Nuclear Workforce Assessment 2019

A scenario-based approach to nuclear workforce planning

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NWA 2019

1 Introduction

Planning for our Nuclear Future: forecasting skills demand and supply in a changing landscape

Since the publication of our last Nuclear Workforce Assessment (NWA) in 2017, the nuclear sector has experienced a series of changes that are set to have a long lasting impact upon the both the nature and makeup of our workforce.

The launch of the Nuclear Sector Deal (NSD) in 2018 was a pivotal moment for the industry. It emphasised the importance of our sector’s role in delivering key themes of the UK’s Industrial Strategy, most notably the ‘Grand Challenge’ of Clean Growth. A global challenge that sees the sector leading the way in providing the technologies, innovations and services to support the shift to a low carbon future.

The NWA provides us with a crucial evidence base to support this ambition, forecasting skills supply and demand across the nuclear sector in the UK—new build, operations, decommissioning, research and development and defence activities. And the skills required to meet this workforce demand include skills for nuclear including all-important trade, generic engineering and project management skills, as well as more specialised nuclear skills.

The People and Skills elements of the Nuclear Sector Deal directly support the foundations of the UK Government’s Industrial Strategy. Through working with the sector, and its wider supply chain, we can bring prosperity to our regions through the opportunities that the nuclear sector can bring.

The People Strand, which is supported by the NSSG, is aimed at ensuring our sector and its supply chain have the skills they need to succeed; at embedding a reformed system of technical and vocational education to boost STEM (science, technology, engineering and maths) and digital skills. The NSSG, working across the sector, will also work to ensure that the benefits that a career in our nuclear sector can bring are open to all.

Since the previous NWA there has been significant and positive progress in the Nuclear New Build (NNB) arena. Hinkley Point C in Somerset saw EDF achieve J0 – the concrete pour for the nuclear island – ahead of schedule, while Sizewell C in Suffolk completed the fourth stage of its consultation with a view to submitting its planning application in 2020.

The China General Nuclear Power (CGN) and EDF Energy Bradwell B new build development in Essex, which was not featured in the previous NWA, and which is still subject to investigative works, is now a firm feature of this updated report.

In addition to multi GWe scale plants, it is now recognised that Small Modular Reactors (SMR) could be a solution to meeting our low carbon energy needs. Also funded feasibility studies for up to 8 Gen IV designs have been set in progress. This is alongside a £20 million Government funding allocation.
for development of Nuclear Advanced Manufacturing and more modular designs to increase cost-effectiveness.

Furthermore, the UK will accelerate efforts to realise fusion energy through a £222 million Government investment in a visionary fusion reactor programme, known as STEP (Spherical Tokamak for Energy Production).

**Scenario Planning**

There is less certainty in some large-scale NNB projects featured in the previous NWA, with cancellation of the NuGeneration project in Cumbria, and the suspension of the Horizon NNB project on Anglesey. This has created some ambiguity in predicting future workforce demand profiles.

All of this means this report is taking a different approach to previous Nuclear Workforce Assessments. Firstly, this has seen us modelling two different nuclear energy output scenarios to consider the impact on future skills needs. Secondly, as noted, this report reflects a significantly revised skills demand profile compared to that presented in NWA 2017. At that point there was a near-term and comparatively narrow peak in workforce demand for c.100,600 in 2021. This raised key challenges – both in terms of actually reaching this peak and then in considering what would happen to those skilled people when the peak had passed.

As a result of the programme changes outlined and the consequent alterations to planned timelines, we set out two new key scenarios. The demand curve under a 9 GWe model (Scenario 1) and an 18 GWe model (Scenario 2) both illustrate a more gradual and sustainable skills demand, and one which will mean less reliance on the need to import skills. The exact contribution of nuclear power to our future energy demand is still to be determined, but by adopting a scenario-based approach, it is possible to see the impact on skills and jobs for different nuclear power output scenarios.

Whilst the overall inflow is reduced, Scenario 1 creates 35,000-40,000 job opportunities by 2030 rising to circa 60,000 job opportunities in Scenario 2. Both scenarios respond to growth and attrition patterns across the sector. The nuclear sector also has an ageing – and of course knowledgeable – workforce with one fifth aged 55 or over. Replacement demand, rebalancing the workforce so it is more diverse and advances in new technologies present us with a continued need to take a range of actions on skills. Also, having a flexible workforce enables the sector to function in an agile way – and we’ll need such mobility and flexibility as our new build operations evolve. This will underpin our approach as we consider the opportunities created by the replication of Hinkley Point C as we continue to roll out our plans for Sizewell C.

As a sector, we have now responded by taking actions under five key themes, which parallel those in the Nuclear Sector Deal and for which this report has gathered data.

*Enhanced Skills Leadership – embracing Equality, Diversity and Inclusion (ED&I)*

Diversity in people leads to the diversity of thought required to introduce innovation and greater productivity. Our sector employs only 20% women, against a nuclear sector deal target of 40% by 2030. This report shows that the women employed tend to be in lower level roles, and are more likely to work in business functions than science, engineering or operations. We are taking action
now, but if we are to achieve the 2030 gender target we know we must recruit at a rate of 50% women across all modes of recruitment.

Local Apprenticeships

Apprenticeship recruitment currently delivers the most diverse outcomes. The trainee population (including graduates) has increased by 20% since the 2017 report. Evidence and challenges around sector utilisation of apprenticeships and apprenticeship levy will be set out in the forthcoming NSSG Nuclear Apprenticeship Survey. There is now positive potential for a shallower, but longer term demand curve to encourage the sector to further invest in apprenticeships.

Transferability

Whilst we have no benchmark data in this area, the recruitment data in this report suggest that we are making good progress at recruiting people into more experienced roles from outside nuclear. External hires represent 60% of the experienced hire recruitment pool. A recent example is the recruitment and appointment of the new Magnox Ltd senior leadership team which includes a number of external hires. Another great illustration of transferability is the 20 Cottam operations staff who moved from our coal powered station to other roles within EDF Energy's new nuclear fleet, thus retaining key skills. Geographic transferability of skills can also increase productivity, and we will continue to work across all the NSD themes to model the benefits of such transfers.

Subject matter expertise

Continued supply of Subject Matter Experts (SMEs) remains as important as ever. Considerable work has been undertaken to ensure a supply of individuals qualified to PhD level via Centres for Doctoral Training (CDTs), and potentially through Level 8 (PhD) apprenticeships. We need to continue to align academic research activity in nuclear to the supply of expert SMEs.

Exciting the Next Generation

Most skills supply routes into the sector are dependent on people with the right education, who are also pursuing a desire to work in the nuclear sector. Strength of skills supply via apprenticeships and graduate applicants is important data that will be analysed via our work on diversity.

The information contained within this latest NWA will continue to support evidence based planning for future interventions and activities the sector will need to meet its skills needs. The NSSG will facilitate these in a continued alliance with key skills partners.

