



NUCLEAR SAFETY DIRECTORATE - BUSINESS MANAGEMENT SYSTEM			
TECHNICAL INSPECTION GUIDE GUIDANCE: LC28 EXAMINATION, INSPECTION MAINTENANCE AND TESTING (EMIT)		T/INS/028	
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Open Government Status: Fully Open		Issue Date: 03/10/05 Review Date: 31/12/10	

1. Purpose and scope

- 1.1 The purpose of this guidance is to promote a consistent approach to LC28 compliance inspection and to provide guidance to inspectors in carrying out their duties in this area. The guidance should not be regarded as either comprehensive or mandatory.
- 1.2 The guidance provided is divided into 5 main elements:
- 1) Purpose of the Licence Condition.
 - 2) Guidance on arrangements for LC28.
 - 3) Guidance on inspection of arrangements.
 - 4) Guidance on inspection of implementation of arrangements.
 - 5) Other relevant information.

2. Licence Condition

TRANSCRIPTION OF LICENCE CONDITION 28: EXAMINATION, INSPECTION, MAINTENANCE AND TESTING

28(1) The licensee shall make and implement adequate arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant which may affect safety.

28(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.

28(3) The licensee shall ensure that once approved no alteration is made to the approved arrangements unless the Executive has approved such alteration or amendment.

28(4) The aforesaid arrangements shall provide for the preparation of a plant maintenance schedule for each plant. The licensee shall submit to the Executive for its approval such part or parts of any plant maintenance schedule as the Executive may specify.

28(5) The licensee shall ensure that once approved no alteration or amendment is made to any approved part of any plant maintenance schedule unless the Executive has approved such alteration or amendment.

28(6) The licensee shall ensure in the interests of safety that every examination, inspection, maintenance and test of a plant or any part thereof is carried out:

2. by suitably qualified and experienced persons;
3. in accordance with schemes laid down in writing;
4. within the intervals specified in the plant maintenance schedule; and
5. under the control and supervision of a suitably qualified and experienced person appointed by the licensee for that purpose.

28(7) Notwithstanding the above paragraph of this condition the Executive may agree to an extension of any interval specified in the plant maintenance schedule.

28(8) When any examination, inspection, maintenance or test of any part of a plant reveals any matter indicating that the safe operation or safe condition of that plant may be affected, the suitably qualified and experienced person appointed to control and supervise any such examination, inspection, maintenance or test shall bring it to the attention of the licensee forthwith who shall take appropriate action and ensure that the matter is then notified, recorded, investigated and reported in accordance with arrangements made under LC7.

28(9) The licensee shall ensure that a full and accurate report of every examination, inspection, maintenance or test of any part of a plant indicating the date thereof and signed by the suitably qualified and experienced person appointed by the licensee to control and supervise such examination, inspection, maintenance or test is made to the licensee forthwith upon completion of the said examination, inspection, maintenance or test.

3. Purpose of Licence Condition

- 3.1 The purpose of this condition is to ensure that all plant that may affect safety, as identified in the safety case, receives regular and systematic examination, inspection, maintenance and testing (EMIT) by and under the control of suitably qualified and experienced persons (SQEPs) and in accordance with arrangements made and implemented by the site. The purpose of this maintenance is to ensure the plant remains capable of performing the function required by the safety case assumptions, with the required level of reliability.
- 3.2 The licensee should have a general maintenance catalogue covering all aspects of EMIT for all plant on site. From this catalogue plant necessary to satisfy the requirements of the safety case should be identified, and a subset of these items necessary to maintain the essential safety functions included in the EMIT requirements of the plant maintenance schedule (PMS).

