

End-point assessment plan for Nuclear reactor desk engineer

Apprenticeship standard reference number	Apprenticeship standard level	Integrated end-point assessment
ST0784	6	No

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Introduction and overview

This document sets out the requirements for end-point assessment (EPA) for the Nuclear reactor desk engineer apprenticeship standard. It explains how EPA for this apprenticeship must operate.

It provides the EPA design requirements for end-point assessment organisations (EPAOs) for this apprenticeship standard. It will also be useful for apprentices undertaking this apprenticeship, their employers and training providers.

EPA must be conducted by an EPAO approved to deliver EPA for this apprenticeship standard. Each employer should select an approved EPAO from the Education & Skills Funding Agency's Register of end-point assessment organisations (RoEPAO).

Full-time apprentices will typically spend 30 months on-programme (before the gateway) working towards this occupational standard. All apprentices must spend a minimum of 12 months on-programme. All apprentices must spend a minimum of 20% of on-programme time undertaking off-the-job training.

Before starting EPA, an apprentice must meet the gateway requirements. For this apprenticeship they are:

- the employer must be content that the apprentice is working at or above the occupational standard
- apprentices must have achieved English and mathematics at Level 2¹
- apprentices must have compiled and submitted a portfolio of evidence to underpin the interview

The EPAO must confirm that all required gateway evidence has been provided and accepted as meeting the gateway requirements. The EPAO is responsible for confirming gateway eligibility. Once this has been confirmed, the EPA period starts. This EPA should then be completed within an EPA period lasting typically for four months.

This EPA consists of three discrete assessment methods.

¹ For those with an education, health and care plan or a legacy statement, the apprenticeship's English and mathematics minimum requirement is Entry Level 3. British Sign Language (BSL) qualifications are an alternative to English qualifications for those who have BSL as their primary language.

It will be possible to achieve the following grades in each end-point assessment method:

Assessment method 1: **Multiple-choice test:**

- fail
- pass

Assessment method 2: **Practical demonstration and professional discussion:**

- fail
- pass

Assessment method 3: **Interview underpinned by a portfolio of evidence:**

- fail
- pass

Performance in these end-point assessment methods will determine the overall apprenticeship standard grade of:

- fail
- pass

Summary table

On-programme (typically, 30 months)	<p>Training to develop the knowledge, skills and behaviours (KSBs) of the occupational standard.</p> <p>Training towards English and mathematics Level 2, if required.</p> <p>Compiling a portfolio of evidence.</p>
End-point assessment gateway	<p>The employer must be content that the apprentice is working at or above the level of the occupational standard.</p> <p>Apprentices must have achieved English and mathematics at Level 2.</p> <p>For the interview, apprentices must have compiled and submitted a portfolio of evidence.</p> <p>For the practical demonstration and professional discussion and multiple-choice test, there are no specific requirements to submit supporting materials.</p>
End-point assessment (typically, four-months)	<p>Grades available for each assessment method</p> <p>Multiple-choice test:</p> <ul style="list-style-type: none"> • fail • pass <p>Practical demonstration and professional discussion:</p> <ul style="list-style-type: none"> • fail • pass <p>Interview underpinned by a portfolio of evidence:</p> <ul style="list-style-type: none"> • fail • pass <p>Overall EPA/apprenticeship can be graded</p> <ul style="list-style-type: none"> • fail • pass
Professional recognition	<p>This apprenticeship standard has professional recognition.</p> <p>The Nuclear Institute:</p> <ul style="list-style-type: none"> • Membership (MNUCL)

Length of EPA period

The EPA will be completed within an EPA period lasting typically for four months, starting when the EPAO has confirmed that all gateway requirements have been met.

EPA gateway

The apprentice should only enter the gateway once the employer is content that the apprentice is working at or above the level of the occupational standard. In making this decision, the employer may take advice from the apprentice's training provider(s), but the decision must ultimately be made solely by the employer.

The EPAO determines when all other gateway requirements have been met, and the EPA period will only start once the EPAO has confirmed this.

In addition to the employer's confirmation that the apprentice is working at or above the level of the occupational standard, the apprentice must have completed the following gateway requirements prior to starting EPA:

- achieved English and mathematics at Level 2. For those with an education, health and care plan or a legacy statement, the apprenticeship's English and mathematics minimum requirement is Entry Level 3. British Sign Language (BSL) qualifications are an alternative to English qualifications for those who have BSL as their primary language
- for the interview, compiled and submitted a portfolio of evidence – see below
- for the practical demonstration and professional discussion, and multiple-choice test, there are no specific requirements to submit supporting materials

Portfolio of evidence requirements:

- apprentices must compile a portfolio of evidence during the on-programme period of the apprenticeship
- it must contain evidence related to the KSBs that will be assessed by the interview
- the portfolio of evidence will typically contain ten discrete pieces of evidence
- evidence should be mapped by the apprentice against the KSBs assessed by the interview
- evidence may be used to demonstrate more than one KSB; a qualitative as opposed to quantitative approach is suggested
- evidence sources may include:
 - workplace documentation, for example workplace policies/procedures, records, work control cards/job sheets/work requests, control room log sheets or records signed and dated by shift manager simulator training records/assessment sheets
 - witness statements
 - annotated photographs
 - photo / video of control room / simulator white boards – subject to security restrictions
 - video clips (maximum total duration 10 minutes); the apprentice should always be in view and identifiable

This is not a definitive list; other evidence sources are possible.