Jennie Chapman, Head of Nuclear Skills Alliance, EDF Energy
2 Foreword

I am delighted to introduce this newly updated Nuclear Workforce Assessment (NWA), which, once again provides a comprehensive forecast of skills supply and demand across the nuclear sector – including new build, current operations, decommissioning, research and development and defence activities. More comprehensive than ever, the report also now starts to explore how we recruit for roles in our sector.

While the UK’s pathway to a low carbon and sustainable energy system is yet to be fully mapped out, a continued role for nuclear, large and small scale, is still very much in the mix, creating many thousands of job opportunities.

Indeed, a range of skills are required across all parts of our sector – from engineering and project skills through to high level R&D skills which, although smaller in number, are critical to the delivery of UK nuclear ambition.

This report is taking a slightly different approach to previous Nuclear Workforce Assessments. Two different nuclear energy output scenarios have been modelled to consider possibilities around future skills needs within the UK. Such scenario planning provides an important evidence-base to determine future skills development activities across the sector. It is also evident that planning our nuclear future is about meeting the demand through a rebalancing of our sector’s workforce, so that it is more diverse in people, and, in turn thought.

Mobility and flexibility between organisations is absolutely key, and we recognise the excellent work done to date in this space by organisations such as EDF and the Nuclear Decommissioning Authority (NDA).

Finally, I’d like to acknowledge the hard work of the NSSG members in providing the all-important data and for shaping this report together with the NSSG support team in enabling it.

Dr Fiona Rayment OBE, Director NIRO (National Nuclear Laboratory) and Chair of the Nuclear Skills Strategy Group
3 Key messages, skills challenges and opportunities

There is evidence of some good progress since the 2017 Nuclear Workforce Assessment. The defence nuclear sector is reporting better progress in gender diversity, increasing the representation of women from 12% in 2017 to 16% in 2019, compared to a reported fall within the civil nuclear sector (26% - 22%). With the sector’s overall figure falling from 22% to 20%, it is clear that significant progress needs to be made at all levels and in all disciplines to achieve the target of 40% women in nuclear by 2030. To achieve this, at least half of those entering the sector between now and 2030 need to be women. In addition, the sector needs to attract younger people from increasingly diverse backgrounds to explore careers in nuclear to ensure support for the anticipated pipeline of work.

Below is a summary of key points from this report:

**Enhanced Skills Leadership and Diversity**

- Evolving civil new build programmes and timescales have changed the demand profile leading to a flatter, more sustainable demand picture.
- At least 50% of new recruits into the sector need to be women to meet the sector deal target of 40% women in nuclear by 2030. There also needs to be a greater focus on creating a balance of gender diversity at a variety of levels and within different professions.
- There is a need to replace the expertise of an ageing workforce - 1/5 of the workforce is over 54 – this poses a great opportunity to get young, diverse and innovative thoughts into the sector over the next decade. The sector has attracted more female trainees, but this will need to be a greater proportion in future.
- Competition will remain with other infrastructure programmes for multi-disciplinary skills expertise. Development programmes for transferees could help overcome barriers to entry, and support their longer-term retention.

**Local Apprenticeships**

- There has been a 25% decrease in reported apprenticeships since 2017. These currently provide the greatest opportunity to diversify the workforce at a trainee level (currently, 33% engineering apprentices are female, compared with 7% of the non-trainee engineering workforce in the nuclear sector).
- There is a need to increase gender diversity in new starts in apprenticeships from 43% to at least 50% by 2021, as well as balancing female participation in different types of apprenticeships.
- Lack of certainty over new build programmes has and will continue to lead to an unwillingness to invest in apprenticeships.

**Sector Transferability**

- Transferability is key to meeting inflow demand as well as diversifying thought – increased effort is needed to ensure talent is attracted from other sectors. Currently, 60% of new recruits are from outside of the sector.
- For every additional new build programme, there are efficiencies to be obtained through the transfer of workforce from one project to another, leading to a greater justification for investment in skills.

**Staying at the Cutting Edge**

- Higher Level Skills are particularly affected by the aging workforce. A continued supply of PhDs from Centres for Doctoral Training (CDTs) and Level 8 apprenticeships will help to develop the future supply of subject matter experts.
- There is a need to reskill and create a workforce to develop and implement new Advanced Nuclear Technologies, which require different skillsets from conventional reactor technology.
4 The Context

Since the publication of the Nuclear Workforce Assessment 2017 the expectations around civil new build have changed significantly. The previous report was finalised just ahead of the announcement that CGN planned to construct a new plant at Bradwell in Essex. At the end of 2018 NuGeneration ended its project at Moorside in Cumbria, and Hitachi began a review of the Wylfa Newydd project on Anglesey.

Hinkley Point C has continued to lead the provision of new facilities with the completion of the Unit 1 reactor base in June 2019. A fourth stage of public consultation for Sizewell C in Suffolk was completed in September, and EDF Energy is expected to make a planning application in 2020. At Bradwell B, the reactor Generic Design Assessment is well advanced and, at the site, investigative works and survey are underway.

Hinkley Point C, Sizewell C and Bradwell B are three active projects that now form the core of the UK new build programme. Outside of that, opportunities remain to exploit both established sites (for additional conventional reactors) and new technologies, on a smaller scale, offering more distributed low-carbon heat and electricity. From a skills point of view, this would help to maintain a sustainable pipeline of nuclear expertise for use nationally and for export to overseas markets.

All the reactors under consideration over the last decade or more have been gigawatt scale Light Water Reactors (LWRs). In the last two to three years, however, the options for small modular reactors have gained traction with government looking at the potential for both LWRs in the near term and advanced systems further into the future. The skills required for yet to be specified technologies is not yet clear in terms of either volume or type.

The assessment looks at the workforce requirements across the whole industry including decommissioning, generation, research and development, new build and defence.

A notable development since the previous Nuclear Workforce Assessment, is the publication of the Nuclear Sector Deal (NSD). The NSSG worked with HMG on developing the people section within the deal, and are now responsible for enabling its delivery. Recognising 5 key workstreams, the core to the NSD is a clarity of demand and supply of the nuclear workforce, and proactive interventions to ensure availability of a diverse, skilled workforce, in the right place at the right time, a workforce that can support innovation in a way which leads to the cost reduction and export targets outlined in the same document. This focus on diversity of workforce and the creativity and innovation that it brings, leads to some specific diversity targets in the nuclear sector deal, most notably to enhance the gender diversity from the level in the 2017 NWA of 22% across civil and defence, to 40% women in nuclear by 2030. Although gender is the easiest element to measure, the focus on diversity is greater than gender alone and is concerned with enhancing diversity of thought. Other elements of the nuclear sector deal include important of trainees, (and particularly apprentice trainees) for supply of a future workforce at all levels, and the opportunity to influence the next generation of future nuclear workers. Many of these elements are explored in this NWA in terms of categorisation of workforce.
4.1 Methodology and alignment with NIA workforce data

Data has been collected, as in previous reports, directly from the site licence companies (SLC). The supply chain is more disparate and as such has had to be modelled. In this report we have looked to align with the Nuclear Industries Association Jobs Map which uses a comprehensive survey of its members and is likely to be a fuller representation of the supply-chain than the method used in the NWA to date. The NIA membership has excellent overlap with the organisations reflected in the NWA, although there is degree of scope difference. The portion of the NIA membership that is in scope to the NWA, but does not report directly to it, has been used to calibrate the supply chain in this report. The result is a more complete measure of the total civil workforce. One particular consequence of this change in methodology is in an increase in the demand workforce in 2018, compared to previous assessments.

