Nuclear Industry Association

SC@nuclear

The Essential Guide to the new build nuclear supply chain

Opportunities, routes to market, codes and quality arrangements for nuclear new build in the UK

Stage One
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Endorsed by:

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Contents

The Essential Guide
Introduction

A significant programme of engagement with UK suppliers has been carried out by SC@nuclear over the last 18 months. This has helped to raise awareness in the market and has highlighted potential opportunities for a large sector of UK industry. A central information portal has been created at www.nuclearsupplychain.com. It has been designed to make the latest key market intelligence available, giving support to companies with commercial aspirations in the new build market.

From interaction with the supply chain it has been found that the larger Tier 2 companies, and mature NIA member companies are well connected to the Utilities and technology vendors, and through this route, are aware of the opportunities which are emerging. These Tier 2 companies generally have a history in the nuclear sector and have strong technical and quality capabilities. They tend to understand the issues surrounding codes, standards, accreditation and quality arrangements.

However new entrants to the nuclear new build sector, smaller Tier 2s and many Tier 3 and Tier 4 companies may not have the marketing or technical depth which is embedded in the larger Tier 2s. These companies still have many questions regarding the nuclear new build programme and are looking for further detail on a range of topics including:-

Project Certainty

Timescale for Orders

Routes to Market

Applicable Codes & Standards

Roles & Requirements

Quality Arrangements

Without the knowledge of the details outlined above, Tiers 3 and 4 find it difficult to specify the level of investments required and the timing of that investment to be ready for the nuclear new build market. Following on from workshops on market opportunities and quality requirements in 2009, SC@nuclear has now embarked on a two stage approach to develop the information required by Tiers 3 and 4 to assist them in making business involvement and investment decisions.

Stage 1

This Essential Guide document summarises the market information and overarching principles relating to quality arrangements. Known information on the selection of appropriate codes and standards by the Utilities/Licensees is included with appropriate health warnings. The aim of this Essential Guide is to give Tier 3/4s information to help them make business decisions on market involvement and investment.

Stage 2

When more information on codes and standards is available, a revision of this document will be issued. In Stage 2 the implications of the specified codes and standards will be discussed. It will also encompass supply chain requirements for decommissioning and support to existing operating plants.

Examples of technical specifications for various components will be incorporated to provide Tier 3 and 4 companies with real examples of the level of quality compliance required for the nuclear new build programme.

The SC@nuclear website should be used in conjunction with this guide as it will expand on themes introduced in this document and will host live information on key matters.

Project Certainty
Nuclear new build market investors

At present three Joint Ventures have expressed a wish to construct new nuclear plant in the UK. In all cases the decision to proceed into construction is subject to acceptable economic conditions (projected demand for power) and certainty of return on investment. The current stated position of each Joint Venture is detailed below. As more certainty develops on the electricity market reforms, the regulatory environment and the timescales, the position of each of the potential nuclear new build investors will be updated in subsequent revisions of this document.

EDF Energy with their investment partner Centrica, through their UK subsidiary Nuclear New Build Generation Ltd (NNB Gen Co), have made their technology choice and are proposing to construct two EPR units at Hinkley Point followed by two EPR units at Sizewell. This is a total generation capacity of 6.6GW. Public consultation is underway at both locations with planning application projected to be submitted for the Hinkley Point site in 2011. First nuclear concrete for the EPR at Hinkley will be in 2013 and 1st power in 2018. Completion of the second reactor at Hinkley is expected by end 2020.

It should also be noted that EDF Energy is additionally planning to build one EPR unit at Penly in Northern France in the same timescale as the first EPR at Hinkley. The implications of this for the UK market will be discussed at a later date.

Horizon Nuclear Power (50/50 Joint Venture formed by E.ON and RWE) is based in the UK and plans to construct approximately 6GW of new nuclear power capacity. Horizon plans to develop 3GW at Wylfa at Anglesey (North Wales) followed by 3GW at Oldbury in Gloucestershire.

Horizon is currently part way through a technology selection process. It is evaluating the EPR plant designed by AREVA and the AP1000 plant designed by Westinghouse. It expects to make a technology choice in 2011. Depending on the choice of Technology, either 3 AP1000 units or 2 EPR units are planned at both Wylfa and Oldbury sites. Planning applications will be submitted for Wylfa in 2012 with final investment decision in 2013 and first nuclear concrete later that year. It is currently expected that the first unit at Wylfa will produce power in late 2019/early 2020. Oldbury will follow with first nuclear concrete projected in 2019.

A Joint Venture between GDF Suez, Iberdrola and SSE has been established under the name NuGeneration Ltd (NuGen). The JV has acquired land at Sellafield in Cumbria for developing their new nuclear plant. NuGen have not made any decisions on technology choice and are presently forming their UK team with an office location expected to be in Cumbria.