- it should not include reflective accounts or any methods of self-assessment
- any employer contributions should focus on direct observation of performance (for example witness statements) rather than opinions
- the evidence provided must be valid and attributable to the apprentice; the portfolio of evidence must contain a statement from the employer and apprentice confirming this
- the portfolio of evidence must be submitted to the EPAO at the gateway

The portfolio is not directly assessed. It underpins the interview and therefore should not be marked by the EPAO. EPAOs should review the portfolio in preparation for the interview but are not required to provide feedback after this review of the portfolio.

Assessment methods

The assessment methods can be delivered in any order.

The result of one assessment method does not need to be known before starting the next.

It is anticipated that the practical demonstration with professional discussion and interview underpinned by a portfolio of evidence will be completed on the same day, to aide efficiency however, this is not a requirement.

Assessment method 1: Multiple-choice test

Overview

This assessment method has one component.

A multiple-choice test is a controlled assessment which consists of a series of questions in which apprentices are asked to provide a response.

The rationale for this assessment method is:

- it allows for the efficient testing of knowledge where there is a right or wrong answer
- it allows for flexibility in terms of when, where, and how it is taken
- it allows larger volumes of apprentices to be assessed at one time

Delivery

Test format

The multiple-choice test can be:

- computer based
- paper based

It will consist of 30 questions.

These questions will consist of multiple-choice questions. The multiple-choice questions will have four options of which one will be correct. The questions must be varied, to avoid the multiple-choice test becoming too predictable, yet allow assessment of the relevant KSBs.

The questions should cover the spectrum of the knowledge categories listed below. Three questions will be assigned to each category. At least one correct answer must be achieved from each category.

Category number	KSBs
1	K1: Nuclear industry regulatory framework. For example: Nuclear Installations Act 1965 and 1969. K5: Principles of deterministic fault analysis and probabilistic risk analysis.
2	K6: Principles and application of radiological protection; including time, distance, shielding, effects of exposure on human health, for example non-stochastic effects and the environment.
3	K7: Fundamental engineering mathematics such as scientific notation, unit conversion, graphs and exponential functions and rate concepts applied to radioactive decay and process controls. K16: Symbols used in engineering drawings, diagrams, schematics and their application in the performance of licensed duties.
4	K8: Reactor physics, the neutron lifecycle and design of reactor systems. K9: Nuclear physics and reactor theory principles for power reactors.
5	K10: Thermal hydraulics and thermal dynamics including multiphase heat transfer, feedback coefficients, the coupling between reactor physics and thermal hydraulics.
6	K12: Chemistry including key functions of chemistry controls to maintain the integrity of materials on both primary and secondary circuits.
7	K14: Key components used in conventional plant and reactor systems, for example valves, pumps, heat exchangers.
8	K15: The operating principles and application of electrical components. For example: isolators, circuit breakers, motors, generators and protective devices.
9	K17: The operating principles of basic sensors, instruments, and control systems used in plant systems; ensuring the accuracy of instrumentation, and calibration frequencies.
10	K23: Fire protection and fire-fighting procedures (systems and techniques).

This test aims to establish the theoretical knowledge of the apprentice – to ensure they have an adequate knowledge base to justify and defend safe, logical decision making and communications - based on their understanding of the technical information and data presented to them and its implications to the primary, secondary and auxiliary systems.

Test administration

Apprentices must have 60 minutes to complete the multiple-choice test.

The multiple-choice test is closed book which means that the apprentice cannot refer to reference books or materials.

Assessment

Multiple-choice tests must be marked by assessors or markers employed by the EPAO following a marking guide produced by the EPAO. Alternatively, marking by computer is permissible where questions types allow this.

A correct response will be assigned one mark.

Any incorrect or missing answers must be assigned zero marks.

Grading boundaries

The following grade boundaries apply to the multiple-choice test:

Grade	Minimum mark	Maximum mark
Fail	0	23
Pass	24; for each category, apprentice must achieve at least one correct answer	30; for each category, apprentice must achieve at least one correct answer

Assessment location

Apprentices must take the multiple-choice test in a suitably controlled environment that is a quiet space, free from distractions and influence, in the presence of an invigilator. The invigilator may be any independent person appointed by the EPAO. The EPAO is required to have an invigilation policy that will set out how the multiple-choice test is to be carried out. This will include specifying the most appropriate ratio of apprentices to invigilators to best take into account the setting and security required in administering the multiple-choice test.

The EPAO is responsible for ensuring the security of any multiple-choice tests they administer to ensure the test remains valid and reliable (this includes any arrangements made using online tools). The EPAO is responsible for verifying the identity of the person taking the multiple-choice test. The EPAO must also verify the suitability of the venue for multiple-choice test-taking.