5 The Demand

The demand for nuclear skills comprises, existing generation, decommissioning, defence and civil new build. Of these the new build programme has most impact in terms of affecting demand. In 2017 the Nuclear Workforce Assessment identified a large forecast peak associated with the new build programme as it was understood at the time. That timeline has had to be reassessed. Inevitably changes to the timeline affect the workforce analyses that flow from them.

Since the National Policy Statements for Nuclear Power Generation were published in 2011, the government has recognised a role for a minimum of 10 -14 GWe new capacity. Subsequently plans for 16 GWe, and later 18 GWe, were factored into national energy plans. With a new commitment to net zero emissions by 2050, the case for going beyond the 9 GWe currently in train has strengthened.

The means by which this can be achieved is nevertheless an open question. With established and accepted reactor designs, and sites agreed for construction, conventional reactors remain a possible route. However, smaller, modular reactors are under development and are being actively encouraged both in terms of small LWRs and also advanced systems.

5.1 Scenario 1 (9 GWe).

Although the overall demand for nuclear skills is determined by the requirements of a range of civil and defence operations, the most disruptive factor in forecasting future demand is the construction and commissioning of civil new build. In NWA 2017 the overlap of expected projects produced a large peak of around 100,000 FTEs at 2021. The termination of the NuGen project at Moorside, Cumbria and the suspension of Hitachi’s work at Wylfa leave three active projects at Hinkley Point C, Sizewell C and Bradwell B – for this report these form Scenario 1, totalling ~9 GWe capacity.
Table 1 Scenario 1 based on established and continuing civil new build projects at three sites, Dates are based on an informed NSSG and do not necessarily represent constructor or client views.

Table 1 lists the three sites of Scenario 1. Hinkley Point and Sizewell C were both included in NWA2017, although Sizewell C has been put back in time by three and half years. Bradwell has been added.

The reduction in the number of sites, the separation of Hinkley Point C and Sizewell C, together with the decreasing underlying demand of the existing estate, cause the demand to flatten and lower compared to NWA 2017. The profile is given in Figure 1. New build is shown in blue on top of existing operations (grey).

<table>
<thead>
<tr>
<th>Site</th>
<th>First Nuclear Concrete</th>
<th>Change from NWA 2017</th>
<th>First Full Plant Power</th>
<th>Generating Capacity (GWe)</th>
<th>Reactor Type</th>
<th>Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinkley Point C</td>
<td>2017 Q3</td>
<td>-</td>
<td>2026 Q4</td>
<td>3.26</td>
<td>EPR</td>
<td>EDF Energy</td>
</tr>
<tr>
<td>Sizewell C</td>
<td>2025 Q1</td>
<td>+3.5 years</td>
<td>2032 Q3</td>
<td>3.26</td>
<td>EPR</td>
<td>EDF Energy</td>
</tr>
<tr>
<td>Bradwell</td>
<td>2026 Q1</td>
<td>Additional site</td>
<td>2032 Q3</td>
<td>2.36</td>
<td>UK HPR1000</td>
<td>CGN/EDF Energy</td>
</tr>
</tbody>
</table>

1 Note that in this and subsequent plots the data have been smoothed to give a more realistic picture than the coarse (annual) time base with year-on-year step changes.
Figure 1 Scenario 1- 9 GWe Hinkley Point C, Sizewell C and Bradwell B

The same profile separated into component activities is shown in Figure 2. Note that while defence demand regional variation, these tend to cancel out in the UK picture.

The demand at 2018 is 93000, while the broad peak at 2027 reaches a maximum of 84000 FTEs.

**NOTE:** although there is a reducing demand curve, there remains a significant recruitment need due to attrition, this will be described in section 4.4 below.
5.2 Scenario 2 (18 GWe)

Given the UK’s commitment to carbon neutrality by 2050, there is considerable scope for the application of nuclear technology to firm power, mid-merit power, heat and hydrogen production as the energy mix is fully decarbonised. It is too early for a definitive view on the most likely mix of technologies, where they might be located, or the skill mix that would be required to produce them. Some discussion is given to the broad issues in section 7. Skills for new technologies.

<table>
<thead>
<tr>
<th>Scenario 2 (18 GWe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
</tr>
<tr>
<td>Hinkley Point C</td>
</tr>
<tr>
<td>Sizewell C</td>
</tr>
<tr>
<td>Bradwell</td>
</tr>
<tr>
<td>Reactor group 4</td>
</tr>
<tr>
<td>Reactor group 5</td>
</tr>
<tr>
<td>Reactor group 6</td>
</tr>
</tbody>
</table>

Table 2 Scenario 2 consisting of Scenario 1 with three additional hypothetical generation sites. While a variety of options exist for generation beyond 9 GWe, the dates represent the plausible re-establishment of projects in the Northwest, Southwest and Wales as an illustrative comparison. Assumptions are those of the NSSG and do not represent Constructor or Developer views.
In order to give a sense of the impact of further new build development we have used an indicative scenario doubling NNB capacity to 18 GWe assuming technology agnostic developments on a challenging but plausible time frame. Scenario 1 plus three additional reactor groups forms Scenario 2 (Table 2).

The demand calculated including Scenario 2 is shown in Figure 3. From the same starting level in 2018 demand reaches a peak in 2028 of 105500 – similar to, but delayed from the maximum demand envisaged in NWA 2017.

![Graph showing workforce changes](image)

*Figure 3 Additional conventional reactor build programme added to Error! Reference source not found. for Scenario 2. This is indicative for comparison only; additional capacity may be delivered by other technology routes, including AMRs*

The component activities in this case are given in Figure 4
5.3 Timeline and milestones

The total work programme for the UK nuclear industry comprises many individual projects in addition to the civil new build programme.

Figure 5 Overall timeline, together with major milestones for the existing estate. Reactor Groups 4, 5 and 6 are indicative only, based on plausible conventional reactor programmes. Advanced Nuclear Technologies pose an alternative route to additional capacity.
These are summarised in Figure 5 along with indicative timescales for the continuing submarine programme.