- 3.3 The licensee's arrangements should include the criteria by which maintenance is specified, controlled and changed.
- 3.4 The maintenance catalogue may be produced in parts, which may be grouped in accordance with their safety significance, with the PMS establishing the principal means of meeting the requirements of the safety case.
- 3.5 Historically PMSs have been compiled on the basis of deterministic assessments of the plant required to comply with the requirements of the safety case. Necessary EMIT has then been specified to ensure that plant remains within its safe operating envelope. Later PMSs have been influenced by the evaluation of the contribution made by plant in reducing the overall risk from the site as measured by the site PSA.
- 3.6 Where a comprehensive PSA is available, essential EMIT may be biased towards a demonstration that sufficient redundant and diverse plant is available/operable to meet safety case requirements. Frequently plant availability is demonstrated through examination, inspection or test which is a requirement of the PMS or Technical Specification surveillances.
- 3.7 In cases where a PMS based on the PSA is in place, which has been produced to satisfy the requirements of LC 28(4), other invasive maintenance carried out on plant that may affect safety, must be adequately addressed by the LC28(1) arrangements.
- 3.8 LC28(1) provides for the making and implementing of arrangements in respect of all plant that may affect safety.
- 3.9 LC28(2) allows the Executive to specify submission of the arrangements or parts of arrangements made under LC 28(1) for approval. This power would be used when first these arrangements were made, not for subsequent alterations. LC28(3) ensures that where the Executive has approved arrangements the Licensee must apply for approval to amend or alter those arrangements. NII does not generally approve any part of LC28(1) arrangements.
- 3.10 LC28(4) provides for the preparation of a Plant Maintenance Schedule (PMS) and gives the power to the Executive to specify submission of the PMS or parts of the PMS for approval. LC28(5) ensures that where the Executive has approved parts of the PMS the Licensee must apply for approval to amend or alter that schedule. In the past the PMS, or significant parts of it, have been approved, but this was deemed to be too inflexible and represented an unnecessary regulatory burden on both the Licensee and NII. This approach has been discontinued on many sites. It is current NII practice to specify a high level section of the PMS, often termed the preface, for approval and this applies on all power reactor sites.
- 3.11 LC28(6) requires that every EMIT of plant is carried out by a SQEP with necessary training (ref LCs 10 and 12) in accordance with a written instruction (ref LC24) within a specified time interval. Explicitly it is expected

that this time interval will be specified in the PMS. The time interval is significant because failure to complete work within this interval would be a non-compliance with this LC. In the past NII has taken enforcement action in this area. This clause also provides for the appointment of SQEPs to control and supervise this work, in accordance with LC26.

- 3.12 LC28(7) this clause gives the Executive the power to agree to an extension of any interval specified in the PMS. At power station sites the maintenance schedule preface is approved and this describes procedures for changing the schedule and dealing with extensions to maintenance intervals. At the time this was approved, an agreement should have been issued 'agreeing to extensions to intervals specified in the maintenance schedule that are controlled in accordance with procedures specified in the Preface'.

Any other extensions to maintenance intervals are contravention of LC28 (6) unless the Executive has issued a specific agreement under LC28 (7).

- 3.13 LC28(8) requires that plant safety issues revealed during EMIT are properly notified, investigated, acted upon and reported in accordance with established site arrangements under Ref LC7.
- 3.14 LC28(9) this clause supports the requirements in LC25 for operational records by explicitly requiring dated, full and accurate reports of all activities carried out under LC28, ensuring also that the record is signed off by the SQEP who controls and supervises the work.

4. Guidance on Arrangements for LC28

- 4.1 If licensees have generic model arrangements, then it is for the site to justify any deviation from the model [note: not all licensees use generic models].
- 4.2 Arrangements to ensure that the totality of plant that may affect safety, is adequately maintained in accordance with all LC 28 licence condition requirements should be provided. The arrangements may be defined as a single document or suite of linked documents which provide the procedures and instructions to ensure that regular and systematic examination, inspection, maintenance and testing of all plant items and systems that may affect safety takes place.
- 4.3 The arrangements should provide for identifying the plant items and systems that may affect safety, for identifying the safety significance of the plant and for adequate examination, inspection, maintenance and testing activities for the identified plant.
- 4.4 The arrangements should ensure that all items and systems that contribute to performance of a safety function claimed in LC 14 documents, are required to ensure compliance with LC23 operating rules, and may be required for LC 11 emergency response, have adequate maintenance requirements.