Question and resource development

Questions must be written by EPAOs and must be relevant to the occupation. It is recommended that this be done in consultation with employers of this occupation. EPAOs should maintain the security and confidentiality of their questions when consulting employers. EPAOs must develop 'multiple-choice test specifications' and 'question banks' of sufficient size to prevent predictability and review them regularly (and at least once a year) to ensure they, and the questions they contain, are fit for purpose. The specifications, including questions relating to underpinning KSBs must be varied, yet allow assessment of the relevant KSBs.

EPAOs must ensure that apprentices have a different set of questions in the case of re-sits/re-takes.

EPAOs will produce the following material to support this assessment method:

- a question bank
- a multiple-choice test specification
- sample multiple-choice tests and mark schemes
- live multiple-choice tests and mark schemes
- analysis reports which show areas of weakness for completed multiple-choice tests/exams and an invigilation policy

Assessment method 2: Practical demonstration and professional discussion

Overview

This assessment method has two components: 1. practical demonstration, 2. professional discussion.

A practical demonstration involves an assessor observing an apprentice undertaking a set task or a series of set tasks in a simulated environment. The simulated environment must closely relate to the apprentice's natural working environment.

A professional discussion is a two-way discussion which involves both the assessor and the apprentice actively listening and participating in a formal conversation. It gives the apprentice the opportunity to make detailed and proactive contributions to confirm their competency across the KSBs mapped to this assessment method.

The practical demonstration and professional discussion will be assessed holistically.

Rationale

The rationale for this assessment method is:

- the practical aspects of this role are best demonstrated through completing tasks in a realistic work setting
- the practical demonstration could make use of existing resources and equipment
- the practical demonstration avoids issues with scheduling that would occur if observation were to be completed in live work environments
- the professional discussion gives the apprentice the opportunity to demonstrate evidence of the underpinning knowledge that cannot be inferred from the tasks and those skills and behaviours that did not naturally occur due to the nature of the tasks
- it is a holistic assessment method
- the practical demonstration allows observation of communication and behavioural skills that would otherwise be very difficult to present supporting evidence for

Component 1 – Practical demonstration

Delivery

The assessor must observe only one apprentice during this assessment method to ensure quality and rigour. The assessor must be unobtrusive whilst conducting the practical demonstration.

The practical demonstration must last for two hours. The assessor has the discretion to increase the time of the practical demonstration by up to 10% to allow the apprentice to complete a task.

The practical demonstration may not be split, other than to allow comfort breaks as necessary, to allow the apprentice to move from one location to another as required.

Where planned breaks occur, they will not count towards the total assessment time. EPAOs must manage invigilation of apprentices during breaks to maintain security of the assessment in line with their malpractice policy.

Apprentices must be provided with information on the tasks they must complete, including the timescales they will be working to before the start of the practical demonstration. They will not be given details of the unplanned shut-down changeover scenario as the purpose is to test their response to an unexpected event.

The following activities should be observed during the practical demonstration as a practical demonstration without these activities would seriously hamper the opportunity for the apprentice to demonstrate occupational competence against the KSBs assigned to this assessment method:

- complete a pre-job or shift handover brief
- complete a planned start up and bring online or changeover of a running auxiliary plant, to include pre-brief if applicable and communications with the plant team
- complete an unplanned shut down or changeover of an auxiliary plant following a trip / failure, to include communications with plant team
- complete the running up or shutdown of a major plant (Turbine / Main Coolant Pumps (MCP) etc)

The practical demonstration should be conducted in the following way to take account of the occupational context.

The assessor must be unobtrusive whilst the practical demonstration is conducted.

An actor will represent colleagues in the practical demonstration as outlined in the 'roles and responsibilities' section of this plan. For example, the actor may play the role of a desk supervisor or maintenance personnel.

Due to the specialist nature of the occupation, the EPAO may request an employer technical expert to support the EPA. The employer technical expert can only provide support as outlined in the roles and responsibilities section of this plan. The employer technical expert must not influence the grading.

Assessment location

The practical demonstration must take place in a nuclear reactor desk room simulator which replicates the reactor desk and the dynamic response of a relevant nuclear plant and associated auxiliary equipment. The practical demonstration must use documentation and apply procedures with which the apprentice is familiar.

Component 2 – Professional discussion

Delivery

A professional discussion is a two-way discussion which involves both the assessor and the apprentice actively listening and participating in a formal conversation. It gives the apprentice the opportunity to make detailed and proactive contributions to confirm their competency across the KSBs mapped to this method. The apprentice leads the discussion.

The professional discussion must be appropriately structured to draw out the best of the apprentice's competence and cover KSBs assigned to this assessment method, which are not fully observed or cannot be inferred in the practical demonstration.

The professional discussion must last for one hour. The assessor has the discretion to increase the time of the professional discussion by up to 10% to allow the apprentice to complete their last point.

During this assessment method, the assessor must use the question bank as a source for questioning and are expected to use their professional judgement to tailor those questions appropriately. Assessors are responsible for generating suitable follow-up questions in line with the EPAO's training and standardisation process. The professional discussion will have a minimum of 10 questions. Follow up questions are allowed.

