause failure mechanisms created by the procedures or by actions of operatives.
5. Inspectors should look for demonstration during inactive commissioning as to the effectiveness of plant and equipment isolations required for EIMT. Part of this demonstration should also prove any return to service procedures as these may differ from plant isolation procedures.
6. As a project proceeds, inspectors should look for evidence that changes to the Maintenance Schedule and Maintenance Instructions are documented. This should be supported by records of the consideration and agreement by all relevant project, safety, and operations disciplines, thus demonstrating comprehensive acceptance.
7. Inspectors should consider to what extent the commissioning will demonstrate the proposed in-service test regime for each part of any such system as well as the whole system (SAPs EMT.5 (Procedures) and EMT.6 (Reliability claims).
8. Where an EIMT activity to satisfy a safety requirement is shown on the appropriate assumptions database, there should be a clear ‘golden thread’ to where its safety role is defined within the nuclear safety case.
9. Inspectors should determine that a Licensee has appropriate arrangements for declaring and justifying when the periodicity or written scheme requirements for each entry on the Maintenance Schedule are to start.
10. Inspectors should confirm that the Completion of Inactive and Active Commissioning Reports not only describes what has been tested, but changes that have resulted from:

* Construction modifications;
* Facility testing and commissioning; and,
* Any changes to the Maintenance Schedules and Maintenance Instructions.

1. Inspectors should confirm that during construction and commissioning the plant will be (or has been) subject to an appropriate EIMT regime, designed to ensure SSCs will deliver safety performance requirements claimed in the safety analysis.
2. Inspectors should consider whether the licensee has defined organisational roles and responsibilities for EIMT during transition from construction to commissioning and operation.

### Operations

1. Inspectors should consider whether EIMT for the various SSCs is specified, standards selected and the work undertaken to a level of quality commensurate with their safety classification (SAPs EKP.5 (Safety measures), ECS.2 (Safety classification of structures, systems and components) and ECS.3 (Codes and standards)).
2. Attention should be paid to the following safety case concerns:

* Confirmation that any safety case requirements for staggered testing are translated into the Maintenance Schedule;
* Confirmation that, in developing the Maintenance Schedule, the Licensee has considered and demonstrated that the minimum configurations of operational safety systems justified in the safety case will be maintained. This should include compliance with any requirements on plant availability derived from consideration of the Single Failure Criterion;
* Where equipment important to safety is taken out of service for EIMT, the continuing safety of operations should be justified. Furthermore, the potential for the examination, inspection, maintenance or testing to initiate a fault should be analysed and the risks so arising justified.

