

Competence Profiles – Guidance for Applicants and Assessors

PART 2 – INDUSTRY CLASSIFICATION (H) - NUCLEAR ENGINEERING

1 Summary

The nuclear industry is complex and diverse. It includes publicly-owned operators of decommissioning and operational sites, privately owned operators of operational sites, regulatory authorities, Royal Navy, private sector manufacturers and service providers and consultancies. The civil nuclear sector is evolving rapidly. The introduction of the Nuclear Decommissioning Authority has established a framework within the industry where the publicly-owned site license holders will compete to run the nuclear sites against other organisations from the private sector. The break-up and privatisation of the current publicly-owned license holders grows ever more likely. The civil sector is lagging the defence sector in this regard, as the naval dockyards were privatised several years ago. However, those parts of the defence sector still in public hands are also looking likely to move to the private ownership and management.

The nuclear industry provides many opportunities for mechanical engineers to achieve the competencies necessary for corporate membership of the Institution. Across the various sectors and type of companies within the industry, the following functions are likely to provide the opportunities for engineers to exercise and demonstrate their professional and mechanical engineering competence necessary for registration: (1) Operations Management; (2) Design, design change and configuration control; (3) Safety Engineering; (4) Project Engineering; (5) Business Development; (6) Consultancy; (7) Maintenance Management; (8) Regulatory Roles; (9) Engineering Officer.

Assessors should carefully review applicants' personal responsibilities and competencies, together with their direct input to projects in their work area and the degree of supervision that they have worked under. As the industry is heavily regulated and controlled it may be difficult for young engineers to demonstrate their personal capabilities, owing to the requirements for them to be Suitably Qualified and Experienced (SQEP) to carry out tasks. The level of training for applicants will give an indication of their capability to carry out tasks independently, as will the level of autonomy allowed by management.

Senior engineering posts within the nuclear industry should be considered as generally likely to meet the requirements of the class of Fellow. Examples of this are Site Manager, Engineering Director, Chief Inspector, Operations Director or Principal Consultant. Applicants in these roles need to demonstrate a very high level of competence in each of the categories defined in the UK-SPEC.

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3 Introduction

The nuclear industry is complex and diverse but encompasses many roles that will qualify its personnel for Chartered or Incorporated Engineer registration. The nuclear industry comprises many interdependent organisations, large and small, in both the public and private sector. However, apart from British Energy, which is listed on the Stock Exchange and earns its money by electricity generation, and GE Healthcare, the majority of funding for the nuclear sector ultimately comes from government.

The nuclear sector is highly regulated by various organisations such as the Nuclear Installations Inspectorate (NII) and the Environment Agency. In all activities safety is paramount, owing to the potential consequences that may arise from poorly conceived design and inappropriate operations or maintenance. In the civil sector, site license holders are required to comply with the Nuclear Installations Act. The NII ensure compliance by assessing the operators against their license conditions and a series of safety assessment principles, which they have developed. For MoD licensed sites compliance with a similar set of principles is necessary. To ensure that the license holders comply with these conditions, they develop their own set of safety assessment rules. From these rules formal safety cases for each plant and operation on the licensed site are developed. These safety cases themselves identify the operations and maintenance necessary for safety critical equipment. Many contractor and consultancy organisations provided specialist design, safety, installation, construction, operational and maintenance services, as required, to the license holders. These organisations are also required to meet the highest levels of safety, and personnel are usually required to be experienced (SQEP) and highly trained to demonstrate to the license holders their capability to do the specified tasks.

The following types of company within the nuclear industry will generally offer professionally qualified mechanical engineers the opportunity to fulfil the requirements for Membership and Professional Registration.

3.1 Nuclear Operating Companies (License Holders)

These companies operate the nuclear licensed sites within the UK. The sites operated are extremely diverse in nature and include: nuclear power stations; nuclear fuel production and enrichment facilities; nuclear reprocessing facilities; nuclear decommissioning sites, where power generation, experimentation or reprocessing has ceased and facilities are being systematically removed; medical technology development and production sites; nuclear submarine bases and nuclear weapons facilities. However, they all work within licensing regimes whereby they are authorised to operate their sites as described in section 2. They are all responsible for ensuring the safe operation of their sites. To this end the license holders tend to employ a core staff of professional engineers and technicians who carry out the necessary design, operation and project management requirements to maintain a given site. The license holders may also employ a team of engineering experts and scientists who have a broader remit to provide specialist advice across all the sites that a licensee may hold. License holders normally have very strong training regimes for their graduates and mature engineers. This is because it is essential in the industry that the personnel are suitably qualified and experienced for the work that they are carrying out and so that the operator may be seen to be actively and intelligently managing their license.