The professional discussion must occur following the practical demonstration, to maintain real life conditions and ensure the apprentice is not distracted.

The questioning must be conducted under controlled conditions.

KSBs observed, and answers to questions must be recorded by the assessor.

The assessor will make all grading decisions. The practical demonstration and professional discussion must be assessed holistically.

Due to the specialist nature of the occupation, the EPAO may request an employer technical expert to support the EPA. The employer technical expert can only provide support as outlined in the roles and responsibilities section of this plan. The employer technical expert must not influence the grading.

Assessment location

The professional discussion should take place in a quiet room, free from distractions and influence. It is anticipated that the employer's premises will be used to reduce cost however, other venues may be sourced if necessary.

Question and resource development: component 1. Practical demonstration and component 2. Professional discussion

Practical demonstration tasks and questions for the professional discussion must be written by EPAOs, be relevant to the occupation and assess the KSBs mapped to this assessment method. It is recommended that this be done in consultation with employers

of this occupation. EPAOs should maintain the security and confidentiality of the practical demonstration tasks and questions when consulting employers.

Each EPAO must develop a test specification with practical tasks that use scenarios developed and operated by the nuclear desk simulator provider; they must put measures in place to prevent predictability.

They must also develop a question bank for the professional discussion of sufficient size to prevent predictability and review it regularly (and at least once a year) to ensure it, and the questions it contain, are fit for purpose.

EPAOs must ensure that apprentices have different practical demonstration tasks and set of questions in the case of re-sits/re-takes.

EPAOs will produce the following material to support this assessment method:

- assessor assessment materials which include:
 - training materials
 - administration materials
 - moderation and standardisation materials
 - guidance materials
 - grading guidance
 - brief for the actor(s)
- bank of practical demonstration tasks
- question bank
- guidance documentation for the apprentice, employer technical expert and employer

Assessment method 3: Interview underpinned by a portfolio of evidence

Overview

This assessment method has one component.

An interview consists of an assessor asking an apprentice a series of questions to assess their competence against the KSBs. The assessor leads this process to obtain information from the apprentice to enable a structured assessment decision-making process.

The rationale for this assessment method is:

- allows for assessment of KSBs that do not occur on a predictable or regular basis
- it allows for testing of responses where there are a range of potential answers that cannot be tested through the multiple-choice test or practical demonstration
- it can be conducted remotely, potentially reducing cost

Delivery

An assessor will conduct and assess the interview underpinned by portfolio of evidence.

The interview must last for 90 minutes. The assessor has the discretion to increase the time of the interview by up to 10% to allow the apprentice to complete their last answer.

The interview will have a minimum of six open questions – two per topic. During this method, the assessor must combine questions from the EPAO's question bank and those generated by themselves, following a review of the portfolio of evidence. The assessor should have a minimum of five working days to review the portfolio of evidence.

The purpose of the questions will be to cover the following topics:

- nuclear reactor design and operation principles
- providing professional advice
- failure modes and consequences

The interview will be conducted as follows.

EPAOs must arrange the interview in conjunction with the apprentice's employer.

Apprentices must be given at least two-weeks' notice of the date and time of the interview.

Questions should be open and competence based. Additional follow up questions are allowed, to seek clarification and to make a judgement against the grading descriptors.

Assessors must use the question bank as a source for questioning and are expected to use their professional judgment to tailor those questions appropriately. Assessors are responsible for generating suitable questions in line with the EPAO's training and standardisation process.

Apprentices must have access to their portfolio of evidence during the interview.

Apprentices can refer to and illustrate their answers with evidence from their portfolio of evidence, however the portfolio evidence is not directly assessed.

Apprentices are expected to understand and use relevant occupational language that would be typical of a competent person in this occupation.

Evidence from the interview must be assessed holistically using the grading descriptors for this assessment method.

Due to the specialist nature of the occupation, the EPAO may request an employer technical expert to support the EPA. The employer technical expert can only provide support as outlined in the roles and responsibilities section of this plan. The employer technical expert must not influence the grading.

KSBs met and answers to questions, must be recorded by the assessor.

The assessor will make all grading decisions.

Assessment location

The interview should take place in a quiet room, free from distractions and influence.

Video conferencing can also be used to conduct the interview but the EPAO must have processes in place to verify the identity of the apprentice and ensure the apprentice is not being aided.

The interview can take place in any of the following:

- employer's premises
- a suitable venue selected by the EPAO, for example a training provider's premises

Question and resource development

A 'question bank' must be developed by EPAOs. The 'question bank' must be of sufficient size to prevent predictability and the EPAO must review it regularly (at least once a year) to ensure that it, and its content, are fit for purpose. The questions relating to the KSBs, must be varied yet allow assessment of the relevant KSBs.

EPAOs must ensure that apprentices have a different set of questions in the case of re-sits/re-takes.

EPAOs will produce the following material to support this assessment method:

- question bank
- outline of the assessment method's requirements
- marking materials
- guidance document for employers, employer technical expert and apprentices on the process/timescales for the interview as well as a description of the purpose
- guidance document for assessors on how to carry out the assessment

Overall grading of assessment methods

All assessment methods are weighted equally in their contribution to the overall EPA grade.