<table>
<thead>
<tr>
<th></th>
<th>First of a Kind Commercial</th>
<th>Nth of a Kind (NOAK) Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SMR</strong></td>
<td>SMR (light water)</td>
<td>Before 2030</td>
</tr>
<tr>
<td><strong>AMR</strong></td>
<td>HTGR</td>
<td>Early 2030</td>
</tr>
<tr>
<td></td>
<td>Other Gen IV</td>
<td>2040s</td>
</tr>
</tbody>
</table>

Table 3 Taken from the NIRAB report “Clean Growth Through Innovation – the need for urgent action”

SMR – Small Modular Reactor. Small light water reactors up to 0.3 GWe

AMR – Advanced Modular Reactor. Advanced reactors (a family of six Gen IV technologies) designed to maximise the amount of off-site factory fabrication

HTGR – High Temperature Gas Cooled Reactor. Advanced reactors (one of six Gen IV technologies) where reactors use high temperature gas coolant that can be used for large-scale hydrogen production, in addition to electricity generation.

5.4 Required inflow to meet Scenario 1 demand

Central to understanding the skills requirement for industry in the short and medium-term is the gap between the demand to meet the expected programme of work and the natural loss over time of an experienced and skilled workforce. The programme demand is not the same as the recruitment demand. Even in times of steady or reducing programme demand, attraction into the industry remains crucial.

Figure 6 shows the demand for Scenario 1 (gold line), currently the minimum expectation, and the projected workforce, as a blue line. The rate at which the existing workforce will be lost from the industry is difficult to know with great accuracy, and so the grey band shows how the projection might vary from retirement at 65 + 2% (top band edge) and retirement + 8% along the bottom edge. The blue line is 4%.

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2 Clean Growth through Innovation – the need for urgent action. A Report for the Department for Business, Energy and Industrial Strategy (BEIS), April 2019, nirab.org.uk
Necessarily, the assumption built-in to this is that the demand curve is static and does not flex, for example, to accommodate a shortage of supply.

Within that constraint, the recruitment inflow (i.e. into post with the necessary experience and knowledge to meet the requirements of the job) in each year is given in Figure 7.
The height of the bar in any year (beyond the first) is the inflow required assuming that all previous years were fulfilled. The low point at 2023 occurs because of the dip in demand at that point. The required inflow decreases after 2030 as demand decreases at that point. Note however, that, despite the decrease, there is still a net inflow. Substantial recruitment, together with the redeployment of skilled workers, is essential over this twenty-year period, and beyond.

![Levels L1 - L8](image)

**Figure 8 Cumulative inflow to match replacement and expansion demand (Scenario 1)**

Figure 8 shows the cumulative recruitment required in Scenario 1. Despite the programme demand having reduced slightly in this picture over the next decade, close to 40,000 FTE personnel will need to move into posts within the industry by 2030. In order to address a combination of replacement and expansion demand. The analysis on recruitment above is all based on Scenario 1. These are all increased significantly by Scenario 2, and indication of which is included in summary form in fig 9 below. Under this scenario 60,000 FTE personnel will be needed by 2030.
The average inflow per year is given in Table 4 for different role levels and the two scenarios. This gives a useful high-level view of the supply needed and shows the change from the build programme expected in 2017 where the requirement was expected to be of the order of 7000 FTEs/year. In any event, this represents a minimum expectation since we cannot take into account the management of local surpluses and deficits.

Although the cumulative total of Figure 8 shows a steady rise over the next 10 to 12 years, this disguises some large variations over time when viewed from the point of view of different Functions (Figure 10). Again, these detailed analyses are only included for Scenario 2.
Engineering generally maintains a large inflow requirement except for a dip around 2023. As expected, Trades largely mirror the engineering requirement representing similar phases of activity. Operations inflow has a reduced level until the mid-2020s when it starts to rise in response to the three core projects moving towards completion. Project Management first peaks ahead of Engineering, Trades and Operations, providing the support for the early and construction phases of new build.

### 5.5 Geography of demand

The geographical distribution of demand is important in maximising the efficient use of the skills available to the industry, in both generic and nuclear specific skills. Figure 11 illustrates the workforce demand changes between key dates in the Scenario 1 profile. Blue circles denote an increase in demand and red a decrease, with the area of the circle proportionate to the size of the change. Once again, it is important to note that a decrease in the demand does not imply that recruitment is not necessary, since replacement demand is critical in all but very steeply declining workforces.

Absolute demand levels by region are shown in Figure 12. Supply chain demand, where location cannot be confidently attributed, is labelled as No Specific Region.
Figure 11 Civil demand by location. Existing estate – grey, New Build - magenta
The absolute levels of demand by region are shown below.

Figure 12 Workforce demand by region – Scenario 1

This also reveals the movement of peak demand from the southwest in 2020 to the southeast in 2027.
Figure 13 Workforce demand by region - Scenario 2 given an illustrative and hypothetical re-establishment of projects in Cumbria, North Wales and Gloucestershire, as hypothetical NSSG scenarios to illustrate the regional impact of additional projects.

For comparison, the regional demand for Scenario 2 is given in Figure 13. The overlap of peak demands around 2027, while speculative, emphasises the possibility of resource tensions on the one hand, and opportunities for shared and managed skills development on the other.

Section Summary: Demand

- Changes to the civil new build schedule mean that the demand profile is flatter (less steep, but longer duration) than previously expected, providing increased opportunity for resource planning, and home grown skills.
- The forecast demand is based on a core (Scenario 1) and core plus (Scenario 2) models reflecting technology choices still to be made beyond the existing conventional build programme of Hinkley Point C, Sizewell C and Bradwell B
- Changes to the civil new build schedule mean that the demand profile is flatter than previously expected
- The (conservative) Scenario 1 leads to a steady decrease in overall demand with a peak in 2027 of 83600
- 35,000 to 40,000 FTEs into the industry by 2030 – Scenario 1. At least half of these need to be women to reach the Nuclear Sector Deal target of 40% by 2030. For Scenario 2 this would increase to 60,000 in the same period
- Combined replacement and expansion demand require a minimum inflow of around 3200 FTEs per year on average for Scenario 1, 4770 for Scenario 2
- The largest changes in demand are, as expected, in the southwest and southeast of England
- For every additional new build programme, there are efficiencies to be obtained through the transfer of workforce, leading to a greater justification for investment in skills
- Replacement demand is included for decommissioning, defence and generation
6 Meeting the demand

6.1 Resource Supply

The supply of resources to meet the demand scenarios that have been presented is achieved through 3 routes:

1. Existing Workforce
2. ‘Trainee’ workforce (including graduates and apprentices)
3. Experienced hires/transferees

Fragile skills

In many cases, an increased demand for skills can easily be met by the availability of those skills in the employment market. In these areas, no particular intervention is required, unless supply becomes more challenged. Where the supply against a particular demand is more challenging, we label these as ‘fragile skills’. There has been no dramatic change in the nature and type of fragile skills in this report, with employers broadly recognising similar areas of fragility of supply.

- Safety Case Preparation
- Control and Instrumentation
- Reactor Operation
- Site Inspectors
- Project Planning and Control
- Commissioning Engineers
- Electrical Engineers
- Emergency Planners
- Quality Assurance staff
- Chemists/Physicists
- Steel Fixers
- Concretors
- Civil Engineering Operatives
- Scaffolders

Recognising that there is more granularly around specific skill types, a series of detailed analyses, led by the Nuclear Decommissioning Authority, have been undertaken over the recent weeks, into a) resilience of alpha skills in the sector, b) integrated waste management capability, and c) health physics and radiation protection capability.