3.2 Regulatory/ Management/ Government Authorities

These organisations regulate, manage and provide services to the nuclear industry. They will normally employ engineering specialists to oversee the areas within their remit. For example, technical specialists could be employed to ensure that compliance is being maintained by operating companies in one specific area, such as external hazards. Nuclear engineers may be employed to provide advice to management authorities with respect to contract technical compliance, by license holders. Specialist

services may be provided with respect to radiological monitoring or health physics advice. Engineers operating in these areas will normally be specialists, with high levels of training and experience. However, they may also be required to understand the wider context of the nuclear industry with respect to commercial and societal implications.

3.3 Defence Related Organisations

These organisations provide services to the UK nuclear submarine and weapons programmes. They include companies that design, construct, operate and maintain the Royal Navy nuclear submarine fleet. They also include organisations that research, design and maintain the warheads for the UK nuclear deterrent. These organisations that provide a service to the programme may, in some instances, also be license holders (see 3.1). In these cases, the organisations are also responsible for the operation and maintenance of the facilities (e.g. naval bases, shore-based reactors) that are necessary to service and support the submarines. Engineers working in these organisations may have a diverse range of skills from design, to maintenance, operation and project management. In terms of shore-based facilities supporting the programme, engineers are likely to specialise in one area, such as knowledge of mechanical handling equipment.

3.4 “Tier 2” suppliers (design, engineering, maintenance, operations, construction companies, safety case support)

These organisations tend to provide services to the license holders for one off design and build contracts; specific decommissioning services or where the license holder requires particular additional support in an area e.g. project management. These suppliers regularly operate in the wider engineering field and for example, may provide services such as construction to the rail and oil and gas industries, as well as the nuclear sector.

e.g. AMEC NNC, RWE Nukem, Mott Macdonald, Halcrow, Jacobs, Weir Group, Mitsui Babcock, Aker Kvaerner, Carillion

3.5 Civil Nuclear “Tier 2/3” suppliers (smaller specialist suppliers of aspects such as safety cases, environmental analysis)

These organisations provide specialist services under smaller scale contracts. They usually attract highly educated personnel and tend to employ, proportionately, larger numbers of Members. This is because they have to demonstrate that they provide Suitably Qualified and Experienced Resources (SQEP) to their clients. Part of this demonstration is often taken as corporate membership of an Institution. The services that these companies tend to provide relate to environmental, safety case, radiological protection or health physics matters. They provide these services either direct to the license holders (and therefore will be acting as tier 2 suppliers), or to companies described in Section 3.4, as sub-contractors, and providing their specialist services as part of much larger projects (in this instance acting as tier 3 suppliers).

e.g. Frazer-Nash, ARC Ltd, Vectra Group, RPS Group, RMC

4 Requirements for Membership

The nuclear industry provides many opportunities for mechanical engineers to achieve the competencies necessary for corporate membership of the Institution. Many of the larger organisations within the sector offer sponsorship through University or Mechanical Engineering or related courses. Such schemes tend to include vacation working and structured training programmes that meet the requirements of the Institution in terms of training.

Alternatively, engineers may start their careers in technician roles or as graduates. Both large and small organisations within the sector offer developmental training that meets the requirements of UK SPEC, which defines the standard to be achieved for Chartered and Incorporated Engineers.

If it has not been possible for an engineer to follow an accredited degree or training programme, Membership and Professional Registration may still be achieved through a Further Learning Scheme, which may be developed with the assistance of the engineer's employer and the IMechE.

5 Assessment of Competence

Across the various types of company within the industry, the following functions are likely to provide opportunities for exercising and demonstrating mechanical engineering competence:

- Operations Management
- Design, design change and configuration control
- Safety Engineering
- Project Engineering
- Business Development
- Consultancy
- Maintenance Management
- Regulatory Roles
- Engineering Officer

Within these types of roles, capable aspiring professional engineers should be able to gain the range of necessary competencies that are required for registration.