Performance in the EPA will determine the apprenticeship grade of fail or pass.

Assessors must individually grade the practical demonstration and professional discussion, and interview underpinned by a portfolio of evidence according to the requirements set out in this plan. A person appointed by the EPAO must grade the multiple-choice test. Alternatively, marking by computer is permissible where question type allows this.

EPAOs must combine the individual assessment method grades to determine the overall EPA grade.

Apprentices who fail one or more assessment method will be awarded an overall EPA fail.

To gain an overall EPA pass, apprentices must achieve a pass in all the assessment methods.

Nuclear reactor desk engineer is a safety critical role. The assessment grading for this apprenticeship is aligned to the requirements for becoming a Duly Authorised Person in accordance with licence conditions (Energy generation) and authorisation conditions (Ministry of Defence (MOD)). Therefore, the assessment methods are graded pass or fail only.

Grades from individual assessment methods should be combined in the following way to determine the grade of the EPA as a whole:

Assessment method 1: Multiple-choice test	Assessment method 2: Practical demonstration and professional discussion	Assessment method 3: Interview underpinned by a portfolio of evidence	Overall EPA grading
Any grade	Any grade	Fail	Fail
Any grade	Fail	Any grade	Fail
Fail	Any grade	Any grade	Fail
Pass	Pass	Pass	Pass

Any grade = fail, pass

Re-sits and re-takes

Apprentices who fail one or more assessment method(s) will be offered the opportunity to take a re-sit or a re-take at the employer's discretion. The apprentice's employer will need to agree that either a re-sit or re-take is an appropriate course of action.

A re-sit does not require further learning, whereas a re-take does.

Apprentices should have a supportive action plan to prepare for a re-sit or a re-take.

The timescale for a re-sit/re-take is agreed between the employer and EPAO. A re-sit is typically taken within three months of the EPA outcome notification. The timescale for a re-take is dependent on how much re-training is required and is typically taken within six months of the EPA outcome notification.

All failed assessment methods must be re-sat/re-taken within a six month period from the EPA outcome notification, otherwise the entire EPA will need to be re-sat/re-taken.

Roles and responsibilities

Role	Responsibility
Apprentice	<p>As a minimum, apprentices should:</p> <ul style="list-style-type: none"> • participate in and complete on-programme training to meet the KSBs as outlined in the occupational standard for a minimum of 12 months • undertake 20% off-the-job training as arranged by the employer and training provider • understand the purpose and importance of EPA • undertake the EPA including meeting all gateway requirements
Employer	<p>As a minimum, employers should:</p> <ul style="list-style-type: none"> • work with the training provider (where applicable) to support the apprentice in the workplace to provide the opportunities to develop the KSBs • arrange and support a minimum of 20% off-the-job training to be undertaken by the apprentice • decide when the apprentice is working at or above the occupational standard and so is ready for EPA • select the EPAO • ensure that all supporting evidence required at the gateway is submitted in accordance with this EPA plan • remain independent from the delivery of the EPA • confirm arrangements with the EPAO for the EPA (who, when, where) in a timely manner (including providing access to any employer specific documentations as required, for example company policies) • ensure that the EPA is scheduled with the EPAO for a date and time which allow appropriate opportunity for the KSBs to be met • ensure the apprentice is well prepared for the EPA • ensure the apprentice is given sufficient time away from regular duties to prepare for and complete any post-gateway elements of the EPA, and that any required supervision during this time (as stated within this EPA plan) is in place • where the apprentice is assessed in the workplace, ensure that the apprentice has access to the resources used on a daily basis

EPAO	<p>As a minimum, EPAOs should:</p> <ul style="list-style-type: none"> • agree the EPA price • understand the occupational standard • appoint administrators (and invigilators where required) to administer the EPA as appropriate • provide training for assessors in terms of good assessment practice, operating the assessment tools and grading • provide adequate information, advice and guidance documentation to enable apprentices, employers and training providers to prepare for the EPA • arrange for the EPA to take place, in consultation with the employer • deliver the EPA as outlined in this EPA plan in a timely manner • where the apprentice is not assessed in the workplace, ensure that the apprentice has access to required resources and liaise with the employer to agree this if necessary • use appropriate assessment recording documentation to ensure a clear and auditable process is in place for providing assessment decisions and feedback to all relevant stakeholders • have no direct connection and no conflict of interest with the apprentice, their employer or training provider • have policies and procedures for internal quality assurance (IQA), and maintain records of regular and robust IQA activity and moderation for external quality assurance (EQA) purposes • conform to the requirements of the nominated external quality assurance provider (EQAP) • conform to the requirements of the Register of End-Point Assessment Organisations (RoEPAO) • deliver induction training for assessors, and for invigilators and markers where used • undertake standardisation activity on this apprenticeship standard for all assessors before they conduct an EPA for the first time, if the EPA is updated and periodically as appropriate (a minimum of annually) • manage invigilation of apprentices in order to maintain security of the assessment in line with their malpractice policy • verify the identity of the apprentice being assessed • use language in the development and delivery of the EPA that is appropriate to the level of the occupational standard
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	<ul style="list-style-type: none"> • request certification via the Apprenticeship Service upon successful achievement of the EPA
Assessor	<p>As a minimum, an assessor should:</p> <ul style="list-style-type: none"> • have the competence to assess the apprentice at this level and hold any required qualifications and experience in line with the requirements of the assessor as detailed in the IQA section of this EPA plan • understand the occupational standard and the requirements of this EPA • have, maintain and be able to evidence up to date knowledge and expertise of the subject matter • deliver the end-point assessment in-line with the EPA plan • comply with the IQA requirements of the EPAO • have no direct connection and no conflict of interest with the apprentice, their operational workplace, and their training provider • attend induction training • attend standardisation events when they begin working for the EPAO, before they conduct an EPA for the first time and a minimum of annually on this apprenticeship standard • assess each assessment method, as determined by the EPA plan, and without extending the EPA unnecessarily • assess against the KSBs assigned to each assessment method, as shown in the mapping of assessment methods and as determined by the EPAO, and without extending the EPA unnecessarily • make all grading decisions • record and report all assessment outcome decisions, for each apprentice, following instructions and assessment recording documentation provided by the EPAO in a timely manner • use language in the development and delivery of the EPA that is appropriate to the level of the occupational standard

