

<b>LC21: Commissioning</b>			
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# 1. Introduction

- 1.1. Many of the licence conditions attached to the standard nuclear site licence require, or imply, that licensees should make arrangements to comply with regulatory obligations under the conditions. ONR inspects compliance with licence conditions, and also with the arrangements made under them, to judge the suitability of the arrangements made and the adequacy of their implementation. Most of the standard licence conditions are goal setting, and do not prescribe in detail what the licensees' arrangements should contain; this is the responsibility of the duty-holder who remains responsible for safety. To support inspectors undertaking compliance inspection, ONR produces a suite of guides to assist inspectors to make regulatory judgements and decisions in relation to the adequacy of compliance, and the safety of activities on the site. This technical inspection guide (TIG) is one of the suite of documents provided by ONR for this purpose.

# 2. Purpose and Scope

- 2.1. The purpose of this guidance is to facilitate a consistent approach to LC 21 compliance inspection and to provide assistance to inspectors while carrying out their duties in this area. The guidance should not be regarded as mandatory. Although every attempt has been made to deal with all the key features that are likely to arise in inspecting for compliance with this licence condition, additional aspects may need to be examined to ensure a comprehensive and complete inspection.
- 2.2. The guidance does not indicate when or to what extent these compliance inspections should be made as these matters are covered in individual inspectors' inspection programmes.
- 2.3. The guidance provided is split into four main elements:
- 1) Purpose of the Licence Condition
  - 2) Guidance on arrangements for LC 21
  - 3) Guidance on inspection of arrangements
  - 4) Guidance on inspection of implementation of arrangements

### 3. Licence Condition 21: Commissioning

21(1) The licensee shall make and implement adequate arrangements for the commissioning of any plant or process which may affect safety.

21(2) The licensee shall submit to ONR for approval such part or parts of the aforesaid arrangements as ONR may specify.

21(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless ONR has approved such alteration or amendment.

21(4) The aforesaid arrangement shall where appropriate divide the commissioning into stages. Where ONR so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the commissioning without the consent of ONR. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed commissioning and shall, where appropriate, provide for the submission of this documentation to ONR.

21(5) The licensee shall appoint a suitably qualified person or persons for the purpose of controlling, witnessing, recording and assessing the results of any tests carried out in accordance with the requirements of the aforesaid commissioning arrangements.

21(6) The licensee shall ensure that full and accurate records are kept of the results of every test and operation carried out in pursuance of this condition.

21(7) The licensee shall ensure that no plant or process which may affect safety is operated (except for the purpose of commissioning) until:

- a) the appropriate stage of commissioning has been completed and a report of such commissioning, including any results and assessments of any tests as may have been required under the commissioning arrangements referred to in paragraph (1) of this condition, has been considered in accordance with those arrangements; and
- b) a safety case or cases as appropriate, which shall include the safety implications of modifications made since the commencement of construction of the plant and those arising from the commissioning of the plant, and any matters whereby the operation of the plant may be affected by such modifications or commissioning, has been considered in accordance with the arrangements referred to in paragraph (1) of this condition.



21(8) The licensee shall, if so, notified by the ONR, submit to ONR the safety case for the aforesaid plant or processes prepared in pursuance of paragraph (7) of this condition and shall not commence operation of the relevant plant or process without the consent of ONR.

## 4. Purpose of Licence Condition

4.1. The purpose of this Licence Condition which is part of the group of conditions (LCs 19, 20, 22 and 35) is to provide a system of rigorous and appropriate regulatory control of changes to plant or processes on the licensed site. These changes may be brought about by the following means:

- Construction, modification or commissioning of new plant.
- Commissioning, modification or experiment on existing plant including any change of process.
- Commissioning of plant during the return to service from a periodic shutdown.
- Modifications to existing plant under construction shall be progressed under arrangements made under LC 20.
- A modification or experiment on an existing plant and/or changes to an existing facility or process shall be progressed under arrangements made under LC 22 as appropriate.
- Decommissioning of existing plant which has reached its design life.