Timescale
For orders associated with nuclear new build

As can be seen in the previous section, EDF Energy and their UK subsidiary, Nuclear New Build Generation Ltd are the furthest advanced in the nuclear new build cycle followed by Horizon Nuclear Power and then by NuGeneration Ltd. The strategies and position of the latter two organisations are developing fast and this document can only present the current snapshot of their position. Updates will be featured at www.nuclearsupplychain.com.

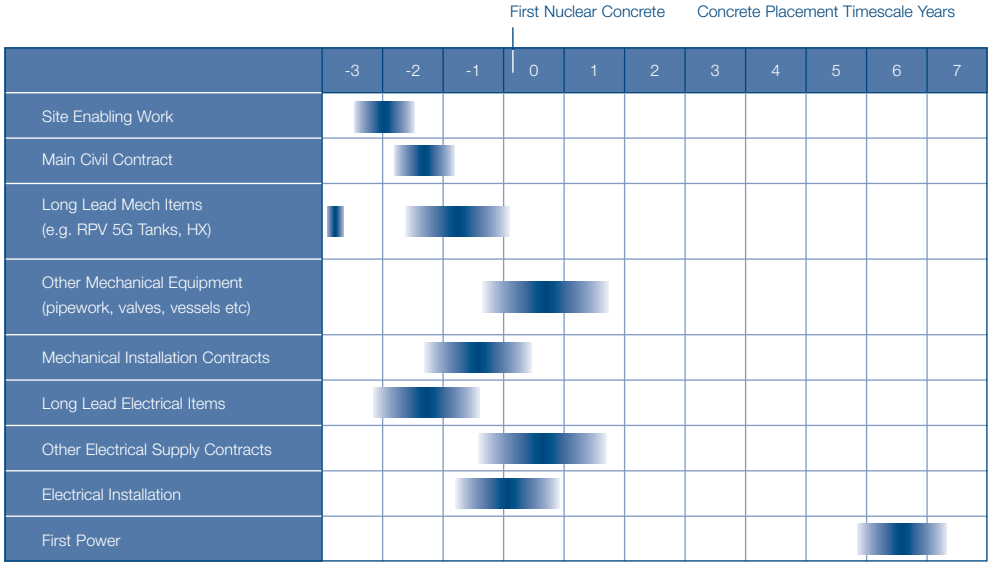
There are several factors which will determine when the nuclear new build projects proceed, and when the orders will flow into the supply chain. These are:

- Economic conditions
- Reform of the Electricity Market
- Ratification of National Policy Statements
- Satisfactory completion of Generic Design Assessment (GDA)
- Effectiveness of Infrastructure Planning Commission (IPC) and its successor Major Infrastructure Planning Unit (MIPU)
- Achievement of local planning consent
- Projected return on investment

All of the above are in the control of the Government, Regulators, Utilities and Local Authorities and cannot be influenced by the supply chain.

Once a nuclear new build project is approved the key date is first nuclear concrete. Everything else can be scheduled round this date. A schematic order placement timescale for the major packages is postulated below for a generic nuclear new build project relative to the first nuclear concrete date.

Schematic Order Timeline for UK Nuclear New Build Programme



The current view is that EDF Energy first nuclear concrete date for Hinkley Unit 1 will be 2013. For Horizon Nuclear Power the equivalent date for the first unit at Wylfa is likely to be late 2013. There is less certainty regarding first nuclear concrete for NuGeneration Ltd at Sellafield but 2015 is possible.

Routes to Market

The delivery strategies to be employed by the Utilities have become clearer over the past 12 months but some uncertainties still remain. The current position is outlined below for EDF Energy and Horizon Nuclear Power new build projects. There is less clarity as regard to the delivery strategies to be employed by NuGeneration Ltd. The SC@nuclear website and future revisions of this document will contain updates as further developments occur.

Market opportunities associated with EDF Energy construction of new nuclear plant

The market opportunities associated with EDF Energy consist of EPRs at Hinkley (2 off), Sizewell (2 off) and Penly in the North of France (1 off). The EPR Plant can be considered in three main blocks:

- Nuclear Steam Supply System to be supplied and probably installed by AREVA
- Turbine equipment and turbine building to be supplied and installed by the selected turbine contractor
- Supply and installation of the remainder of the plant will be procured by EDF Energy directly. This accounts for circa 60% of the total scope

Plant and equipment sourced by EDF Energy Direct

The procurement process for the EPR units at Hinkley and Sizewell is currently being overseen by NNB Gen Co in the UK, and run by EDF Procurement based in Paris. Because Hinkley EPR Unit 1 and Penly EPR are planned to proceed on the same timescales, some elements of procurement will be common for both stations. At present EDF Procurement are publishing Requests for Information on their EDF Energy Portail Achats web based portal and via the Official Journal of the European Union (OJEU) in the form of prequalification questionnaires. NNB Gen Co has engaged with Somerset and Suffolk/Norfolk Chambers of Commerce to provide business support to local suppliers.