<p>Person/actor for the EPA professional demonstration</p>	<p>As a minimum, the person/actor will:</p> <ul style="list-style-type: none"> • be trained to support a nuclear desk reactor engineer and be someone who the apprentice can interact with to demonstrate practical assessment techniques or interventions • follow a brief provided by the assessor which confirms what is required • be at the assessment venue and be in situ prior to the assessment • be briefed prior to assessment by the assessor • adhere to confidentiality about all aspects of the assessment and the brief they have been provided • act as a member of personnel according to the brief • not ask questions of the apprentice that indicate how to complete the practical demonstration successfully • not provide guidance or influence the assessment outcome in any way • have no direct connection and no conflict of interest with the apprentice, i.e. they cannot have been involved directly with the apprentice's on-programme training • provide a written statement to confirm that all of the task is attributable to the apprentice
<p>Employer technical expert</p>	<p>As a minimum, the employer technical expert will:</p> <ul style="list-style-type: none"> • have no direct connection or conflict of interest with the apprentice, i.e. they cannot have been involved directly with the apprentice's on-programme training • provide technical support, advice and guidance such as confirming company policies, procedures, processes, providing context on technical information or on emerging technologies • provide information only at the request of the assessor (who has the final say over the assessment and grade awarded) • not provide information on behalf of the apprentice, ask the apprentice questions or influence the apprentice or the assessment judgement in any way • not amplify or clarify points made by the apprentice

Training provider	<p>As a minimum, the training provider should:</p> <ul style="list-style-type: none"> • work with the employer and support the apprentice during the off-the-job training to provide the opportunities to develop the knowledge, skills and behaviours as listed in the occupational standard • conduct training covering any knowledge, skill or behaviour requirement agreed as part of the Commitment Statement (often known as the Individual Learning Plan). • monitor apprentices progress during any training provider led on-programme learning • advise the employer, upon request, on the apprentice's readiness for EPA • remain independent from delivery of the EPA.
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Reasonable adjustments

The EPAO must have in place clear and fair arrangements for making reasonable adjustments to the assessment methods for the EPA for this apprenticeship standard. This should include how an apprentice qualifies for reasonable adjustments and what reasonable adjustments will be made. The adjustments must maintain the validity, reliability and integrity of the assessment methods outlined in this EPA plan.

Internal quality assurance (IQA)

Internal quality assurance refers to the strategies, policies and procedures that EPAOs must have in place to ensure valid, consistent and reliable end-point assessment decisions. EPAOs for this EPA must adhere to all requirements within the Roles and Responsibilities section and:

- have effective and rigorous quality assurance systems and procedures that ensure fair, reliable and consistent assessment across employers, places, times and assessors
- appoint assessors who are competent to deliver assessment method 2. Practical demonstration and professional discussion, and assessment method 3. Interview underpinned by a portfolio of evidence and who:
 - have recent relevant experience of the occupation/sector to at least the occupational level gained in the last three years or significant experience of the occupation/sector
 - are employed by the Independent Nuclear Assurance (INA) - Energy sector, or the MOD internal regulator Defence Nuclear Safety Regulator (DNSR)
 - The INA and DNSR are internal regulators, for EDF Energy and MOD respectively, with clear lines of separation from operational activity. The Office of Nuclear Regulation is the UK - Nuclear Regulating Authority
- operate induction training for assessors and any other personnel involved in the delivery and or/assessment of the EPA (e.g. markers and invigilators)
- provide training for assessors in terms of good assessment practice, operating the assessment tools and grading
- where appropriate provide ongoing training for markers and invigilators
- provide standardisation activity for this apprenticeship standard for all assessors:
 - before they conduct an EPA for the first time
 - if the EPA is updated
 - periodically as appropriate (a minimum of annually)
- conduct effective moderation of assessment decisions and grades
- conduct appeals where required, according to the EPAO's appeals procedure, reviewing and making final decisions on assessment decisions and grades

Value for money

Affordability of the EPA will be aided by using at least some of the following:

- completing applicable assessment methods online (i.e. computer-based assessment)
- utilising digital remote platforms to conduct applicable assessment methods
- assessing multiple apprentices simultaneously
- using the employer's premises
- conducting assessment methods on the same day

Professional body recognition

This apprenticeships standard has professional recognition.