Assessors should carefully investigate and review applicant's personal responsibilities and competencies, along with their direct input to projects in their work area and their degree of supervision. This should include an appraisal of the candidate's company organisation chart and the candidate's position within the organisation. This is particularly important in the nuclear sector owing to the necessity for personnel to be SQEP, and the consequent level of supervision that may have had to be provided to aspiring corporate members.

5.1 Competence Statements A & B

Successful applicants will be able to demonstrate their use of a combination of general and specialist engineering knowledge and understanding to optimise the application of existing and emerging technology within the nuclear industry whether it be in operations, maintenance, design or other areas outlined above. They will also be able to identify how they have applied appropriate theoretical and practical methods to the analysis and solution of engineering problems.

Applicants engaged primarily in project engineering, commercial aspects or management should provide, and assessors should seek, evidence of responsibility for technical specifications, technical risk management, evaluation of technical solutions and monitoring against technical performance standards.

Examples of situations or opportunities that may give mechanical engineers the opportunity to achieve and demonstrate professional competence in these areas include:

- Theoretical studies in the design or operational problems of existing nuclear plant (whether it be power or process plant), either in a design and manufacturing environment or in providing a specialist service. These tasks could be carried out within most of the organisations identified within Section 3.
- Participation in the evolution, development, manufacture, testing and commissioning of new plant or facilities relating the nuclear industry. This could relate equally to new plant for generating, for processing or to facilitate decommissioning.
- Problem solving relating to operational failures and maintenance issues. This could involve tasks such as RCM (Reliability Centred Maintenance), or ARM studies (Availability, Reliability, Maintainability).
- Research or analysis at operational/ technical level to identify opportunities for an employer in terms of technical innovation, or operational improvement.

5.2 Competence Statement C

Many roles in the nuclear industry give the opportunity to develop competencies in this area of providing technical and commercial management. Applicants need to demonstrate their particular engineering skills and personal responsibilities at the level they have reached, as well as their relationships with their colleagues and superiors.

Examples of situations or activities that may give mechanical engineers the opportunity to achieve and demonstrate professional competence in these areas include:

- The planning and personal supervision of plant modifications or the manufacture/ fabrication of new equipment for plant. The project management of operations on existing plant, including budgetary control.
- Contract management to ensure that appropriate resources are applied to tasks and that timescales are met.
- Quality and/or safety management to ensure that projects are implemented within the regulatory regime as defined by individual license holders, by ensuring that safety and quality management systems are complied with and that any shortfalls are identified and rectified.
- Active participation in design reviews and performance reviews of operational plant or designs, which establish improvement action plans.
- The review of maintenance schedules for plant and responsibility of changes to the schedule to ensure that new equipment is included in the schedule and that safety critical equipment is maintained at the appropriate periodicity and to necessary quality levels.
- The supervision of technical staff either on a individual or team basis, involved in problem solving. This could include managing personal development and monitoring performance.
- The management of plant maintenance activities and/or the responsibility for plant performance and/or continuous improvement.

5.3 Competence Statement D

Communication and interpersonal skills should be assessed by consideration both of the Professional Review Report and interview performance. Assessors should expect a report which has a logical structure, aimed at presenting a portfolio of evidence against each of the five competency statements, whilst providing a qualitative description of activities and achievements. It should be apparent what the candidate's personal responsibilities and influences are. With MPDS applicants, reports submitted should include the evidence required relating to communications skills.

Assessment of verbal communication skills should analyse the ability to give clear, concise and relevant answers which address the question without undue digression and provide sufficient, but not superfluous detail.

Additional evidence of competence in this area may be sought by investigating:

- Whether the candidate has been involved in the chairing or recording of technical meetings. This could include design review, HAZOP, ALARP review etc
- Whether the applicant routinely makes presentations to in-house management at various levels and/or outside clients and contractors. Subjects that may have been discussed include project plans, problem resolution, business plans etc.
- Whether the applicant is involved in contract liaison and negotiations or the development of systems, safety cases, procedures, method statements etc.
- Whether the candidate is a team-player and has the ability to empathise with others, to facilitate project or organisational goals.