For each of these areas, when the analysis identifies a key gap, appropriate interventions will be delivered in conjunction with the NSSG.

Subject Matter Experts

Subject Matter Experts are defined as previously. Personnel with authority in a specific work area developed through 10 or more years’ experience of the subject. Typically, they will have high-level authority to sign off plans-for-work and documents verifying safe completion. They are likely to hold the highest technical knowledge for that subject in the organisation. SMEs do not necessarily have the highest educational qualification or hold senior managerial positions. In some organisations,
these are known as ‘Heads of Profession’, in others ‘Professional Leads’ or ‘Intelligent Customer’. The key is those individuals where loss of a Subject Matter Expert’s knowledge would cause a serious disruption to the organisations work programme. Table 5 explores SME supply within NSSG member organisations. Therefore it excludes academics, and the high proportion of SME capability that is secured from the supply chain. It is estimated that the total UK number of SMEs for the nuclear sector would be around 1/3 higher than the total below.

<table>
<thead>
<tr>
<th>Function</th>
<th>FTEs</th>
<th>Total</th>
<th>Percentage by Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Functions</td>
<td>90</td>
<td>519</td>
<td>17.3%</td>
</tr>
<tr>
<td>Engineering</td>
<td>196</td>
<td></td>
<td>37.8%</td>
</tr>
<tr>
<td>Operations</td>
<td>82</td>
<td></td>
<td>15.8%</td>
</tr>
<tr>
<td>Project and Programme Management</td>
<td>36</td>
<td></td>
<td>6.9%</td>
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<tr>
<td>Science Technical Health Safety &amp; Environment</td>
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<tr>
<td>Trades</td>
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</tr>
</tbody>
</table>

Table 5 Subject Matter Experts by Function

6.2 Replenishing and developing the workforce

The workforce inflows needed to realise the programmed demand will be met by recruitment of experienced hires, who already have much of the experience and knowledge necessary, and trainees (apprentices and graduates) who are part of a programme of developing new talent, and through reskilling and promotion of existing people in the organisation.

This section will explore the utilisation of trainees compared to experienced hires/transferees and reskilling to meet the gap between existing workforce and current and projected demand.

6.3 Age Profile and attrition

Attrition can be accelerated by the opportunity for retirement, so an ageing workforce presents challenges in terms of the rate at which the existing workforce is lost and (potentially) with it, critical skills. More positively, it provides the opportunity to recast the makeup of the workforce to meet future expectations. The civil part of the industry in particular shows a higher number of older workers (Figure 14), overwhelmingly male.
The defence sector has a double peak, the first of which (centred on 50-54) will impact on attrition rates for the next 10-15 years. Again, in the older age bands males are disproportionally represented.

Based on information regarding our existing workforce, retirement and attrition rates, and demand against the conservative 9 GWe model, the implied annual inflow rate to 2025 is 3200 recruits (4770 for the indicative 18 GWe model). This inflow rate includes anticipated demand from supply chain organisations. This is a lower annual recruitment rate than had been previously forecast in NWA2017, which was based on a very significant and short term ‘peak’ of resources required to meet the needs of projects being delivered to similar timescales and with competing resources. There were concerns with this as a resourcing model for the UK, for the following reasons - a) intense competition for skills would serve to increase salary costs b) the peak was very short lived, leading to resources issues associated with oversupply in the medium term c) the inability of the system to cope with this level of demand whilst competing with other major infrastructure projects.

As a result of the NSSG approach and interventions taken, and impact of programme delays, a more sustainable resourcing profile is now more likely, one which will provide for longer term workforce opportunities, the peak is shallower, but the demand lasts longer.

This kind of resource profile provides greater justification for longer term investment in workforce, and a reduction of short-term solutions such as inflated salary or imported skills. It provides evidence to support a more strategic and proactive approach to skills. Work efficiencies and innovation implemented by sector could serve to further reduce overall numbers, or shift the nature of roles required (see 7. Skills for new technologies). Additionally the cost reduction and innovation required by the sector, result in the need for an increased diversity of skills and thought. This reinforces the need for a sector level approach to equality, diversity and inclusivity, to attract and retain people from backgrounds that better represent the UK society.
Whilst the total number of people may have reduced, the focus of the NSSG has always been on quality and specialisms as well as the quantity of skills required. Therefore, understanding and resourcing the shortage areas in the sector, niche skills and the subject matter expertise required remains a priority.

6.4 Trainee Workforce

‘Trainee’ is used in this section to refer to apprentices and graduates entering the sector for a period of training, typically directly after full-time education. The separation of apprenticeship and graduates is now less clear, as increasingly organisations are utilising apprenticeship levy to recruit apprentices across the full range of levels.

As in the 2017 Nuclear Workforce Assessment, we have accessed trainee data from the organisations that contributed data to this report. In 2017, the total number reported in training was 3291, which compares to 2461 in 2018 for this report (988 civil vs 1473 defence). This reflects a 25% decrease on the 2017 level. Whilst some of this variance might be due to the organisations that have responded, and the accuracy of data collection, there is, nonetheless a likely significant reduction in the trainee population.

The trainee workforce is the route for organisations to proactively plan for future demand. This is a long-term investment in future resource requirements. A reduction in investment in trainees, could be an indicator of future uncertainty. A fuller estimate of the trainee population along with indications of the impact of the apprentice levy on apprentice and graduate intake, will be reviewed as part of the NSSG Apprenticeship Survey, due out in November 2019.

Figure 15 illustrates the distribution of trainees across the levels of traineeship and is clearly dominated by the defence sector at Level 2.

Figure 15 Total trainee population segregated by level, for Civil and Defence Sectors
Figure 16 shows the same population segmented across different work Functions. In this case it is the Engineering population that dominates across civil and defence (49% of the defence trainee population and 41% of the civil trainee population), followed by the trades function (32% of defence trainees, compared to 28% of civil trainees.).

Taken together this suggests the largest bars (Level 2 and Engineering/Trades) reflect the training populations of the MoD’s industrial partners\(^3\).

![Figure 16 Total trainee population segregated by business function, for Civil and Defence Sectors](image)

**Figure 16 Total trainee population segregated by business function, for Civil and Defence Sectors**

Whilst the above clarifies the overall number of ‘trainees’ in the civil and defence sector, it does not give a feel for the relative contribution of trainees compared to other recruitment methods, in meeting recruitment needs of the sector, nor what the annual recruitment figure of trainees is.

### 6.5 Recruitment

For the first time, this NWA has requested recruitment data, as a valuable indicator of resourcing practices for the sector. We therefore have no comparable data from previous reports in this area, and the recruitment data presented here is not complete. No Defence employer data was provided, and within the Civil sector there were one or two omissions from NSSG companies. Recruitment data for supply chain organisations is also excluded. Given the value gained from analysing this data subset, one recommendation is for the acquisition of a more complete data set in future reports. The recruitment data collected represents around 30% of predicted required inflow. 899 recruits have been identified by this population of which 228 are trainees (graduates and apprentices).