The Nuclear Institute:

- Membership (MNucl)

The experience gained and responsibility held by the apprentice on completion of the apprenticeship standard will either wholly or partially satisfy the requirements for registration with the professional body. For more details on the requirements and application process, please contact the professional body directly.

Mapping of knowledge, skills and behaviours (KSBs)

Assessment method 1: Multiple-choice test

Knowledge
K1. Nuclear industry regulatory framework. For example: Nuclear Installations Act 1965 and 1969.
K5. Principles of deterministic fault analysis and probabilistic risk analysis.
K6. Principles and application of radiological protection; including time, distance, shielding, effects of exposure on human health, for example non-stochastic effects and the environment.
K7. Fundamental engineering mathematics such as scientific notation, unit conversion, graphs and exponential functions and rate concepts applied to radioactive decay and process controls.
K8. Reactor physics, the neutron lifecycle and design of reactor systems.
K9. Nuclear physics and reactor theory principles for power reactors.
K10. Thermal hydraulics and Thermal Dynamics including multiphase heat transfer, feedback coefficients, the coupling between reactor physics and thermal hydraulics.
K12. Chemistry including key functions of chemistry controls to maintain the integrity of materials on both primary and secondary circuits.
K14. Key components used in conventional plant and reactor systems, for example valves, pumps, heat exchangers.
K15. The operating principles and application of electrical components. For example: isolators, circuit breakers, motors, generators and protective devices.
K16. Symbols used in engineering drawings, diagrams, schematics and their application in the performance of licensed duties.
K17. The operating principles of basic sensors, instruments, and control systems used in plant systems; ensuring the accuracy of instrumentation, and calibration frequencies.
K23. Fire protection and fire-fighting procedures (systems and techniques).

Assessment method 2. Practical demonstration and professional discussion

Knowledge
K3. Control panel indications and control loop status for different modes of reactor operation, for example: start up, steady state and shut down.
K20. Error prevention techniques that support safe, reliable operation, for example Stop, Think, Act Review (STAR) and Peer Checking.
K21. Multi-disciplined team working, conflict management, error likely situations and interactions with other team members of different personality types.
K22ii. Documentation for example normal operating procedures, surveillance procedures.
K22iii Documentation for example abnormal operating procedures and emergency planning procedures.
Skills
S1. Following operational and maintenance procedures; maintaining compliance with technical specifications.
S3. Monitoring and evaluating plant conditions under different modes of operation, for example shut down, start up, abnormal, fault, emergency and critical steady state operations.
S4. Communicating verbally - face to face and via radio. For example: using error prevention techniques such as 3 way communications and use of phonetic alphabet.
S6. Directing people and operations, exercising authority.
S7. Using error prevention techniques, such as STAR and peer checking, procedural use and adherence, briefing, flagging.
S8. Validating plant system information by using multiple sources, such as data processing systems, hard wired indications and feed-back from plant operatives.
S9. Analysing information, such as plant information and trends in data.
S10. Operating the panel controls to transition between manual, start-up and/or automatic modes of operation.
S11. Responding to abnormal events and/or alarms.
S12. Evaluating the effectiveness of corrective actions and their impact.
S13i. Using IT applications. For example: plant computing and control systems.
S15. Time management. For example planning and scheduling work.

Behaviours
B2. Team player. For example takes account of impact of own work on others, helps and supports colleagues.
B4. Committed to safety. For example: leads by example, demonstrates visible proactive approach to safety, challenges unsafe behaviours and understanding of the consequences as set out in the nuclear industry requirements.
B5. Takes responsibility for own actions, for example ensuring all rules procedures and principles for safe reliable operation are complied with.
B8. Adaptable. For example changes style or approach dependent on situation, circumstances and environment.

Assessment method 3: Interview underpinned by a portfolio of evidence

Knowledge
K2. Nuclear reactor failure modes and potential consequences. For example: fuel pin failure and radiological release to atmosphere
K4. Hazards affecting reactor control and operation. For example: Loss of automatic control or external factors such as flooding cold weather, loss of grid. The principles ALARP (as low as reasonably practicable) and BAT (best available techniques).
K11. Reactor materials including properties and selection criteria of reactor materials; the mechanisms of corrosion and degradation and the effects of irradiation on materials including fuel.
K13. Interdependencies of reactor physics, reactor materials, chemistry and thermal hydraulics on the design and operation of reactor systems.
K18. Design of major plant systems such as feed water, steam systems, reactor support systems, decay heat removal systems, emergency injection systems and long term cooling systems. Fundamental plant operating principles, including start-up of a main steam turbine.
K19. Operating License and Technical Procedures that define the operating parameters for the plant.
K22i. Documentation for example departmental policies and directives.
K24. Operating experience of key nuclear industry events such as Windscale, Three Mile Island, Chernobyl, Fukushima, and events outside the nuclear industry such as Challenger Space Shuttle, US Airways, Nimrod, Piper Alpha, and relating these to the lessons learnt such as organisational weaknesses and plant design.