These prequalification documents are for large packages of scope or are for the supply of specialist plant and equipment. In some cases the scope is for supply of components, plant and equipment for both Penly and Hinkley. In other cases the scope is associated with construction/installation works for Hinkley or Penly separately. The packages are such that Tier 3/Tier 4 UK companies are unlikely to prequalify on their own, and they will need to form consortia or supply agreements with larger Tier 2 companies to prequalify for the packages. Exceptions to this are niche service or specialist equipment supply companies. Enquiries for the main civil works and some of the early mechanical equipment supply have already been issued and tenders have been returned to EDF Energy for evaluation.

Supply of Nuclear Steam Supply System (NSSS) by AREVA to EDF Energy

The NSSS system is being supplied by AREVA for Hinkley, Sizewell and Penly. AREVA is also supplying equipment for several reactors round the world using their existing supply chain, and some UK companies are already involved in delivering equipment to support AREVA. As the AREVA supply chain expands to cope with increasing demand there may be opportunities for Tiers 2, 3 and 4 companies to supply niche market products and services such as specialist equipment or NDE inspection services to AREVA.

Routes to Market

Market opportunities associated with Horizon Nuclear Power construction of new nuclear plant

Horizon Nuclear Power has chosen a different delivery model, requesting the technology providers to tender for the supply of the complete power station. Two technologies are being considered, the EPR Reactor as supplied by AREVA and the AP1000 as supplied by Westinghouse. It is not certain if Horizon will employ an Architect Engineer to oversee the delivery or if they will utilise their own resources to manage the supply of the power station. Each of the technology providers (AREVA and Westinghouse) has aligned with other major companies to assist them in the delivery of the EPC project. Whichever option is ultimately selected, the Regulator will expect Horizon, as the Licensee, to have adequate arrangements to act as intelligent customer for the products and services being procured, to have arrangements to control the procurement process, and to maintain adequate oversight of the work carried out by the supply chain.

Tendering to deliver the AP1000 Technology to Horizon is a Joint Venture called Nuclear Power Delivery UK. This consists of Westinghouse, Toshiba, Shaw Group and Laing O'Rourke. This JV can be considered as a Tier 1 contractor to the Licensee. It will execute elements of the work itself and will go out to the market to Tier 2s for other major packages which it cannot deliver itself.

To deliver the EPR technology to Horizon, AREVA has combined with Balfour Beatty/Vinci and Siemens to form a delivery JV. Again this grouping, as a Tier 1 under contract to the Licensee, will self execute some of the work but will also employ Tier 2s to deliver major packages.

At present Nuclear Power Delivery UK and the AREVA/BBV/Siemens JV are approaching selected companies to obtain prices for elements of the work to help formulate their offer to Horizon Nuclear Power. It is only after the technology selection has been confirmed in mid 2011 that enquiries for real packages of work will emerge from the successful group into the supply chain.

Market opportunities associated with NuGeneration Ltd construction of new nuclear plant

Delivery arrangements to be employed by NuGeneration Ltd have yet to be publicised but the individual companies have major in-house Architect Engineering subsidiaries. It is possible that they could employ the model being used by EDF Energy as described above and use their own Architect Engineering companies to procure major packages of work under contract to the Licensee.

The Regulator will expect NuGen to have adequate arrangements to act as intelligent customer for the products and services being procured, to have arrangements to control the procurement process and to maintain oversight of the work carried out by the supply chain.

For further information and links to get involved visit
www.nuclearsupplychain.com

Applicable Codes & Standards

There are only two codes which are in widespread use in western countries which apply to the nuclear significant pressurised components to Class 1, Class 2 and Class 3 Standards:

1. French Nuclear Code RCC-M/RCC-E
2. American Nuclear Code ASME Section III

Class 1 are primary circuit, high integrity components. Most of the opportunities for Tiers 2, 3 and 4 companies will be to deliver Class 2 and Class 3 non-nuclear significant components. Examples of these will be included in the future revision of this document.

The RCC and the ASME III codes have similarities and it is possible to cross relate many sections in RCC-M to the equivalent section in ASME III. However while compliance with RCC-M will ensure compliance with ASME III, the reverse does not apply. For non-nuclear safety critical components it may be possible to use EN standards or national codes subject to the agreement of the Licensee.

The UK has considerable experience in the use of ASME and EN codes. Much of the oil, petrochemical and pharmaceutical industries specify the use of sections such as ASME VIII or ASME B31.3. In other industrial sectors, EN standards are routinely specified. If either of the ASME or EN routes were chosen by the Licensee, UK industry could make the transition to deliver (i.e. design, manufacture and install) much of the Class 2 and Class 3 nuclear and non-nuclear safety related plant and equipment for the Nuclear New Build programme.