4.2. The purpose of this Condition is to ensure that adequate arrangements exist for the commissioning of a new plant or equipment or modified plant or process which may affect safety, these arrangements should:

- Verify that structures, systems and components fulfil the design safety objectives through corresponding acceptance criteria.
- Validate those operating procedures and surveillance procedures for which the commissioning tests provide representative activities and conditions.
- Validate by testing/trial so far as reasonably practicable, that the facilities, surveillance and emergency procedures are adequate.
- Familiarise the operating, maintenance and technical staff with the operation of the plant or equipment.
- Facilitate the collection of baseline data for equipment and systems for future reference.

4.3. The term "commissioning" is defined in Condition 1(1) and this condition applies to all commissioning activities whether on new or existing plant. The purpose of commissioning testing is to verify that the plant performs in the



way expected by the designer and which was assumed in the plant's safety case. The tests performed should provide a progressive and systematic challenge and validation of the plant up to full design specification.

- 4.4. Specific requirements for decommissioning, including strategies and programmes, shall be progressed under arrangements made under LC 35.

## 5. Guidance on Arrangements for LC21

- 5.1. In addition to the general requirements for all Licence Conditions the licensee's arrangements shall satisfy the specific Licence Condition requirements which are:
- 1) A clear requirement that the arrangements cover commissioning of any plant or process which may affect safety. 21(1)
  - 2) The requirement to submit for approval to ONR those parts of the arrangements ONR may specify. 21(2)
  - 3) The requirement that once approved by ONR arrangements cannot be altered without the approval of ONR. 21(3)
  - 4) The requirement to allow, where appropriate, the commissioning to be divided into stages. 21(4)
  - 5) The requirement that where ONR specifies a hold point, the licensee shall not commence nor proceed from one stage to the next without the consent of ONR thereby providing regulatory control in the implementation process. 21(4)
  - 6) The requirement for the provision of adequate safety documentation to justify the safety of the commissioning and where appropriate, provide for the submission of this documentation to ONR. 21(4)
  - 7) The requirement to appoint a suitably qualified person or persons for, controlling, witnessing, recording and assessing the results of any commissioning tests. 21(5)
  - 8) The requirement to keep full and accurate records of commissioning tests and operations. 21(6)
  - 9) The requirement to ensure that no plant or process which may affect safety is operated (except for the purposes of commissioning) without:
    - i. a report of each stage of commissioning having been completed and considered; 21(7a)
    - ii. a safety case which shall include any modifications arising as a result of commissioning having been considered. 21(7b)
  - 10) The requirement if so, notified by ONR to submit a safety case for operation of the plant and not to commence operation of the plant without the consent of ONR. 21(8)



- 11) It is during commissioning that the systems comprising the plant or process are tested and the arrangements should ensure a structured, systematic approach with appropriate controls at all stages.
- 5.2. Commissioning requirements may be captured in a LC 22 submission for modifications to existing plants provided that there is clear linkage between the arrangements under LCs 20, 21 and 22

## 6. Guidance on Inspection of Arrangements for LC21

- 6.1. Arrangements shall address the licence condition requirements.
- 6.2. The following list includes elements of good practice which have been compiled from information currently available. This list is neither exclusive nor exhaustive and will be subject to review and revision in the light of operational experience. Good practice elements may exceed the minimum compliance requirements.
- a) If licensees have generic model(s) for arrangements then it is for the site or in the case of multi-plant sites the facility, to justify any deviation from the model(s). Site staff should be able to demonstrate how their arrangements meet the regulatory requirements. [Note: not all licensees use generic models].
  - b) Arrangements should demonstrate that the facility “as built” meets relevant safety criteria, including safety function; and can be safely operated within the limits set out in its safety case.
  - c) Arrangements should enable the production of a programme of safety commissioning activities that will so far as reasonably practicable, demonstrate at each stage of the commissioning process:
    - i. The safe functioning of all systems and equipment.
    - ii. Prove all safety claims.
    - iii. Confirm safety assumptions and the effectiveness of all safety related procedures.
    - iv. Clearly identify those aspects of safety that cannot be demonstrated inactively.
  - d) Arrangements should ensure that in undertaking modular or phased commissioning the licensee has adequately demonstrated that the system as a whole meets the “design intent” and safety objectives.
  - e) On large or complex projects such as new nuclear build the arrangements should require the production of a commissioning strategy or other similar document setting out how commissioning will be organised and managed. Furthermore, the move from construction/installation (LC19) to commissioning (LC21) in large projects may be staggered across systems and in such cases the arrangements need to clearly describe how this is to be managed.



