COMPETENCY AND EXPERTISE IN THE NUCLEAR INDUSTRY

The nuclear industry recognises the importance of competence. How does it know what competencies are required, and whether personnel can demonstrate appropriate levels of those competencies? **Jon Berman** discusses how the industry approaches this issue, and how it provides confidence that competence is being managed effectively.

KEY POINTS

- It is for each nuclear 'Licensee' to determine what competence they require and to demonstrate that the competence management system is effective.

- It is essential to understand the inter-relationships between safety arguments, competence, and training and experience if the claims on human performance are to be realistic and valid.

- There is increasing recognition that critical self-awareness of competence is important for compliance.

The nuclear industry, like other high-hazard industries, relies on human performance to support safety. Whilst the primary reliance is on design and engineering – the integrity of the nuclear containment system, the performance of emergency cooling, the availability of standby power generation – individuals must perform their work effectively. This is no different from aviation, where there is both reliance on the design and integrity of the airframe or the communications systems, and also reliance on the performance of people – the crew on the flight-deck, the maintenance teams, or the controllers within the ATM system.

The hierarchy of risk controls in safety engineering pushes the nuclear industry towards engineered defences – multiple pumps and valves, interlocks to prevent inappropriate actions, etc. Nevertheless, the industry relies on human performance.

What are the foundations of high-reliability human performance? Much of it is around the design of the tasks and ensuring that the demands placed on people match their capability. Staff should undertake well-designed tasks, with good tools and job-aids. At the same time, the procedure that the person must follow needs to be carefully developed to minimise opportunities for error and maximise the ability to detect and recover from errors when they do occur.

But good procedures are not the only element. The person also needs to be competent, and therein lies

the challenge. One can envisage a continuum, where at one extreme there might be highly detailed procedures that foresee every eventuality, and which enable the task to be completed by a novice. At the other extreme one could have an exceptionally highly trained and competent workforce, and a one-page procedure. Reality falls somewhere between the two extremes – but the decision as to where to pitch the procedures and the associated training and competence regime needs careful consideration.

Unsurprisingly, the nuclear industry adopts a structured approach, such as that advocated by the International Atomic Energy Agency (IAEA) (1996), although the manner in which it is applied is for the Licensee to decide (the 'Licensee' is the organisation with a licence to operate – the nuclear equivalent of an ANSP). One of the overarching principles within the UK nuclear industry is that of self-regulation. The regulator (Office for Nuclear Regulation – ONR) licenses an organisation to operate a particular site. It does not license the individuals

that operate within that facility. The Licensee must ensure that personnel are competent, and determine what that means and how to deliver it.

Each plant is different, and whilst having broad similarities with other power stations, each plant requires its own safety case and tailored arrangements. The Licensee needs to understand its own safety arguments sufficiently well to be able to define the necessary competences, and then deliver them.

The Office for Nuclear Regulation in the UK sets out the principles that they apply when assessing a Licensee. These Safety Assessment Principles (SAPs) (ONR, 2014) include some that apply to the management system and some that are specific to human factors:

- SAP EHF.8 demands the application of "a systematic approach to the identification and delivery of personnel competence". It expects that such a process would encompass job analysis, identification of competence requirements, training needs analysis, training programme design and implementation, formal assessment of competence, and training programme evaluation. But it is for the licensee to decide what this should look like.
- SAP EHF.9 addresses procedures, and notes that they should "meet the needs of all intended users". This reinforces the link with competence – who are the intended users and what level of competence are they expected to have?

It's also worth noting that the safety assessment principle concerning 'Capable Organisation' expects that "Processes and systems should secure and assure maintenance of appropriate technical and behavioural competence of directors (both executive and non-executive), managers, leaders and all other staff and contractors with safety rules and responsibilities."

This focus on non-technical skills, and on managers and leaders, is important. But what does this mean in terms of the actual arrangements for assuring competence? The industry expends significant effort and investment in

developing and sustaining competence. It also faces extensive regulatory scrutiny, driven by the Licencing framework and the specific Licence Condition (LC10) that demands an appropriate focus on training. The ONR Technical Assessment Guide on training (ONR, 2017) provides useful guidance.