There is much less experience in the UK in the use of RCC-M (mechanical) or RCC-E (electrical) codes. Even for experienced designers, training courses in the use of these codes on their own would not be sufficient to demonstrate that individuals are Suitably Qualified and Experienced Personnel (SQEP) for lead roles in the design process. Partnering with French companies with nuclear design and manufacture experience is an alternative approach to gain experience in the application of RCC codes.

A summary of the application of codes to the design, manufacture, inspection and testing of nuclear pressure boundary components is presented below.

Class of Component		
Class 1	RCC-M Section 1-B	ASME III NB
Class 2	RCC-M Section 1-C	ASME III NC
Class 3	RCC-M Section 1-D	ASME III ND
Non-Nuclear Significant components	EN Specs plus special requirements	EN Specs plus special requirements

It should be noted that only a small percentage of power station components need to be designed and constructed to Class 1 or Class 2 levels. Many of the components and equipment can be designed to EN Specifications with some special conditions attached. Many sections of RCC-M call up EN codes such as NF EN ISO 15609 for Weld Procedure Qualification and NF EN 583 for Examination Methods. This opens a large scope of work to Tier 3/4 companies who can deliver to these less onerous codes and standards under their normal ISO 9001 accreditation arrangements.

The AP1000 technology has been designed by Westinghouse to the relevant section of the ASME Code, and manufacture to ASME requirements will be required for this plant. It is likely that most of the Class 1 components for this technology (e.g. reactor pressure vessel, steam generators etc) will be manufactured abroad by organisations which possess the ASME N stamp.

For manufacture and installation of other components it is unlikely that companies will require N stamp. However this will require the Licensee to develop an ASME equivalence document (as was written for Sizewell B) to demonstrate how the quality arrangements to be put in place will deliver products and a plant which has a similar level of integrity and traceability to one which was built under N stamp arrangements. An important feature of the equivalence document will be the demonstration of how the quality arrangements will flow down into the supply chain.

For the EPR plant built to the RCC codes, a similar equivalence document may be required to be written by the Licensee. In this case the document must consider how those aspects of RCC required by French law will be enacted in the UK to ensure an equivalence of UK legislation, governance and quality arrangements.

Site Licence conditions

Under the Nuclear Installation Act, HSE will grant a Nuclear Site Licence to an organisation when it is satisfied that the applicant meets HSE's policies on Nuclear Site Licensing as set out in "The Licensing of Nuclear Installations". HSE has the power to attach conditions to the licence, and there is a standard set of 36 licence conditions which are attached to all Nuclear Site Licences. It is the responsibility of the Licensee to satisfy itself and the HSE's Nuclear Installations Inspectorate that it is complying with these licence conditions.

One of these conditions requires Licensees to make and implement adequate quality assurance arrangements in respect of all matters which may affect safety. These arrangements will be reflected in contracts between the Licensee and Tier 1 contractors and will flow down into contracts with Tier 2, 3 and 4 contractors. Although it is the responsibility of the Licensee to ensure compliance with licence conditions, it is expected that each Tier within the supply chain is made aware of, and understands the nuclear safety significance of its work, and that it complies with the contract specification. Each link in the supply chain should therefore ensure that its staff and any sub-contractors are suitably trained and briefed on their responsibilities for nuclear safety, and that suitable measures to assure compliance with contract specifications are implemented.

Roles & Requirements

The role of the Licensee

The Licensee or Prospective Licensee such as EDF Energy, Horizon Nuclear Power or NuGeneration Ltd will arrange the financing and planning of a new power station and will interface with the Regulators to gain a Nuclear Site Licence.

The supply chain can then be divided into a number of levels, each having its own roles and responsibilities. At the top of the supply chain is the Principal, or Tier 1, contractor. The Licensee/Prospective Licensee will specify the delivery requirements under formal contractual arrangements with the Tier 1 contractor and oversee the delivery of the finished products or services. The overriding principle is that it is the responsibility of the Licensee/Prospective Licensee to ensure that products or services that are being procured are of a satisfactory quality. This is particularly important where those products or services may have the potential to impact on nuclear safety.

The Licensee/Prospective Licensee must ensure that it has sufficient, competent resources and arrangements to specify requirements and oversee supply chain activities. These arrangements will be translated into contractual requirements which will pass through to each sub-contract in the supply chain in an appropriately quality-graded manner. However, ultimate responsibility for management of the supply chain and the quality of the procured product or service rests with the Licensee/Prospective Licensee.