- 4.5 The plant maintenance schedule describing the EMIT activity declared by the licensee as required to support the safety case, may be a single document or comprise several tiered parts, each tier perhaps reflecting a different level of safety significance.
- 4.6 Where the contents of the PMS are based on demonstrations of operability/availability and continuing plant reliability, then the EMIT activity identified should be sufficient to achieve adequate compliance with the assumptions contained in the site PSA. It must be ensured in such cases that the specified EMIT activities are sufficient to support the PSA predictions. In some cases the provision of PSA based "risk meters" may be incorporated into the process of decision making when carrying out the EMIT requirements.
- 4.7 The arrangements should ensure that all the required activities are carried out within time interval specified in the arrangements. If the licensee wishes to include permitted tolerances to the identified periods these should be clearly defined.
- 4.8 Where an extension of the interval for plant maintenance is required, the arrangements should identify the need to request agreement from the Executive under LC28 (7) unless the generic agreement described in para 3.12 applies. The arrangements should define how such an extension would be controlled, as this is particularly important for maintenance schedule activity.
- 4.9 The licensee's arrangements should include the means of controlling amendments to maintenance arrangements. In such cases, a modification proposal should be considered in accordance with the LC 22 arrangements.
- 4.10 Failure to comply with specified maintenance or monitoring should be investigated in accordance with the requirements of LC7.
- 4.11 Where EMIT activities that are specified in the plant maintenance catalogue can only be carried out during a plant shutdown, the maximum operating period between periodic shutdowns should be defined.
- 4.12 The arrangements should ensure that suitably qualified and experienced persons having been trained for and appointed to the task, in accordance with LCs 10 & 12, carry out EMIT on all items that may affect safety.
- 4.13 The arrangements should ensure that all activities would be carried out in accordance with written instructions in accordance with LC24. There should be a system for ensuring a clear auditable trail from the specified maintenance requirements to the work instruction. The instructions should identify the work that is required, the acceptance criteria (if appropriate) and the safety precautions that must be taken.
- 4.14 The arrangements may allow for maintenance, inspection, examination and testing to be carried out by employees of the licensee on the site or by people not directly associated with the site, such as staff from the licensee's HQ

departments, contractors or external agencies. The arrangements should ensure that all workers comply with the requirements of LCs 10 & 12 prior to the work being authorised.

- 4.15 The arrangements should ensure that all work will be done under the control and supervision of a suitably qualified and experienced person appointed for that purpose by the licensee, in accordance with LC 26.
- 4.16 Records of maintenance carried out on plant that may affect safety should be compiled and retained by the licensee in accordance with LCs 6 & 25.
- 4.17 The arrangements should ensure that the requirements in LC28(8) and (9) for notifying, reporting, recording, investigating and remedying defects or deficiencies revealed by the examination, maintenance, inspection or test meet the requirements of LC22 and LC7 in particular, and that adequate records of such incidents are kept in accordance with the requirements of LC 25.
- 4.18 The arrangements should allow for plant to be taken out of service and ensure that such unavailability is recorded, assessed and drawn to the attention of staff responsible for operating the plant according to LCs 23 & 27 requirements. In ensuring that sufficient items of plant remain in service or available for use to provide the level of safety required by the safety case, an assessment of the effect of such activity on overall risk may be included.
- 4.19 The arrangements should ensure that plant or systems that have had preventive or breakdown maintenance carried out are reinstated and tested prior to being declared operable and available within the plant operability requirements. Before the plant or system is returned to service, the responsible person(s) should accept it.
- 4.20 The arrangements should ensure that replacement of plant items is controlled with respect to design, procurement, storage, issue, fitness for purpose and installation. The arrangements should ensure that suitably qualified and experienced persons control these aspects and complete appropriate records.
- 4.21 The arrangements should identify the person who has responsibility for reporting any non-compliance with established arrangements to the appropriate body.
- 4.22 The arrangements should ensure that, where necessary, a Licence Instrument or Approval is obtained from the Executive, where this is required for modifications to the arrangements, PMS changes or extension of PMS intervals before implementation. The person(s) responsible for ensuring compliance with this requirement should be identified in the arrangements.
- 4.23 The arrangements should enable the licensee to respond to any Specification from the Executive. Such arrangements should identify the person responsible for responding to the Specification and should identify the system

whereby constraints, caveats or conditions imposed by the Executive are implemented.