- f) Arrangements should clearly define the commissioning organisation and should ensure that adequate organisational resources are available to support commissioning prior to each stage of commissioning commencing.
- g) Arrangements should include a requirement for modification proposals to commissioning instructions to be systematically compiled, reviewed, assessed, revised, extended, validated, verified, approved or cancelled by Suitably Qualified and Experienced Persons (SQEPs)/ Duly Authorised Persons (DAPs). Where appropriate, independent company safety departments and expert staff should also confirm satisfaction with the proposal. Arrangements should require that there is a clear linkage to other supporting arrangements e.g., LC 12 Duly Authorised and other Suitably Qualified and Experienced Persons, LC14 Safety Documentation, LC20 Modification to Design of Plant Under Construction, LC22 Modification and Experiment on Existing Plant, LC24 Operating Instructions and LC28 Examination, Inspection Maintenance and Testing, LC35 Decommissioning.
- h) Arrangements should include provisions to ensure that operating and maintenance personnel participate in commissioning activities as far as reasonably practicable.
- i) Arrangements should include a system for classification by safety significance, based on hazard, for the commissioning, installation or modification of plant which takes due recognition of the works being inadequately conceived or executed and should include a review process for each classification commensurate with safety significance. This should include referral to the relevant safety committee or Nuclear Safety Committee (NSC) as appropriate.
- j) Arrangements should be specific about assuming the worst that can happen, i.e., inadequately conceived or executed, without reference to risk. Classification systems should apply reasoned judgement in their approach and final outcome. It is good practice for classification systems to have categories linked to potential doses, to members of the public and workers on the site. Where there is the potential for significant off-site doses (e.g., doses in excess of 1 mSv for members of the public) or where dose limits for workers on the site could exceed legal limits, such proposals should be referred to ONR as well as clearing the licensee's own due process.
- k) The classification system for safety significance should be consistent with that used for LC19, 20, 22 and 35.



- l) Arrangements should allow ONR to agree or acknowledge and opt in or out of regulatory hold points as appropriate (flexibility for ONR permitting activities).
- m) Arrangements should identify the requirements for commissioning proposals to include adequate time for assessment of safety submissions by ONR and, where appropriate, other regulators. This time should be independent of that required for their own internal peer review processes, which should be complete before formal submission to the regulators.
- n) Arrangements should be in place for tracking all commissioning work activities and linkages between them.
- o) Arrangements should be in place for tracking and progressing technical queries, concessions, omissions, non-conformities and modifications arising from commissioning activities including the potential for the aggregation of concessions needs to be actively managed.
- p) Arrangements should require that commissioning is undertaken in accordance with a quality plan or similar scheme which addresses:
- q) all hazards during commissioning (nuclear, conventional, environmental);
  - i. procedures - what needs to be done - how it is done - how it is closed out;
  - ii. the identification of the decommissioning records to be kept
  - iii. issues tracking and close-out;
  - iv. responsibilities and how the licensee controls the work of contractors;
  - v. the requirement for contractors to comply with licensee's arrangements and system of work.
- r) Arrangements should ensure that commissioning activities consider the wider impact on an existing facility's safety case or the safety case for a new facility.
- s) Arrangements should recognise that where appropriate and notwithstanding the requirement for installation tests, some benefit may be claimed for inactive commissioning activities undertaken outside controlled areas and/or at manufacturer's works.



- t) Arrangements should recognise that where appropriate benefit may be claimed for the results from First Plant Only Tests (FPOT) conducted during commissioning of the first unit of a kind to characterise the performance or behaviour of a system or component.
- u) Arrangements should identify the requirement for a progressive challenge to commission the plant demonstrating that the plant can be safely operated in accordance with the operational limits and conditions. Such stages may include inactive and trace active before fully active commissioning.
- v) Arrangements should identify where performance testing of a facility or plant equipment requires a steady state of operation to determine whether the structures, systems and components are operating according to specifications.
- w) Appropriate emergency response arrangements under LC11 should be in place and should be tested before the commencement of active commissioning. In preparing emergency response arrangements for the commissioning stage, account should be taken of the fact that construction related hazards may still exist.