1. Inspectors should confirm that in service testing of SSCs important to safety proves the complete system and the safety function of the individual components (SAP EMT.7(Functional testing)). In all cases, the associated reliability analysis should reflect the actual testing carried out.
2. Where it is not feasible to test a system end-to-end, inspectors should look for justification of partial testing. This should include how the results of each part can be linked to demonstrate continuing achievement of design intent for the whole system.
3. The safety case may preclude full in situ testing, in which case alternative arrangements may be necessary, for example the removal and rig testing of a device. Inspectors should consider the adequacy of any alternative arrangements a Licensee has made in such situations (SAP EMT.7(Functional testing)).
4. Inspectors should pay particular attention to the Licensee’s arrangements to ensure re-establishment of the correct plant configuration following EIMT.
5. Safety case assumptions regarding component reliability, can influence mean time between tests, and performance along with unavailability for EIMT. Inspectors should consider whether these assumptions are adequately reflected in implementation documentation such as maintenance schedules and instructions.
6. Inspectors should confirm that the EIMT instructions provide for full and accurate reporting. This should include the recording and reporting of any defects and of any properties or parameters which may need to be monitored to confirm continuing safe operation. Clear criteria for successful completion of the work should be stated and the procedures should provide for the reporting and rectification of non-conformances.
7. Arrangements should include review of recorded data to identify trends in failures or gradual degradation over time. (SAPs Para 216)
8. The implementation arrangements should ensure that activities are performed and supervised by competent staff using equipment and tools which have been demonstrated to be adequate for the task. In certain circumstances the personnel and equipment may require validation.
9. The Maintenance Instructions usually only address direct measurements required or require achievement of pre-defined acceptance criteria. Inspectors should seek confirmation that further examination and trending of lifetime data is undertaken as appropriate by SQEP resource from the Design Authority.
10. Inspectors should look for evidence that both safety case and plant changes are adequately assessed by appropriate SQEP to identify commensurate effects on the existing EIMT arrangements and the need for any additional EIMT. Such changes may result in the need to modify the Maintenance Schedules and Maintenance Instructions.
11. Inspectors should establish whether the Licensee has adequate EIMT arrangements for equipment provided to support the facility’s emergency arrangements.
12. Inspectors should confirm that the Licensee has adequate arrangements for identifying (OpEX) of relevance to EIMT and responding accordingly (this should include both OpEX from the Licensee’s activities and external OpEX).
13. Licensees should have adequate arrangements for managing Foreign Material Exclusion (FME) during EIMT activities on the facility (e.g. FME control points, FME covers, use of lanyards and logging of tools).
14. Inspectors should visit Licensee’s maintenance facilities / workshops for safety important SSC’s to determine whether the housekeeping and work practices are adequate with respect to both FME and quality control.
15. Licensees should make adequate provisions for the secure, quarantined storage of overhauled safety important equipment prior to it being re-installed on the facility.
16. Inspectors should seek confirmation that a Licensee has a formal process for EIMT operatives to identify shortfalls, inconsistencies or discrepancies in EIMT procedures. The process should be simple to follow and remove human error traps or workarounds. Inspectors should seek evidence that operatives are using the process and that it provides a mechanism for dealing with the observations raised.
17. Where a Licensee’s maintenance arrangements are based on generic approaches, inspectors should seek evidence that the facility safety case provides appropriate justification. Such approaches include:

* Reliability Centred Maintenance
* Condition Monitoring
* Planned Maintenance
* Preventative Maintenance
* Risk Based Maintenance
* Run to Failure (Corrective) Maintenance
* Inspection Based Maintenance

### Outages

1. Inspectors should establish prior to Licensee’s pre-planned facility shutdowns (usually termed outages) that a programme of work has been prepared such that all nuclear safety significant Plant Maintenance Schedule items needing EIMT are covered.
2. Inspectors should establish that the programme of work provides the necessary coverage of the facility (within an overall long term plan). This should include all additional work identified as necessary as a result of previous inspections, commitments or safety concerns identified during operation of the facility or arising from generic concerns.
3. The outcome from such EIMT should be assessed by SQEP personnel from the Licensee’s Operational and Design Authority Organisations.
4. Inspectors should confirm that all EIMT activities will be carried out to written procedures. Appropriate arrangements should be in place for the independent checking (by sampling) of inspections to confirm that appropriate quality is maintained.
5. Inspectors should consider licensees' arrangements for the reporting and review of EIMT results. This should include arrangements for categorisation and sentencing of defects, including where appropriate independent assessment.
6. Where there is a regulatory or procedural control over restart, all findings which are pertinent to the safety justification for the restart should be provided for timely consideration by inspectors.
7. Procedures should be sampled to confirm that they contain clear and adequate instructions. Procedures should include clear reporting criteria and adequate means of spatially identifying and recording items inspected and any features or defects observed.
8. Inspectors should review the final outage inspection reports or any equivalent reports and appropriately advise if any of the matters reported raise new concerns which should be considered in the context of restart. They should also review the reports to confirm that the licensee has considered and adequately addressed any trends in the results of the inspection etc.
9. Outage periodicity has to be demonstrated to be consistent with the requirements of design integrity assurance. Such assurance requirements are drawn out from within design reports or safety analyses and should be defined within Safety Cases. When changes to outage periodicity are requested by a licensee there may be a need for a multi-discipline review by ONR.

### Plant Not Used Continuously

1. Some Licensees use some of their plant and equipment when required for example to support the work carried out on a submarine in a dock, and do not set a periodicity for its EIMT. Instead, the Licensee identifies that appropriate EIMT is to be carried out prior to the plant being used.
2. Inspectors involved in the review of the planned EIMT for such plant should consider whether the Licensee has adequately addressed the potential deterioration of the plant in periods between use in determining the required EIMT. Inspectors should also consider whether there are any legal requirements to perform periodic maintenance on such items.