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\(^3\) AWE, Rolls Royce, BAE and Babcock
On analysing this data, trainees make up around 25% of the civil recruitment activity, with experienced hires/internal redeployment making up the other 75%.

### Table 6 Civil recruitment (sample)

<table>
<thead>
<tr>
<th>Recruitment (sample of UK industry)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff recruited</td>
</tr>
<tr>
<td>Staff from non-nuclear</td>
</tr>
<tr>
<td>Trainee recruitment 2018</td>
</tr>
<tr>
<td>Apprentices</td>
</tr>
<tr>
<td>Graduates</td>
</tr>
<tr>
<td>Trainee stock</td>
</tr>
</tbody>
</table>

Figure 17 Annual recruitment data, split by recruitment categories

6.6 Diversity of our workforce

Increasing the ratio of females to male in recruitment is the main lever in improving gender balance. It is true though that those who are nearing retirement age are more likely to be men (Figure 14), reflecting historically higher rates of men in the workforce. Men make up 83% of the 50+ age category across civil and defence. Replacing retiring older workers with younger recruits will help the process of rebalancing (provided the inflow itself is well balanced). A simple model, discounting the current workforce age distribution, shows the sector deal target of 40% women by 2030 could be achieved if the sector recruit at a 50% rate now, given attrition at a nominal 8% and assuming a steady workforce total. This level of attrition, whilst high for the sector, might reflect the increased likelihood of retirement of an aging population. If the sector were to see significant growth, then
the ability to hit the 40% women in nuclear target becomes easier, as you are not waiting for people to leave to redress the balance. In any event, given that women currently makeup under 40% of the workforce, reaching that level by 2030 will require recruitment that averages more than 40% in the intervening period.

In terms of data collected for the 2019 NWA, we have gender data for the current workforce, both in civil and defence sectors for those organisations that provide data into the NWA. This excludes the supply chain, but includes site licence companies, regulators, MOD and defence supply chain strategic partners. This data is broken down by discipline, by level and for the first time we now have some recruitment data. This is especially important since it will give us an indicator as to how quickly (if at all) we are redressing the gender imbalance.

<table>
<thead>
<tr>
<th></th>
<th>NWA2017</th>
<th>NWA2019</th>
<th>Sector Deal target by 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil</td>
<td>28%</td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td>Defence</td>
<td>12%</td>
<td>16%</td>
<td>40%</td>
</tr>
<tr>
<td>Combined</td>
<td>22%</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

*Table 7 Percentage Gender in civil and defence sectors compared to NWA2017*

Data collected in 2016 for the NWA2017 report was the first to separate male and female components of the nuclear workforce. Compared to the NWA2017, it appears that the defence sector is achieving a better balance, where there is no improvement in the civil sector. With only the first and second rounds of gender data collection to compare definite trends remain to be established. With that caveat, we can look at this total population, by functional area and by level, to explore how the overall percentage female is distributed across the workforce.

Figure 18 below show that it is only in the business area where the gender split reaches the 40% level targeted within the sector deal with engineering and trade functions at the lowest levels.
Figure 18 Female participation in the existing workforce (lines show 2017 levels)

The lines on the graph show the previous level indicating that only the Business and Project Management areas have increased their gender proportion. Disappointingly, whist the sector showed a larger proportion of females in engineering than national benchmark in 2017, in 2019 our data are lower than the national benchmark. Project management fares better than industry norms, whereas science and technical remain about in level with these norms.

When we look at the workforce gender divide by level, we can see that the highest proportion of women is at the lower levels (20-25%), tailing off at more senior levels (12-15%). This may be due to several factors, for example the number of higher roles available, or issues of progression. It is not possible to more specific within the current data. Additional information on rates of progression could help to clarify this.
6.7 Gender diversity in recruitment

Increasing the ratio of females to male in recruitment is the main lever in improving gender balance. It is true though that those who are nearing retirement age are more likely to be men (Figure 14), reflecting historically higher rates of men in the workforce. Men make up 83% of the 50+ age category across civil and defence. Replacing retiring older workers with younger recruits will help the process of rebalancing (provided the inflow itself is well balanced). A simple model, discounting the current workforce age distribution, shows the sector deal target of 40% women by 2030 could be achieved if the sector recruit at a 50% rate now, given attrition at a nominal 8% and assuming a steady workforce total. The older male workforce will lower the rate needed somewhat, and with growth the opportunity to make a difference also increases. In any event, given that women currently makeup under 40% of the workforce, reaching that level by 2030 will require recruitment that averages more than 40% in the intervening period.
A second sector deal gender target is that the sector should achieve a rate of 50% female apprenticeship starts by 2021.

The starting position for apprenticeship recruits is **43% female** for apprentices recruited in 2018 (this is taken from the civil sector only, as we do not currently receive recruitment data for defence). This is a higher rate than in other recruitment areas. In the same year, for this sample of civil sector organisations at least, graduates were recruited at a rate of 27%, and transferees and internal deployments at 32%; an average of 33% across all recruitment routes.

Whilst this is an improvement on the 24% gender balance currently achieved in the civil sector, if maintained it would clearly be insufficient to reach the 40% women in nuclear target by 2030. From now an average of 50% female recruitment is needed. Each year that recruitment is lower than 50% will mean the target will be slower to achieve. A rate of 50% female apprenticeship starts is only one component of the solution, albeit an important flagship.

<table>
<thead>
<tr>
<th>Recruitment Route</th>
<th>NWA 2019 (recruitment in 2018)</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprentices</td>
<td>43%</td>
<td>50%</td>
</tr>
<tr>
<td>Graduates</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>Transferees and Redeployments</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>Combined</td>
<td>33%</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 20 Gender balance forecast for different recruitment rates**

**Figure 21 Gender balance in Trainee recruitment**
As well as concentrating on achieving 50% apprentice recruits, it is important to ensure there is an equity in the level and function that these females are recruited to.

6.8 Civil and Defence trainee population recruitment

Whilst we did not have recruitment data from the defence sector, we do have data on their stock of trainees, i.e. individuals currently on a traineeship irrespective of intake year. The trends for trainee recruitment can largely be observed across the entire trainee population which includes defence trainees. The break down in terms of level, and function for the entire civil and defence trainee population is illustrated in Figure 22 and Figure 23 below. There does seem to be a greater proportion of female higher-level trainees in the defence sector than in the civil sector, probably reflecting the fact that the level 2 defence trainees tend to be in trades, a discipline dominated by males. There are some improvements in the female participation in training in some disciplines. Engineering trainees represented on 14% of the workforce in 2017, and now represents 32% across civil and defence. This is a considerable improvement and bucks the engineering trend of HESA graduate engineering data which was at 17%. The utilisation of apprenticeships to redress the balance in engineering may be a useful strategy. There may be a more immediate opportunity to influence rate of applicants to engineering apprenticeships, than for applicants to engineering degrees, as interventions tend to be more targeted and local.