In particular the Licensee/Prospective Licensee will specify:

- Overall procurement strategy
- Project management arrangements
- Health & safety expectations and culture
- Quality arrangements and how they will flow down through the supply chain
- Project delivery structure

Licensees/Prospective Licensees have the flexibility to deliver the project through a variety of arrangements. Options include:

- To procure the Architect Engineer through one of their subsidiary companies
- To procure the services of an Architect Engineer through an external company to manage the delivery and construction on their behalf
- To procure the plant on a turnkey engineering, procurement, construction (EPC) basis from the technology providers

In cases where a company, separate from the Licensee/Prospective Licensee, is used to provide these functions, it is regarded as a Tier 1 contractor. This includes the subsidiary where it is a separate legal entity (corporate body) from the Licensee/Prospective Licensee.

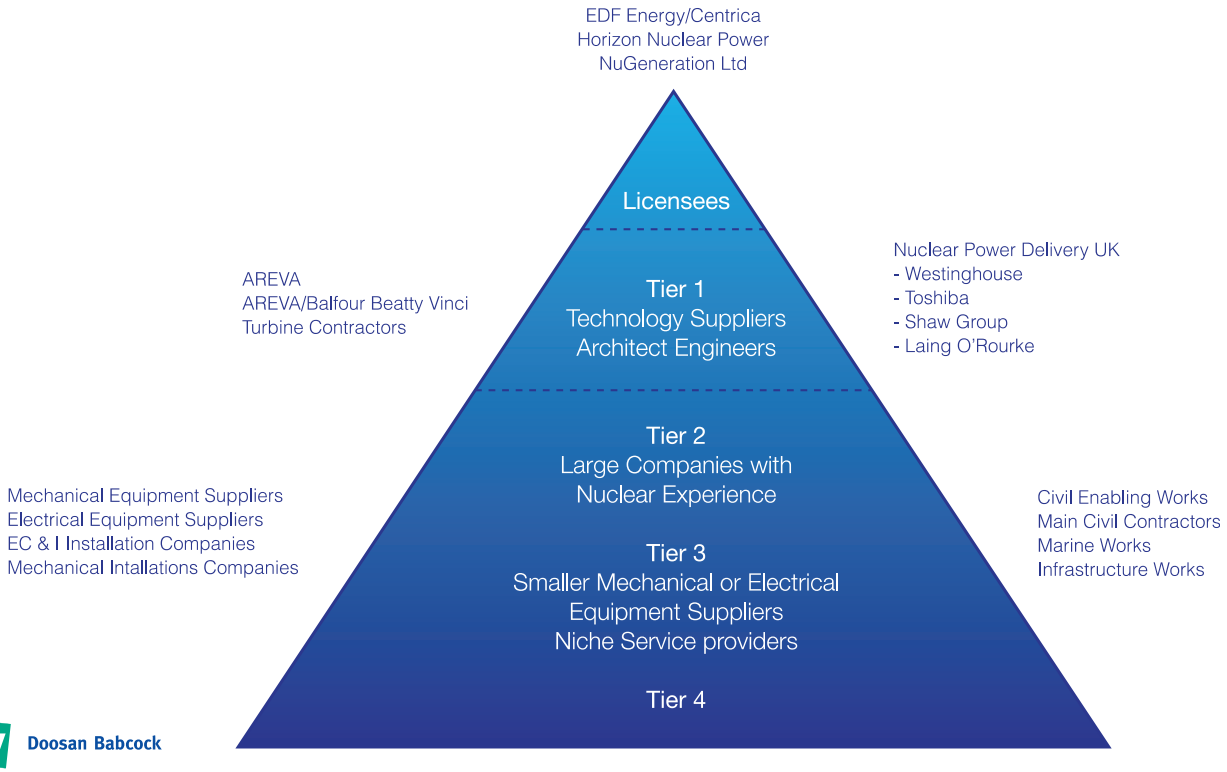
Therefore, whichever option is selected, the Regulator will expect the Licensee/Prospective Licensee to have adequate arrangements to act as an intelligent customer for the products and services being procured; to have arrangements to control the procurement process; and to maintain adequate oversight of the work carried out by the supply chain. The Licensee/Prospective Licensee will clearly specify the requirements through formal contractual arrangements with Tier 1 companies and seek confidence that the Tier 1, and in turn the Tier 2, companies have the right processes/competencies/culture for their respective products and

services. The Licensee/Prospective Licensee is very likely to sample directly down the supply chain to gain this assurance.

Tier 1 companies may wish to have a limited number of major suppliers who can take full responsibility for major packages of work, equipment supply or installation packages. These Tier 2 companies will usually be large companies with a track record in the nuclear industry. They will deliver the work through the use of their own resources and that of their supply chain. One of the key roles for Tier 2 companies is in the flow down of the quality arrangements through their own activities and down into their supply chain. In addition to managing the delivery to time and cost they must instil a nuclear safety culture throughout all their work and through their supply chains.