### Verification of EIMT

1. The Licensee should have a process for verification of EIMT implementation, with the depth and breadth of verification graded in relation to the importance to nuclear safety of the equipment and associated EIMT. This should specifically include an appropriate level of physical verification of EIMT on the facility.

### Periodic Safety Reviews

1. The Periodic Safety Review (PSR) process should include a review of the EIMT regimes by describing plant failures, anomalies and the means found for rectification. The output of this process should be either recommendations for changes to the EIMT or demonstration that the existing EIMT regime is adequate.
2. Confirmation should be provided that cumulative data from EIMT continues to support the reliability claims made within the safety case.
3. Inspectors should look for evidence that Licensees are adopting the latest good practices for EIMT.
4. For further guidance on PSRs refer to NS-TAST-GD-050 Periodic Safety Reviews.

### End of Routine Operations

1. Inspectors should consider the extent to which any reductions in EIMT are supported by revised safety cases for the various phases of facility decommissioning. Inspectors should also consider whether additional or modified EIMT is needed, given potential changes to environmental conditions, frequency of use and such other factors.
2. For further guidance on Decommissioning refer to NS-TAST-GD-026 – Decommissioning on Nuclear Licensed Sites.

# References

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| --- | --- |
| [1] | ONR, “Safety Assessment Principles (SAPs) for Nuclear Facilities - 2014 Edition (Revision 1),” 2020. |
| [2] | WENRA, “Safety Reference Levels for Existing Reactors,” 2020. |
| [3] | IAEA Safety Standards, “Safety of Nuclear Power Plants: Design, Specific Safety Requirements No. SSR-2/1 (Rev. 1)”. |
| [4] | IAEA Safety Standards, “Maintenance, Testing, Surveilance and Inspection in Nuclear Power Plants, Specific Safety Guide No SSG-74”. |
| [5] | IAEA Safety Standards, “Safety of Nuclear Power Plants: Commissionining and Operation, Specific Safety Requirements No SSR-2/2 (Rev. 1)”. |
| [6] | IAEA Safety Standards, “Commissioning for Nuclear Power Plants, Specific Safety Guide No. SSG-28”. |

# Glossary and Abbreviations

ALARP As low as reasonably practicable

EIMT Examination, Inspection, Maintenance and Testing

FME Foreign Material Exclusion

HSE Health & Safety Executive

IAEA International Atomic Energy Agency

LC Licence Condition

ONR Office for Nuclear Regulation

OpEX Operational EXperience

PSA Probabilistic Safety Analysis

PSR Periodic Safety Review

R&D Research and Development

RGP Relevant Good Practice

RL(s) Reference Level(s)

SAP(s) Safety Assessment Principle(s)

SQEP Suitably Qualified and Experienced Person

SSCs Structures, Systems and Components

TAG(s) Technical Assessment Guide(s)