Skills
S2. Making recommendations utilising technical knowledge. For example: modifications to system and component design throughout the reactor lifecycle.
S5. Evaluating pre-defined calculations for reactor physics and thermal hydraulics. Taking action to maintain compliance with technical procedures.
S13ii. Using IT applications. For example: word, email.
S14. Communicating – written. For example handover logs, condition reports and email
Behaviours
B1. Professional. For example, reliable, integrity, polite and courteous.
B3. Committed to personal development, learning and self- improvement. For example: open to feedback and takes responsibility to identifying learning opportunities.
B6. Committed to sustainability and minimising environmental impact.
B7. Advocate for the nuclear industry. For example, presents positive arguments, challenges misconceptions.

Grading descriptors

End-point assessment method 1: Multiple-choice test

KSBs	
K1 K5 K6 K7 K8 K9 K10 K12 K14 K15 K16 K17 K23	<p>Test mark will determine whether apprentice achieves fail or pass</p> <p>For each category, apprentice must achieve at least one correct answer</p>

Assessment method 2: Practical demonstration and professional discussion

KSBs	Pass, apprentices must demonstrate all the pass descriptors to pass
Reactor desk operation K3 K22ii S1 S3 S10 S13i B5	<p>Monitors and evaluates control panel indications under different modes of operation. Differentiates key parameters and interprets control loop status. (K3, S3)</p> <p>Takes responsibility to operate the panel controls to transition between modes of operation. (S10, B5)</p> <p>Ensures compliance to all applicable rules, operational and maintenance procedures, technical specifications and principles for safe reliable operation utilising plant computing and control systems. (K22ii, S1, S13i)</p>
Abnormal events K22iii S8 S9 S11 S12 B8	<p>Analyses reactor plant and system information including values and trends. (S9)</p> <p>Validates information using multiple sources and adapts to respond to abnormal events and/or alarms in line with abnormal operational procedures. (K22iii, S8, S11, B8)</p> <p>Evaluates effectiveness of corrective actions and their impact, assessing the potential consequences on cooling, containment and reactor control and operation. (S12)</p>
Communication K20 S4 S7	<p>Communicates verbally, face to face and via radio, using error prevention techniques that ensure support safe, reliable operation. For example, 3-way communications, use of phonetic alphabet and STAR (Stop Think Act Review). (K20, S4, S7)</p>
Teamwork and leadership K21 S6 S15 B2 B4	<p>Outlines and justifies their approach to directing people and operations when exercising their authority, applying principles of multi-disciplined teamworking, conflict management, and time management. (K21, S6, S15, B2)</p> <p>Applies an approach to work which reflects their own commitment to safety, leading by example whilst challenging unsafe behaviours. (B4)</p>
Fail: apprentices will fail where they do not meet the pass criteria	

Assessment method 3: Interview underpinned by a portfolio of evidence

KSBs	Pass, apprentices must demonstrate all the pass descriptors to pass
<p>Nuclear reactor design and operating principles</p> <p>K11 K18</p> <p>S5</p>	<p>Summarises key features of the design and operating principles of nuclear reactor primary and secondary plant systems. Describes how the selection of materials relates to the mechanisms of corrosion, degradation and the effects of irradiation. (K11, K18)</p> <p>Articulates how they evaluate pre-defined calculations for reactor physics and thermal hydraulics and justifies appropriate actions to maintain compliance with technical procedures. (S5)</p>
<p>Providing Professional Advice</p> <p>K13 K19 K24</p> <p>S2 S13ii S14</p> <p>B1 B3 B6 B7</p>	<p>Makes recommendations considering the interdependencies of reactor physics, reactor materials, chemistry and thermal hydraulics on the design and operation of reactor systems as well as local operating license and technical procedures, and operating experience of key nuclear industry events. (K13, K19, K24, S2)</p> <p>Predicts and justifies any environmental impact whilst showing a commitment to sustainability. (B6)</p> <p>Communicates their (written) professional advice, using IT applications, suitable to the audience. (S13ii, S14)</p> <p>Articulates a commitment to personal development to improve the effectiveness and impact that their advice can provide. (B3)</p> <p>Supports their position as an advocate for the Nuclear Industry through their ability to formulate and defend clear arguments in a professional manner (appropriate to the audience), with integrity (based on facts), in support of the industry principles and processes. (B1, B7)</p>
<p>Failure modes and consequences</p> <p>K2 K4 K22i</p>	<p>Analyses plant failure modes and potential consequences. (K2)</p> <p>Evaluates how hazards potentially affecting reactivity control, containment and cooling are controlled and mitigated through design, site documentation and safety principles. Compares these approaches with reference to principles such as ALARP (as low as reasonably practicable) and BAT (best available techniques). (K4, K22i)</p>
<p>Fail: apprentices will fail where they do not meet the pass criteria</p>	