The Tier 3 and Tier 4 companies are companies who support the Tier 2 companies in the delivery of their packages of work, supplying specialist plant, equipment or on-site services. In the execution of their work the Tier 2, 3 and Tier 4s must work to the quality, health & safety and other project delivery requirements as specified by the Tier 1 and ensure that their contract review, communications, notification processes are effective. This will ensure that they fully understand the goods and services that they are producing in terms of functional and technical characteristics during installation and plant operation. They can use their own quality arrangements for this provided they meet their client's requirements.

Nuclear new build market structure



DOOSAN Doosan Babcock

The key feature of the supply chain is that arrangements specified by the Licensee/Prospective Licensee must flow down in a transparent manner through the supply chain to the smallest subcontractor supplying the smallest component. The Regulator may test these arrangements to ensure that, amongst other things, sufficient, demonstrably competent resources are being deployed at all levels on the project; that there is adherence to the appropriate quality standards; and that a nuclear safety culture runs from top to bottom on the project. It is essential that the Tier 1 companies actively engage with and support the Tier 2, 3 and 4 companies to achieve these objectives.

Roles and requirements of Tier 2 contractors

Tier 2 contractors will deliver a significant proportion of the new nuclear plant either through self execution or via their Tier 3 and 4 subcontractors. As such they have an important role to play to ensure compliance with the codes, standards and quality arrangements specified by the Licensee.

A key requirement for a Tier 2 is to have a well managed supply chain of competent Tier 3 and Tier 4 companies, vetted and managed through an approved supply chain process. The main features of a typical supply chain approval process are described below.

Supply chain approval process

For any significant subcontract package Tier 2 companies will expect Tier 3 and Tier 4 companies to have proven quality, environmental and health & safety management systems. The appropriate requirements will be specified in the contract, but in general, they should be compliant with:

- ISO 9001
- ISO 14001
- BS QHSA 18001

Although companies should be certificated by an approved independent authority to demonstrate compliance with these standards, it is still the duty of Tier 2 companies to carry out robust assessment of their subcontractors before incorporating any company into their approved supplier list.

Typical topics for supplier assessment will include:

- The structure of the business including company organisation, roles & responsibilities, approval processes and internal business audit processes
- Accountability for quality management arrangements, quality processes and performance including review of non conformances, customer compliments and complaints, any systematic quality failings along with effectiveness of improvement plans
- Health & safety leadership and performance within the company including review of any serious incidents, improvement plans and effectiveness of remedies taken
- Delivery performance of projects to date including management of own workforce and management of subcontractors
- Training, management of competency of staff through SQEP records and staff development planning
- Environmental compliance with stated policy and procedures

Supplier approval is not a one off event and good Tier 2 contractors will regularly update the performance of their supply chain. At the end of each project, a formal contract review process should allow both parties to reflect on both the performance of the contract and the experience of working together. This should be a two way process with feedback and learning for both parties after which the Tier 2 contractor updates the supply chain assessment of the Tier 3 and Tier 4 contractor and shares it with them.

Quality Arrangements
For the design and construction of new nuclear plant

Why are quality arrangements important?

It could be argued that if codes and standards such as ASME or RCC are followed to the letter, delivery of a safe high integrity nuclear power station will result. While this is true it must be recognised that the activities from design through to commissioning require significant human effort and human interpretation of the actions which the codes require. History has shown us that humans are fallible, and despite best intentions, do not always follow instructions to the letter. A good quality system with robust checks and balances goes a long way to eliminate the likelihood of errors and will:

- Enhance the integrity of the plant
- Assist in protecting the environment and the public from radioactive release
- Provide a structured method for linking the level of checking and inspection with the nuclear safety significance of the component
- Assist in minimising the risk of expensive remedial activities by detecting errors early
- Provide demonstration of compliance with codes, standards, nuclear safety, environmental and other requirements associated with the design and condition of new nuclear plant.
- Define roles, responsibilities and authorities for the execution of work
- Provide instruction and guidance on what needs to be done and provide opportunities for learning and continuous improvement

Application of quality arrangements

For any quality system to provide the level of protection detailed above, it must be rigorously applied throughout the entire project. No activity, no matter how small, should fall outside the quality regime.

The Licensee, as the Nuclear Site Licence holder, has the responsibility for defining the overall project quality arrangements.

The Nuclear Regulator may wish to review the Licensee's proposed high level quality arrangements and their applications to ensure that they:

- Are robust, with accountability well defined
- Cover all aspects of the work
- Can be applied by, and flow down to, all levels of the supply chain
- Have provision for adequate, independent oversight through the use of Independent Third Party Inspection Authorities (ITPA)
- Apply a graded approach to quality, which aligns with the nuclear safety significance of the component

The selected Tier 1 contractors will take the agreed quality arrangements as specified in their contracts from the Licensee and embed them into the contracts they let to the Tier 2 contractors for design, procurement, manufacturing, plant installation and commissioning activities. It will be the responsibility of the Tier 2s to ensure that they flow these arrangements, as appropriate, down throughout the supply chain. The Nuclear Regulator and the Licensee have the right to audit this process at any time during the contract.