![Figure 22 Trainee population broken down by level](image-url)
Despite there being some way to go in achieving the 50% gender split in some levels and disciplines, some progress is being made.

Since the NWA 2017 there have been improvements as well as deteriorations in terms of the gender balance in trainee stock. The defence sector has uniformly increased the number of females at all levels (except level 3 where it remained essentially unchanged). The civil sector has improved the gender balance at the lower levels and regressed at level 4, which is arguably a backward step in terms of an equality mission. Interestingly the level 4 percentage was noted as being particularly high in 2017, but was a limited total population so may not have been reliable.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L2</td>
<td>36%</td>
<td>59%</td>
<td>16%</td>
<td>19%</td>
</tr>
<tr>
<td>L3</td>
<td>15%</td>
<td>20%</td>
<td>9%</td>
<td>8%</td>
</tr>
<tr>
<td>L4</td>
<td>45%</td>
<td>36%</td>
<td>10%</td>
<td>32%</td>
</tr>
<tr>
<td>5/6</td>
<td>37%</td>
<td>38%</td>
<td>35%</td>
<td>45%</td>
</tr>
<tr>
<td>Graduate</td>
<td>24%</td>
<td>26%</td>
<td>19%</td>
<td>8%</td>
</tr>
</tbody>
</table>

| Good Progress since 2017 | No improvement since 2017 | Deterioration since 2017 |

Table 8 Comparison of female participation data - 2017 and 2019.

Section Summary: Meeting the demand

- Overall women in nuclear stands at 20%
- 16% women in defence sector, improved from 12% previously, 24% women in civil sector, declined from 28% previously
The opportunity to make the industry more diverse comes primarily through the supply of skills to meet replacement and any expansion demand.

Ability to achieve the Nuclear Sector Deal target is improved with greater sector growth.

Recruitment rates for women in all types are recruitment are better that the current industry percentage of 20%, but apprenticeships do best at recruiting a higher proportion of women.

The overall nuclear sector that report data to the NSSG have a trainee stock of 2461 trainees, a 25% reduction on the NWA2017.

Required annual inflow is now around 3200 per annum, a lower, but more sustainable level, supporting resource planning.

Engineering trainees represent a significant proportion of trainees for both civil and defence.

In the civil sector trainees make up around 25% of the recruitment activity, with 75% being through experienced hires and redeployment.

Unfortunately, female apprenticeship recruits tend to be disproportionately at the lower levels and in business functions.

The overall female percentage in the trainee population has increased all levels for the defence sector, in the civil sector it has only increase for lower level apprenticeships.

Apprenticeship recruitment is the most diverse, 43% of apprentices recruited in 2018 were female, however apprenticeships currently make up less than 20% of new recruits.

1/5 of the workforce are 55 or over.

In 2018 33% of trainees across civil and defence are female – apprenticeship area excellent way of increasing diversity.

Transferability is key – work hard to ensure that we are attracting diverse talent from other sectors.

60% experienced hires from outside of the sector.

Multiple new build scenarios increase opportunity for geographic transferability to increase efficiency.

7 Skills for new technologies

Since the first commercial nuclear fission reactors began generating electricity in the 1950s, reactor technology has gone through several stages of evolution to improve efficiency and safety. In parallel, the average reactor capacity increased as the cost of land and gaining regulatory and planning consent led to economy of scale.

More recently, design improvements, particularly modularisation, have begun to reverse that trend. Reactors of a few hundred megawatts, rather than gigawatts, have potentially fewer siting restrictions, allowing them to be positioned close to high energy consuming industries, or on brown field sites replacing decommissioned fossil fuel stations. Waste heat can be used for heating or for driving industrial processes. With component standardisation and on-site construction reducing delays and cost overruns, the economic prospects for nuclear power generation are greatly enhanced.

---

4 From a sample of Civil sector organisations covering around 8000 personnel
As the UK accelerates efforts to reduce carbon emissions to net zero over the next three decades, particularly the decarbonisation of transport, nuclear technologies that can be made cost-effective can contribute significantly. Nevertheless, bringing this capacity online will take commitment and resource. The Nuclear Innovation Research Advisory Board (NIRAB) has recommended\(^5\) that between 2021 and 2026 the Government invests around £1 billion in a Nuclear Innovation Programme, expecting to see such support reflected in an increase in private sector support in response.

The 2018 Nuclear Sector Deal included initiatives to encourage nuclear manufacturing in the UK to continue to develop nuclear technology. In an initial stage eight organisations\(^6\) were awarded contracts to engage in feasibility studies for Advanced Modular Reactors. Although SMRs began as the primary focus, Government is keen to keep the options for new reactor technologies as open as possible, preferring to use the term Advanced Nuclear Technologies (ANT).

Worldwide the deployment of SMRs is still in its infancy with only a few units in operation, although more 100-600 MWe units are scheduled for the USA, China, South Korea and Canada.

Inevitably, a detailed understanding of the workforce required for the commercial manufacture and commissioning of so-called NOAK\(^7\) reactors has yet to be developed. It is clear though that the skills profile of the industry needs to adapt to meet the challenge. The NIRAB report encourages the development of ‘High Performance’ and ‘Innovation’ cultures, the growth of technology commercialisation skills, and a high-level skills drive to include, amongst others, skills for an advanced fuel cycle. The aim is not only to bring online a fleet of new reactors but also to be international ‘partners of choice’.

The context and starting point is an industry with a long nuclear legacy and a high skill base; 44% of the workforce occupies role levels 4 to 8, and 13% levels 7 and 8.


\(^7\) Nth of a Kind, as distinct from, generally more expensive, First of a Kind (FOAK)
In general, the civil scientific workforce is younger than the industry in general (Figure 14).

Within the conservative Scenario 1 (which includes no AMR technology), around 3000 science and research FTEs are required now and into the future (Figure 25 and Figure 26). This will require the inflow of ~130 scientists and researchers per year to maintain the status quo.

**Figure 24** Age distribution for Scientific and Research occupations

**Figure 25** Demand and current workforce of Scientists and Scientific Researchers without additional AMR demand. All Levels
Higher level skills (Levels 7 and 8) are currently at around 500 FTEs rising to 600. Again this assumes the least challenging Scenario 1.