WENRA Western European Nuclear Regulators’ Association

# Appendix 1 – Site Licence Conditions

Table - Relevant Site Licence Conditions relating to EIMT

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| Site Licence Conditions | Notes: |
| LC 7: Incidents on the site | Any incidents involving EIMT activities which had or may have had an effect on nuclear safety should be recorded, investigated and notified to ONR. |
| LC 10: Training | The Licensee shall make and implement adequate arrangements for suitable training for all those on site who have responsibility for any EIMT operations which may affect safety. |
| LC 12: Duly Authorised and other Suitably Qualified and Experienced Persons | Only Suitably Qualified and Experienced Persons shall perform EIMT activities which may affect nuclear safety. |
| LC 14: Safety documentation | The safety case for the facility, including the identification of EIMT, is produced and assessed by the licensee under this condition, which also requires documentation to be submitted to ONR on request. |
| LC 15: Periodic review | The adequacy of the Licensee’s safety case should be reviewed in terms of EIMT against the current operating conditions, Operating Experience (OpEX), statutory requirements and modern techniques to ensure that there have been no significant changes sufficient to invalidate the safety case. |
| LC 17: Management systems | Adequate quality assurance arrangements shall be implemented for all EIMT activities. |
| LC 20: Modifications 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 21: Commissioning | The Licensee should take the opportunity to both demonstrate the practicality of EIMT activities and gather baseline plant data during commissioning. |
| LC 22: Modification or experiment on existing plant | Such modifications should be assessed to ensure that they do not impact adversely on EIMT and any additional EIMT for new equipment should be identified. |
| 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 interest 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 EIMT activities which may affect nuclear safety. |
| LC 26: Control and supervision of operations | EIMT activities which may affect nuclear safety shall be carried out under the control and supervision of suitably qualified and experienced persons appointed for that purpose by the licensee. |
| LC 27: Safety mechanisms, devices and circuits | EIMT activities shall not be carried out unless suitable and sufficient safety mechanisms, devices and circuits are properly connected and in good working order. |
| LC 29: Duty to carry out tests, inspections, and examinations | The licensee shall carry out such tests, inspections and examinations in connection with any plant (in addition to any carried out under LC28) as ONR may specify. |
| LC 30: Periodic shutdown | When necessary for the purposes of enabling any EIMT of any plant or process to take place, the licensee shall ensure that any such plant or process shall be shut down in accordance with the requirements of its plant maintenance schedule referred to in LC28. |
| LC 31: Shutdown of specified operations | The licensee shall, if so directed by ONR, shut down any plant, operation or process on the site within such period as ONR may specify. |

# Appendix 2 – Safety Assessment Principles

Table - SAPs applicable to EIMT activities

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| SAP | Notes: |
| MS.2: Capable organisation | The organisation should have the capability to secure and maintain the safety of its undertakings. |
| SC.2: Safety case process outputs | The safety case process should produce safety cases that facilitate safe operation. Safety case documentation should be clear and logicaly structured so that information is easily accessible to those who need to use it. This includes maintenance staff. |
| SC.4: Safety case characteristics | A safety case should be accurate, objective and demonstrably complete for its intended purpose. A safety case should identify requirements such as surveilance, maintenance ans inspection. |
| SC.6: Safety case content and implementation | The safety case for a facility or site should identify the important aspects of operation and management required for maintaining safety and how these will be implemented. The means of implementation should include the required examination, inspectoin, maintanance and testing regimes justified in or assumed by the safety case. |
| SC.7: Safety case maintenance | A safety case should be actively maintained throughout each of the lifecycle stages and reviewed regularly. |
| EKP.3: Defence in depth | Defence in Depth principles state that nuclear facilities should be designed and operated so that defence in depth against potentially significant faults or failures is achieved by the provision of multiple independent barriers to fault progression. This may include prevention of abnormal operation and failures by design, through conservative design, construction, maintenance and operation. |
| ECS.2: Safety classification of structures, systems ad components | Structures, systems and components that have to deliver safety functions should be identified and classified on the basis of those functions and their significance to safety. |
| ECS.3: Codes and standards | Structures, systems and components that are important to safety should be designed, manufactured, constructed, installed, commissioned, quality assured, maintained, tested and inspected to the appropriate codes and standards. |
| EQU.1: Qualification procedures | Qualification procedures should be applied to confirm that structures, systems and components will perform their allocated safety function(s) in all normal operational, fault and accident conditions identified in the safety case and for the duration of their operational lives. |
| ERL.2: Measures to achieve reliability | The measures whereby the claimed reliability of systems and componenets will be achieved in practice should be stated. |
| ECM.1: Commission testing | Before operating any facility or process that may affect safety it should be subject to comissioning tests defined in the safety case. |
| EAD.2: Lifetime margins | Adequate margins should exist throughout the life of the facility to allow for the effects of materials ageing and degradation processes on structures, systems and components. |
| ELO.1: Access | The design and layout should facilitate access for necessary activities and minimise adverse interactions while not compromising security aspects. |
| FA.6: Fault sequences | For each initiating fault within the design basis, the relevant design basis fault sequences should be identified. |
| FA.14: Use of PSA | PSA should inform the design process and help ensure the safe operation of the site and its facilities. |