Quality Arrangements
For the design and construction of new nuclear plant

It is important that the Tier 2 contractors use their knowledge and expertise of the nuclear industry to interpret the requirements of the codes, standard and quality arrangements for the specific scope of work to be subcontracted to Tiers 3 and 4. For each piece of equipment or service required the Tier 2 company should write product specific requirements or specification incorporating details such as:

- Technical and functional requirements
- Project management and programme requirements
- Quality arrangements and quality documentation/quality plans required including specification of hold and witness points
- Document submission schedules
- Design codes to be used plus any special additional requirements
- Material specifications and additional material testing requirements
- Reporting requirements including a process for identifying and closing out concessions
- Arrangements for issuing tracking and close out of technical queries
- Applications of non-conformance process and non-conformance reporting
- Inspection and test procedures to be applied
- Delivery requirements including timescales, packaging, etc.

With this detailed specification, the Tier 3 and Tier 4 contractors can work to the specification provided plus their own ISO 9001 quality arrangements.

The other advantage of providing this level of detailed specification is that the level of checking, intervention, inspection, witnessing and testing can be aligned with the nuclear safety significance of the equipment or service being provided. For equipment with a high impact on nuclear safety, a much greater level of checking, verification and independent assessment will be required. This may involve the Licensee and the Regulatory Inspectors as well as the Tier 2 contractor and the Independent Third Party Assessor.

During the execution of the project the Tier 2 contractors have a duty to support the Tier 3 and Tier 4 contractors in the execution of the tasks as well as audit and check on their performance. Typical areas of support include:

- Project briefing on overall project technical quality and project execution arrangements to help the Tiers 3/4 understand their position in the project structure and delivery arrangements
- Explanation of the meaning of nuclear safety culture and the requirements for transparency and openness in working arrangements, quality reporting and delivery issues
- Application of technical queries, non conformance and concession processes as it applies to the scope of work

The Nuclear Regulator, the Licensee, and Tier 1 and 2 contractors may wish to have the right of audit of the Tiers 3/4 contractors and their subcontractors at any time. This would be included in the contractual arrangements between the parties. Such audit rights may not be

restricted to the conformance and quality issues but could also incorporate any area of the business including health & safety, policy and performance, environmental compliance, adherence to Project Execution Plans/project working arrangements and business improvement plans where relevant to the work being executed.

As was discussed at the start of this section, activities are carried out by people and people are fallible. Quality systems provide one safeguard but the expertise, professionalism and training of personnel engaged in the delivery process, from the project director to the handy men on the shop floor is the second key safeguard. All those involved in the process, in whatever capacity, must be Suitably Qualified and Experienced to carry out the activities they undertake.

Specific requirements will differ significantly between activities, not least between different sectors and the nuclear and non-nuclear aspects of a project. However in all cases any company bidding for contracts in the UK nuclear programme, to be successful, will need to demonstrate that its workforce has the appropriate skills, training and education to carry out the work safely and effectively. The focus on safety is of paramount importance across the breadth of the nuclear industry. For further information on skills and the support available to companies please visit the skills section of www.nuclearsupplychain.com and the website of the National Skills Academy Nuclear at www.nuclear.nsacademy.co.uk.

It must also be recognised that training is an essential part of the overall requirement and when companies are setting people to work the 'Experienced' element of SQEP must be clearly recognised. Where an individual does not have sufficient experience, additional mentoring and support arrangements must be put in place to provide support and ensure oversight of their decisions and activities.

Processes for control of work on new nuclear build projects

Effectiveness of project delivery for nuclear new build is enhanced if certain processes and procedures are followed. Some examples of processes which have been found to be helpful to Tier 3 and Tier 4 in delivering nuclear projects are described below. It should be stated that this list is not exhaustive and will be added to in further revisions of this document. In general it will be the responsibility of the Tier 3/4s to prepare the documents listed below for their scope of work. The documents will require to be approved by the Tier 2s, in some cases by the Independent Third Party Inspector and in a few cases by the Licensee.

Project Execution Plan (PEP)

This is a formal document which describes how the Tier 3/4s intend to execute the works. It defines the scope of work, the organisational structure they propose, key processes which will be carried out and roles and responsibilities within the Tier 3/4 companies. Names should be attached to key roles with evidence that they are Suitably Qualified and Experienced for the role. Significant subcontracts associated with the work should be identified for Tier 2 approval. Depending on the complexity of the work, separate procurement and engineering plans may also be required to define the next level of activities.

Project Quality Assurance Plan (PQP)

A Project Quality Plan (PQP) will be prepared specific to the contract. It is the document which sets out the policies, practices and procedures for the project. It also identifies Key Performance Indicators (KPIs), control measures, control criteria and records of verification associated with the project scope through all phases of its "lifecycle".