![Graph showing demand and current workforce of Scientists and Scientific Researchers without additional AMR demand. Levels 7 and 8.](image)

It is now critical to develop workforce models that will allow the impact of new nuclear technologies to be forecast over a range of scenarios. Commercial sensitivities will make this a difficult undertaking, but it is in the interests of the industry, and the aspiration of a net zero carbon economy that the skills for the future are developed today. That means understanding new skills requirements as well as we understand the demands of the current.
<table>
<thead>
<tr>
<th>Role Level</th>
<th>Component</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Qualification/Experience</td>
<td>Describes a role that would require qualification or equivalent experience at level 1 (e.g., GCSE D-G level, foundation diploma).</td>
</tr>
<tr>
<td></td>
<td>Knowledge</td>
<td>Has basic factual knowledge of a subject and/or knowledge of facts, procedures and ideas to complete well-defined routine tasks and address simple problems; and is aware of aspects of information relevant to the area of study or work, which involves the application of knowledge and skills in the performance of a range of varied work activities most of which may be routine and predictable.</td>
</tr>
<tr>
<td></td>
<td>Skills</td>
<td>Use basic cognitive and practical skills to complete well-defined routine tasks and procedures. Select and use relevant information. Identify whether actions have been effective.</td>
</tr>
<tr>
<td>2</td>
<td>Qualification/Experience</td>
<td>Describes a role that would require qualification or equivalent experience at Level 2 (equivalent to grades A*-C in the General Certificate of Secondary Education (GCSE)).</td>
</tr>
<tr>
<td></td>
<td>Knowledge</td>
<td>Has knowledge and understanding of facts, procedures and ideas in an area of study or field of work to complete well-defined tasks and address straightforward problems. Can interpret relevant information and ideas. Is aware of a range of information that is relevant to the area of study or work. Involves the application of knowledge and skills in a significant range of varied work activities, performed in a variety of contexts. Some of the activities are complex or non-routine, and there is some individual responsibility or autonomy. Collaboration with others, perhaps through membership of a work group or team, may often be a requirement.</td>
</tr>
<tr>
<td></td>
<td>Skills</td>
<td>Select and use relevant cognitive and practical skills to complete well-defined, generally routine tasks and address straightforward problems. Identify, gather and use relevant information to inform actions. Identify how effective actions have been.</td>
</tr>
<tr>
<td>3</td>
<td>Qualification/Experience</td>
<td>Describes a role that would require qualification or equivalent experience at Level 2 (AS and A level, level 3 extended diploma, level 3 certificates)</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Has factual, procedural and theoretical knowledge and understanding of a subject or field of work to complete tasks and address problems that while well-defined, may be complex and non-routine. Can interpret and evaluate relevant information and ideas. Is aware of the nature of the area of study or work. Is aware of different perspectives or approaches within the area of study or work. Has an informed awareness of different perspectives or approaches within the area of study or work. Involves the application of knowledge and skills in a broad range of varied work activities performed in a wide variety of contexts and most of which are complex and non-routine. There is considerable responsibility and autonomy, and control or guidance of others is often required.</td>
<td></td>
</tr>
<tr>
<td>Skills</td>
<td>Use appropriate investigation to inform actions. Review how effective methods and actions have been. Identify, select and use appropriate cognitive and practical skills, methods and procedures to address problems that while well-defined may be complex and non-routine. Can interpret and evaluate relevant information and ideas.</td>
<td></td>
</tr>
<tr>
<td>Qualification/Experience</td>
<td>Describes a role that would require qualification or equivalent experience at level 4 (Certificate of Higher Education or Higher Apprenticeship)</td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>Has practical, theoretical or technical knowledge and understanding of a subject or field of work to address problems that are well defined but complex and non-routine. Can analyse, interpret and evaluation relevant information and ideas. Is aware of the nature of approximate scope of the areas of study or work. Has an informed awareness of different perspectives or approaches within the area of study or work. Involves the application of knowledge and skills in a broad range of complex, technical, or professional work activities performed in a wide variety of contexts and with a substantial degree of personal responsibility and autonomy. Responsibility for the work of others and the allocation of resources is often present.</td>
<td></td>
</tr>
<tr>
<td>Skills</td>
<td>Identify adapt and use appropriate cognitive and practical skills to inform action and address the problems that are complex and non-routine while normally fairly well-defined. Review the effectiveness and appropriateness of methods, actions and results</td>
<td></td>
</tr>
<tr>
<td>Qualification/Experience</td>
<td>Describes a role that would require qualification or equivalent experience at level 5 (HND, HNC, Higher Diploma, Foundation Degrees)</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
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<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>Has practical, theoretical or technological knowledge and understanding of a subject or field of work to find ways forward in broadly defined complex contexts. Can analyse, interpret and evaluate relevant information, concepts and ideas. Is aware of the nature and scope of the area of study or work. Understand different perspectives, approaches, or schools of thought and the reasoning behind them. Involves the application of knowledge and skills in a broad range of complex, technical, or professional work activities performed in a wide variety of contexts and with a substantial degree of personal responsibility and autonomy. Responsibility for the work of others and the allocation of resources is often present.</td>
<td></td>
</tr>
<tr>
<td>Skills</td>
<td>Determine, adapt and use appropriate methods, cognitive and practical skills to address broadly defined, complex problems. Use relevant research or development to inform actions. Evaluate actions, methods and results</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Qualification/Experience</th>
<th>Describes a role that would require qualification or equivalent experience at level 6 (Degree level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Has advanced practical, conceptual or technological knowledge and understanding of a subject or field of work to create ways forward in context where there are many interacting factors. Understands different perspectives, approaches or schools of thought and the theories that underpin them. Can critically analyse, interpret and evaluate complex information, concepts and ideas</td>
</tr>
<tr>
<td>Skills</td>
<td>Determine, refine, adapt and use appropriate methods and advanced cognitive and practical skills to address problems that have limited definition and involve many interacting factors. Use, and where appropriate, design, relevant research and development to inform actions. Evaluate actions, methods and results and their implications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Qualification/Experience</th>
<th>Describes a role that would require qualification or equivalent experience at level 7 (post graduate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Reformulates and uses practical, conceptual or technological knowledge and understanding of a subject or field of work to create ways forward in context where there are many interacting factors. Critically analyses, interprets and evaluates complex information, concepts, and theories to produce modified conceptions. Understand the wider context in which the area of study or work is</td>
</tr>
</tbody>
</table>
located. Understands current developments in the area of study or work. Understand different theoretical and methodological perspectives and how they affect the area of study or work.

<table>
<thead>
<tr>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use specialised skills to conceptualise and address problematic situations that may involve interacting factors. Determine and use appropriate methodologies and approaches. Design and understand research, development or strategic activities to inform or produce change in the area of work or study. Critically evaluate actions, methods and results, and their short and long term implications.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Qualification/Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describes a role that would require qualification or equivalent experience at level 8 (doctorate level).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develops original practical conceptual or technological understanding to create ways forward in contexts that lack definition and where there are many complex interacting factors. Critically analyses, interprets and evaluates complex information, concepts and theories to produce new knowledge and theories. Understands and reconceptualises the wider context in which the field of knowledge or work is located. Extends the field of knowledge or work by contributing original knowledge or thinking. Exercises critical understanding of different theories and methodological perspectives and how they affect the field of knowledge or work.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses advanced and specialised skills and techniques to conceptualise and address problematic situations that involve many complex interacting factors. Formulates and uses appropriate methodologies and approaches. Initiates, designs and undertakes research development or strategic activities that extend or produce significant change in the field or work or study. Critically evaluates actions, methods and results and their short and long term implications for the field of work or knowledge and its wider context.</td>
</tr>
</tbody>
</table>