- 4.24 Where NII have responsibility of ensuring adequacy of plant under a MoU, for example with EA, SEPA or OCNS, it should be ensured that the site arrangements adequately address these responsibilities.

5. Guidance on Inspection of Arrangements

- 5.1 This part of the guidance is to assist inspectors in judging the adequacy of the licensee's arrangements. The following list is neither exclusive nor exhaustive and will be subject to review and revision in light of operational experience. However it provides a list of aspects of LC28 compliance requirements that might be examined during routine inspections carried out on the basis of sampling.
- 5.2 Establish what the licensee has specified in the site licence compliance arrangements to address the requirements of LC28.
- 5.3 Check that arrangements have been implemented to demonstrate compliance with LC28.
- 5.4 Sample the arrangements to determine that:
- The format is consistent.
 - They remain valid following any changes.
 - Note whether instructions, methods and quality assurance procedures have been followed.
 - The arrangements adequately describe the methods and criteria for identifying the safety significance of all plant items and systems, and identify the safety significance of all examination, inspection, maintenance and test activities.
 - All items and systems having safety significance, including those required for emergency situations, are included in the maintenance catalogue.
 - Confirm whether the plant maintenance schedule is a single document or comprise several parts, if the latter option is chosen, the plant maintenance schedule is produced in a tiered format, each tier or part reflecting safety significance.
 - Where work activities that are specified in the plant maintenance catalogue can only be carried out with the plant shutdown, the

arrangements should define the maximum operating period between periodic shutdowns.

- The arrangements should, for each item listed, identify the period for such examination, inspection, test or maintenance activity, where included tolerances to the identified periods must be clearly defined.
- The completeness of the plant maintenance catalogue following from the plant safety case. Changes to the catalogue require a safety justification produced and assessed in accordance with LC14 arrangements and regulated under LCs 20 & 22 as appropriate, with failures to meet requirements should be investigated in accordance with LC7.
- All those items listed in the maintenance catalogue should be properly maintained, inspected, examined or tested in accordance with the arrangements by suitably trained, qualified and experienced persons appointed for the task, as required by LCs10, 12 & 26.
- All maintenance activities should be carried out in accordance with written instructions that are consistent with LC24 arrangements. There must be a system for ensuring a clear auditable trail from the plant maintenance catalogue to the work instruction. The instructions must identify the work that is required, the acceptance criteria (if appropriate) and the precautions that must be taken.
- All the required maintenance activities should be carried out at or before the time interval specified in the maintenance catalogue.
- Intervals in the plant maintenance schedule should not be extended without the agreement of the Executive unless covered by a generic agreement as described in para 3.12. The arrangements should describe the appropriate control and authorisation measures.
- The arrangements may allow for maintenance, inspection, examination and testing to be carried out by people not directly associated with the site, such as staff from the licensee's HQ departments, contractors or external agencies. In this case confirm they ensure that the qualifications and experience of such workers are checked and approved prior to the work being authorised. Check that the arrangements specify the person responsible for ensuring that migrant workers are suitably qualified and experienced persons.
- All work should be done under the control and supervision of a suitably qualified and experienced person appointed for that purpose by the licensee, as required by LCs 12 & 26.
- The arrangements should require that:

- i) plant or system defects discovered during the course of maintenance, examination, inspection or test, will be reported to the person controlling the work;
 - ii) persons controlling the work will ensure that the defect is brought to the attention of the appropriate person on the site;
 - iii) notification, recording and investigation of any defect is completed if appropriate under the arrangements required by LC7;
 - iv) action necessary to rectify defects are carried out in accordance with the requirements of LC22 (except where rectification is carried out using "like for like" replacements), and that the safety significance of the defect is reviewed; and
 - v) full and accurate records of the action taken are made by the person appointed to control and supervise the activity.
- When plant is taken out of service it is important the arrangements ensure that sufficient items of plant remain in service or available for use to provide the necessary level of safety that it justified in the plant safety case, this may be informed by assessments of risk for sites with a developed PSA, and may include a contribution from a site "risk-meter".
 - Plant or systems that have had preventive or breakdown maintenance carried out are reinstated, tested and accepted by the responsible person before being returned to service.
 - Replacement of plant items should be controlled with respect to design, specification, manufacture, function, procurement, storage, issue, fitness for purpose and installation. The arrangements must ensure that suitably qualified and experienced persons control these aspects and complete appropriate records.
 - If any parts of either the approved arrangements or the approved plant maintenance schedule are to be changed, an approval must first be obtained from the Executive.
 - The arrangements should:
 - i) include a system for submission for approval to the Executive those part of parts of the arrangements that may be specified, including the identities of the responsible persons; and
 - ii) contain such controls that any consequent amendments only take place with the Executive's approval.

6. Guidance on Inspection of Implementation of Arrangements

6.1 This part of the guidance is to assist inspectors in judging the adequacy of the Licensee's implementation of their arrangements. The following list is neither exclusive nor exhaustive and will be subject to review and revision in light of operational experience. It does however, provide a hit list of aspects of LC28 that can be examined during routine inspections.

6.2 Endeavour to confirm on a sampling basis that:

- Maintenance work has been carried out to an authorised and validated instruction. Identify any requirements on the works order card in terms of qualifications and experience, special parts, particular features to be examined and results required to be recorded and check that there has been compliance with these requirements.
- Sample results from inspection and testing activities of plant listed in the plant maintenance catalogue and compare with the criteria that are required to satisfy operating rule, Technical Specification, surveillance, equipment qualification schedule, operating instruction, maintenance instruction or emergency requirements. Discuss findings with the appropriate licensee's representative.
- Sample maintenance instructions or other adopted systems such as work order cards and check they have been completed to the detail required in the system. Check that the plant was deemed fit for purpose at the end of the specified activity. Check that any comments from the person who completed the work have been followed up, and discuss with the responsible person as necessary for those items that are safety related.
- If repair/refurbishment has been required, confirm that such repair or refurbishment has been completed, and any tests required were performed satisfactorily, completed and recorded at an appropriate time before the plant was declared in service.
- Sample completed work order cards and associated specifications and result sheets. Check that details specified in the authorised instruction have been completed and signed off. Check that the works order cards/result sheets when completed are stored in an appropriate manner and are readily available in accordance with LC25 requirements.
- Establish if the correct stores items have been received, stored and identified as nuclear safety related plant spares and issue of such is controlled to ensure the correct use. Such control shall include a fitness for purpose check by a SQEP on receipt of the item to the stores and prior to use.

- Sample the records for LC22 to establish whether the modifications procedure was invoked where alternative items have been used during plant maintenance. If so follow up to see that such items are fit for purpose.
- If any modifications have required changes or additions to be made to the plant maintenance catalogue, and have been identified in the modifications register. Ensure that such changes or additions have been incorporated into the plant maintenance catalogue, the work planning system and have been implemented.
- Activities identified during shutdown should be detailed and included in the programme for the next periodic shutdown. For those plant items that support operating rules, check that the required availability with respect to plant taken out of service was met.
- For decommissioning sites ensure that a progressive review of the plant maintenance schedule is carried out to ensure that the contents relate to the current safety case and hazard, and that changes to the PMS are properly controlled using the LCs.
- Review the nuclear safety committee minutes for any topic that may be relevant to this condition. Follow up with the responsible person during the next site visit.
- The suitability of maintenance staff may be sampled by:
 - i) discussing with the person carrying out examination, inspection, maintenance or testing of plant, details of their task. During such discussions try and identify if the person is suitably qualified and experienced, if in doubt check the training records of the person. Similarly confirm that migrant workers are subject to an equivalent regime:
 - ii) reviewing with the appropriate section head that those persons controlling and supervising activities have suitable job specifications identifying their responsibilities and that their training is current and valid; and
 - iii) reviewing with the training personnel and examine records to establish that persons responsible for completing activities are suitably qualified and experienced.
- If an interval in the plant maintenance schedule has been extended, establish that either the Executive has issued an agreement or it has been done under procedures included in the generic agreement as described in para 3.12.
- The way plant defects are handled:

- i) examine a sample of defect cards in whatever form they are held and check what follow up actions were identified;
- ii) for defect cards examined under (1) above, check implications of the defect (specific and generic) and recommended investigation and reporting requirements. If it is considered that the defect has safety significance then further check that the requirements of LC7 have been met;
- iii) review a sample of defect cards that required action to be taken and check that such action(s) were completed and signed off;
- iv) examine a sample of defect cards to establish that for activities (with the greatest nuclear significance) that defects only occur on an infrequent basis. For those activities contained in the remainder of the maintenance catalogue establish that there is not a rising trend in the number of defects and discuss with the person responsible as necessary; and
- v) review any defects of safety significance with the appropriate personnel and establish if changes to the safety case are needed. If so follow up under LCs 14 and 22.

7. Other Relevant Information

7.1 As already mentioned in this guide, one format for LC28 arrangements is a tiered plant maintenance schedule.

7.1.1 The top tier (Part 1) of the plant maintenance schedule might contain work on all items or processes that have a major effect on safety. For example, this part might include the main examination, inspection, maintenance and testing activities of:

- i) all plant or systems that are required to demonstrate compliance with the plant safety case, including the PSA, to include for example safety circuits, devices and mechanisms, essential electrical supplies systems and emergency equipment;
- ii) all plant or systems that would be necessary to prevent or control the release of radioactivity for example, primary containment structures and filtered ventilation systems; and
- iii) all plant or systems that would be necessary to ensure safe conditions for example reactor shutdown systems and decay heat removal systems.

7.1.2. The second tier (Part 2) might contain plant and systems that have an effect on safety and plant operability. For example this part might include:

- i) all plant and systems which, if they failed could lead to a release of radioactivity, the exposure of the work force to radiation or the radioactive contamination of plant or equipment for example glove boxes containing low active material;
- ii) all plant and systems which provide support for the main safety systems for example power supply systems for reactor guarding systems; and
- iii) all plant and systems that are necessary for reliable operation.

7.1.3. The third tier (Part 3) might contain all other plant and systems that have a lesser effect on safety. This part might include other plant or systems that if considered for modification under the arrangements for modifications on existing plant (see guidance on LC22 arrangements) might constitute a lower category modification:

- i) this part of a plant maintenance schedule for power reactors might include such items as the turbine cooling water systems etc.

7.2 Other formats for LC28 arrangements may be chosen by the licensee, and in all cases the preceding information might be used as guidance to decide on the adequacy of the specific arrangements made.

7.3 Sites that have a developed PSA may have a PMS that is based mainly on examination, inspection or test to demonstrate operability, availability and reliability, as assumed in the PSA determination of overall risk. In these cases it must be ensured that arrangements to control all other aspects of EMIT on plant which may affect safety, are adequate, as required by LC28(1).

7.4 For sites that have Technical Specifications, surveillance and equipment qualification (EQ) arrangements, EMIT requirements may be met through these provisions. In these cases it must be ensured that control of surveillances is adequate, and that sufficient EMIT is carried out to continue to meet the equipment qualification schedule requirements, support the PSA assumptions and meet the safety case commitments. In these cases, it must also be ensured that arrangements to control all other aspects of EMIT on plant that may affect safety are adequate, as required by LC28(1).