The overall objective is to develop a system of controls in order that the contract is completed in accordance with the project quality standards, customer codes, specifications and drawings.

Quality Arrangements
For the design and construction of new nuclear plant

The project quality assurance plan supports the Project Execution Plan (PEP) in detailing the project quality requirements.

Design/Engineering Quality Plan

This document defines the design/engineering process including the design reports/documents to be produced by the Tier 3/4 contractors. The verification/checking process should be specified along with measures to ensure the checkers/verifiers are both independent of the original calculation process and are SQEP to carry out the role. For higher levels of safety classified products, the level of independent checking must be increased to reflect the higher nuclear safety significance of the product. The hold points to allow Tier 2, or other third party reviews to be held should be clearly identified and compliance with these is mandatory.

The design quality plan is normally signed off by the Tier 2 contractor and no design work should commence until this is complete.

Manufacturing and Test Philosophy Document

This document provides the Tier 2 contractor with an early overview of the complete manufacturing, inspection and test processes being proposed by the Tier 3/4 contractors. It describes at a high level control processes which will be used to deliver an appropriate quality of product. Key subcontractors are identified so that the Tier 2 can carry out any vetting they require. The manufacturing philosophy is described including methods of cutting and forming, weld processes, heat treatments and inspection philosophy. Outline test procedures are described along with test acceptance criteria. This document requires the approval of the Tier 2 contractor before the work commences.

Manufacturing & Test Quality Plan

This document is the detailed manufacturing control document. It must describe every step in the process from the initial checks on the pedigree of the original material, right through to the sign off of the final acceptance certificate. It will contain several hold/witness points for the Tier 2 contractor and the independent third party inspector. Typical hold points include:

- Verification of authenticity of material
- Witness of transfer of markings
- Verification of weld procedure qualification and welder qualifications
- ntermediate inspection and dimension control check points during the manufacturing process
- Verification of NDT procedure qualification and NDT operator qualification
- Inspection and test plan documentation
- Final inspection prior to shipping

The manufacturing quality plan produced by the Tier 3/4 contractor must link out to any of their subcontractor's quality plans. The Tier 3/4s must take full responsibility for the management of their subcontractor's quality arrangements and for the quality/correctness of the documents/equipment their supply chain produces. The manufacturing quality plan and the linked subcontractor's quality plan must be signed off by the Tier 2 and independent third party inspector before any manufacturing work commences.

Quality Arrangements
For the design and construction of new nuclear plant

Manufacturing Documentation and Method Statements

These documents are a development of the manufacturing philosophy & test document and must align with the requirements of the manufacturing quality plan. The method statements should be detailed documents describing the manufacturing process as a series of detailed steps and processes.

The technical query process and non conformance reporting processes need to be documented along with details of how both processes will operate, e.g. technical query or non-conformance numbering systems, distribution lists and identification of how authorisation to proceed will be given. A system of archiving must exist to ensure there are traceable records of communication and decisions regarding technical queries and non-conformances. It is very important to develop an open culture whereby subcontractors at all levels in the supply chain are actively encouraged to report non-conformances.

Documentation and record keeping of the manufacturing or test processes must be completed as the work is carried out to ensure a complete record is available on completion of the manufacturing activity. It is normally a contractual requirement that the final documentation pack for the manufactured component is completed and signed off by the Tier 2 contractor and the Independent Third Party Inspector before the component is shipped to site or to quarantined storage.

Generation and archiving of all the above documentation is extremely important. The requirements for the management of records should be clearly specified in the contract documents.

Summary

Summary

Industry in the UK has a long and successful history of manufacturing and constructing, maintaining, and upgrading nuclear power plant in the UK. There is also significant, recent experience in constructing new nuclear facilities for the UK Decommissioning Programme. Much of this is to a similar quality standard to that required for new nuclear stations.

A significant number of UK companies are already manufacturing and constructing new high integrity plant and equipment in the oil, gas, petrochemical and pharmaceutical industries. With the support of experienced Tier 1 and Tier 2 contractors these companies can make the transition to be successful in the new nuclear manufacturing and construction market.

The key requirements are to:

- Develop a workforce with a nuclear safety culture and the necessary skills
- Develop robust quality assurance arrangements, including quality plans for manufacturing and construction activities, with agreed hold points for independent inspection
- Deliver on time and in accordance with the agreed quality, manufacturing and construction plans
- Develop a culture of “if in doubt stop and ask”

By following these principles the UK industry can manufacture and construct a significant proportion of the new nuclear power plant in the UK.

The UK market for nuclear new build is developing rapidly with the Government providing facilitation via, for example, the National Policy Statements and the Generic Design Assessment process. The Utilities are firming up their plans for nuclear new build in terms of technologies, procurement, strategies and timescales. As further clarification emerges, this Essential Guide will be updated and revised in Stage 2 to be issued in early 2011.

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