5.4 Competence Statement E

The observance of safe working procedures, including compliance with license conditions, management procedures and local rules is inherent in virtually all engineering activities within the nuclear industry. Similarly, there are codes which cover the design and manufacture of all major plant components and the operation of all plant. Applicants should be able to demonstrate their knowledge and commitment to the use of any such codes as relevant. Similarly, the candidate should be aware of and comply with the Code of Conduct of the IMechE.

The candidate should be aware of Health, Safety and Environmental issues within the context of their job and have an understanding of the broader societal issues related to the environment, safety and sustainability. They should be aware of the broader context of their work in terms of the community and stakeholders. This is of importance in the nuclear industry, due to the level of public and regulatory scrutiny, and the potential implications if something goes wrong. The candidate could provide evidence of developing or implementing environmental, health, safety or risk management systems, or of interfacing with the broader community in an engineering context.

Evidence of professional integrity and commitment should include a Self-Development Action Plan, stating how the applicant intends to maintain and enhance competence through personal development. The plan should include short, Medium and long-term goals and explain how these are likely to be achieved. Assessors should note that UK-SPEC interprets Continuing Professional Development (CPD) as commencing at the point where Chartered status is attained; therefore applicants are not required to provide proof or record of courses attended etc when applying for corporate membership and professional registration.

Examples of CPD activities recognised by the Institution as acceptable include:

- Extra qualifications such as an MBA, Diploma in Engineering Management
- Any relevant technical or business courses
- Conducting or attending workshops
- Attending, presenting or participating in seminars or conferences
- Presenting or attending lectures
- Writing technical papers
- Reading technical articles or journals
- Distance or open learning
- Secondments and job rotation
- Updating in own and other fields of work
- Institution meetings and events
- Active IMechE (or similar organisation) committee work
- Learning a foreign language
- Involvement in government activities
- Community and charity work

6 Requirements for Fellowship

Senior engineering posts within the nuclear industry should be considered as likely to meet the requirements for the class of Fellow. Examples of these are: Site Manager, Engineering Director, Chief Inspector, Operations Director or Principal Consultant. Applicants need to demonstrate a very high level of competence in each of the categories defined in the UK-SPEC, and provide evidence of this in their application. For example, a candidate CV that does not address the relevant competencies will not normally be acceptable, without additional supporting evidence.

Applicants will generally have significant responsibilities and decision-making powers for resources (both financial and manpower) and also have wide understanding of strategic, financial and commercial issues. They may well be experts in their particular fields, e.g. the type of reactor plant or process that is being designed, operated, regulated or maintained, or have specialist knowledge of the fundamental principles and techniques associated with nuclear plant design or operation. They are also likely to be “champions” for their directorate, company or industry sector. Applicants will generally be able to demonstrate strong leadership qualities and have significant autonomy within their role.

All applicants would normally be expected to show that they promote and develop young engineers and potential engineers. Further examples of suitable CPD activities not covered under the requirement for Competence Statement E above, that may help achieve this objective, include:

- MPDS Mentoring
- Acting as an IMechE Membership Panel interviewer
- Active participation in Institution committees
- Evidence of presentations, published papers etc.

All candidates applying for the class of Fellowship must demonstrate a commitment to the development of the engineering profession in the broader context and to their own Continuing Professional Development.

Valid applications for election or transfer to Fellow may be received from other engineers with established reputations in important positions of responsibility in engineering science or

practice. This applies to engineers both in operating companies, regulatory authorities, consultancies and in companies which design and/ or manufacture equipment. In addition, the demonstration of achievements and standing in their field of engineering science or practice, applicants would be expected to participate in external forums, for example, by promoting the importance of engineering issues in debate with Government and other bodies, via the Institution.

For candidates applying directly for the class of Fellow, a Professional Review Report similar to that for the class of Member would be required in addition to an interview. In particular this report must contain additional supporting evidence detailing:

- The position of senior engineering responsibility held by the applicant.
- The applicant's contribution to the professional development of young engineers.
- How the applicant intends to keep up to date regarding developing technologies, from both a technical and commercial standpoint.