## 7. Guidance on Inspection of Implementation of Arrangements for LC 21

- 7.1. Inspectors are required to apply their experience and discretion to determine the extent and depth of a particular inspection taking due account of a number of factors such as safety significance, complexity, importance and technical specialism of the area.
- 7.2. Inspectors should establish with the licensee the point at which the plant status moves from one of "installation" to one of "commissioning" and when commissioning has been declared completed by an appropriate authority.
- 7.3. The following list of areas for inspection of the implementation of arrangements for compliance with LC 21 has been compiled from best information available. This list is neither exclusive nor exhaustive and will be subject to review and revision in light of operational experience.
  - a) Sample check that licensees have a process for commissioning that is fit for purpose with adequate arrangements for oversight and control of the commissioning activities, (i.e., Technical Queries (TQs) have been appropriately addressed before moving from non-active to active commissioning).
  - b) Sample check that commissioning is undertaken in stages commensurate with the safety significance, (hazard presented both nuclear and conventional) and complexity of the plant to provide a progressive and systematic challenge and validation of the plant up to its full design specification.
  - c) Inspectors should ensure, as appropriate, that adequate justification is provided for crediting the results from FPOTs conducted during the commissioning of the first unit of a kind. The Nuclear Energy Agency's Multinational Design Evaluation Programme (MDEP) for new nuclear power reactor designs, of which ONR is a member, has prepared a common position paper [1] to provide guidance for vendors/ licensees intending to take credit for a FPOT performed during the commissioning of the first unit of a kind.
  - d) Inspectors should ensure that the licensee identifies when the operating rules, safety mechanisms, devices and circuits, and maintenance schedule take effect. This point should occur prior to the introduction of radioactive material and becomes the point at which commissioning may attract more rigorous scrutiny from inspectors and may require the



identification of a subset of the full operating rules or even additional rules specifically designed for the particular phase of commissioning.

- e) Sample check how licensee's safety classification system for commissioning has been used, challenge as necessary.
- f) Sample check that for the different commissioning stages, the safety functions for all conditions considered in the safety case have been met.
- g) Sample check that appropriate safety equipment is in place and tested and maintained and that appropriate liaison takes place with other regulatory bodies on topics such as Construction Design Management (CDM) regulations, fire certificate, discharge authorisations, prior to the commencement of that commissioning stage.
- h) Sample check that adequate provisions are made for putting appropriate emergency arrangements into effect for commissioning activities.
- i) Sample check for clear linkages between safety commissioning schedule(s) and safety case requirements.
- j) Sample check that commissioning schedules are supported by commissioning written instructions. Sample check the application of the licensee's process for progressing issues arising from commissioning including technical queries, concessions omissions and modifications.
- k) Sample check the licensee's control of implementation of commissioning including:
  - i. whether key responsibilities are clearly defined and recognised, and are captured in the Nuclear Baseline, (including appropriate role/post profiles);
  - ii. that there are sufficient competent personnel to support the applicable commissioning phase.
  - iii. whether suitable and sufficient instructions have been written for significant on-site activities e.g., procedures, method statements, worksheets;
  - iv. whether arrangements for calibration of any test equipment associated with commissioning is adequate;
  - v. whether the supporting systems of work address all hazards, maintenance during commissioning and update of plant maintenance schedule; control of temporary commissioning aids e.g., control & instrumentation (C&I) hardwired links, isolations, spades in process lines.



- l) Where there is significant contractor work involved in the design / substantiation and management of the project, sample check whether control and supervision of staff and contractors is adequate. Sample check the licensee's system for appointing SQEPs to undertake commissioning, their level of independence, their level of challenge and the considered use of independent experts to provide appropriate challenge. This balance should be dependent upon the safety significance of the plant or equipment and the commissioning phase being considered.
- m) Sample check that licensee operating, and maintenance personnel are sufficiently involved in commissioning activities to become familiar with plant/ equipment.
- n) Sample check that the arrangements include validation of those operating procedures for which the commissioning tests provide representative activities and conditions, and to validate by trial use, to the extent practicable, that the facility's operating procedures are adequate.
- o) Sample check that the guidance on commissioning described in ONR Guide NS-TAST-GD-028 Control and Instrumentation [2] aspects of nuclear plant commissioning are adequately captured in the licensee's arrangements.
- p) Sample check witnessed commissioning tests and records for adequate completion in accordance with the licensee's arrangements and that adequate provision has been made for their eventual transfer to the licensee.
- q) Sample check the use of Operational Experience (OPEX) in commissioning.
- r) Sample check the use of As Low As Reasonably Practicable (ALARP) justifications for substantiation of equipment or commissioning activities.
- s) Sample check that Human Factors have been adequately considered.
- t) Sample check that a report is completed for each commissioning stage and considered by an appropriate overseeing body according to its safety classification, before commencement of the next commissioning stage.
- u) Sample check that, where relevant, the results of such tests are integrated into the safety case.
- v) Sample check the implementation of arrangements for tracking and progressing Technical Queries/problems/issues/shortfalls, their safety



significance and their resolution within the identified commissioning phases.

- w) Sample check that the licensee has appointed a suitable qualified person or persons for the purpose of controlling, witnessing, recording and assessing the results of any commissioning tests – LC 21 (5).
- x) Sample check that the licensee’s arrangements ensure that full and accurate records are kept of the result of every test and operation carried out in pursuance of commissioning – LC 21(6). These records should include all test reports, stage reports, records of deficiencies and reservations during commissioning, certificates, plant and system handover documents and supporting documentation.
- y) Identify and sample any novel or complex commissioning activities, or where the commissioning activities impact on operating plant.
- z) Where a Consent is required to proceed beyond a hold point, sample check that licensees’ due process has been completed in addition to the elements listed in 7.3 above.

## 8. Safeguards Requirements

- 8.1. Regulation 3 of the Nuclear Safeguards (EU Exit) Regulations 2019 (NSR19) makes specific requirements of operators regarding the timeliness of submitting Basic Technical Characteristics (BTC) documents to ONR at different stages of plant commissioning. Such BTCs contain safeguards relevant aspects of facility design and their timely submission is the basis for early safeguards engagement with ONR and, if necessary, the IAEA. Inspectors should contact ONR Safeguards to ensure that the requirements for BTCs in NSR19 have been complied with for each stage of the commissioning process.

## 9. Further Reading

IAEA guidance SSG-28 “Commissioning for New Power Plant” [http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1595\\_web-30214867.pdf](http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1595_web-30214867.pdf)

IAEA Specific Safety Requirements SSR 2/2 <https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1716web-18398071.pdf>

Nuclear Safety Technical Assessment Guide, NS-TAST-GD-028, [http://www.onr.org.uk/operational/tech\\_asst\\_guides/ns-tast-gd-028.pdf](http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-028.pdf)

IAEA Nuclear Energy Series, NP-T-2.10, Commissioning Guidelines for Nuclear Power Plants, [https://www-pub.iaea.org/mtcd/publications/pdf/p1742\\_web.pdf](https://www-pub.iaea.org/mtcd/publications/pdf/p1742_web.pdf)

## 10. References

[1] Nuclear Energy Agency, “MDEP, CP-STC-01, Common Position Addressing First Plant Only Tests, Version 1, April 2018 (2019/46062)”.

[2] ONR, “NS-TAST-GD-028 - Control and Instrumentation”.

## 11. Definitions

ALARP	As Low As Reasonably Practicable
C&I	Control and Instrumentation
CDM	Construction Design and Management Regulations
DAP	Duly Authorised Person
FPOT	First Plant Only Test
LC	Licence Condition
MDEP	Multinational Design Evaluation Programme
NSC	Nuclear Safety Committee
ONR	Office for Nuclear Regulation
OPEX	Operational Experience
SQEP	Suitably Qualified and Experienced Personnel
TQ	Technical Query