Training does not equate to competence. Whilst clearly supported by training, competence is also influenced by prior experience, aptitude, attitudes and behaviours, skills and knowledge. Training affects these in different ways. It's therefore important to understand the following:

- What are the claims being made on human performance? What does the safety case expect, and how are those claims translated into competence requirements? Do we have a clear understanding of the required knowledge, skills, attitudes and behaviours?
- What are the training needs associated with acquiring and maintaining competence? What other factors need to be considered? How much does experience contribute? How should those contributions be controlled?
- What is the appropriate mix of training methods? Is there a sound understanding of the strengths and limitations of classroom-based learning, e-learning, on-the-job training, etc?
- How is competence assessed? Does the assessment really address competence, or is it mainly knowledge and skills-based?
- How is competence maintained? How is the timing of re-assessment and refresher training determined? Is the potential for skill-fade fully understood?

The concept of 'Suitably Qualified and Experienced Person" – SQEP – is widely used regarding qualifications AND relevant experience. Neither is sufficient alone. The notion of SQEP plays an important part in understanding transferability of competence (some of the workforce move around frequently, particularly in the area of maintenance). This is the equivalent of a licence for ATCOs and ATSEPs. There is a thread that runs from the 'claims' being

made concerning safety in a safety case, through the identification of competence requirements to support the claims, to the process for acquiring, assessing and maintaining competence.

Licensees maintain rigorous records of training and competence, but recognise that keeping records does not mean staff are competent. There is a need continuously to reflect on whether the competence management system is actually delivering competent staff.

How does competence influence rule compliance? A good example arose when the regulator was undertaking a routine inspection at a site, observing a front-line worker. The worker undertook a particular activity in a slightly unusual way. On being asked by the Inspector "Is that the way the procedure instructs you to do the task?", the worker replied, "Oh no – when we do this task we don't follow the procedure…". A telling comment. It suggests that the worker was confident they were performing in the manner the organisation expected and hence there was nothing wrong. He was content to tell the regulator that they don't follow the procedure in those circumstances. What does this say about the competence management system? What elements of the training and experience of this worker led them to understand that non-compliance was permissible?

This raises an important aspect of competence: its role in supporting rule compliance. In the nuclear industry, compliance with procedures is more critical than in other more human-centred industries. In recent work on procedural compliance for a Licensee, we identified that a key predictor of non-compliant behaviour was a misplaced perception of one's own level of competence. Erroneously thinking that you are highly competent can 'legitimise' inappropriate non-compliance: "I know what I'm doing, and the risks". People who have genuinely high levels of competence properly understand the risks and the importance of the procedural elements that manage them. People who recognise that their competence is low – perhaps they are newly qualified – tend to be more diligent in complying with the procedures. It is those workers
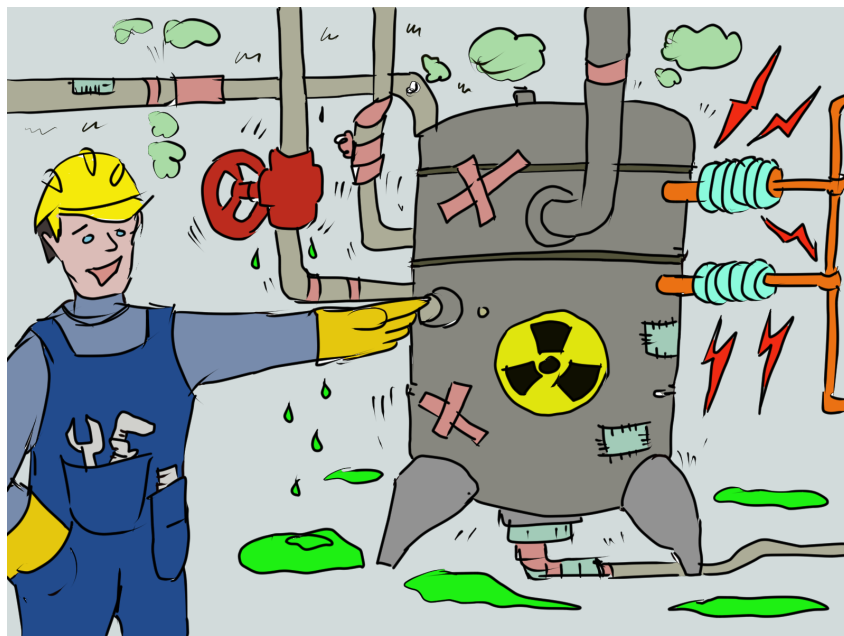
It's nothing a little WD40 and duct tape couldn't fix… trust me! I'm an engineer!

who have a misplaced perception of their own abilities who tend to 'bend the rules' inappropriately. Bear in mind that most men consider that they are above-average drivers… How many competence management systems focus on ensuring an accurate self-perception of competence? How many focus on highlighting ongoing limitations in knowledge and competence? When their teenage children pass their driving tests, parents will try to emphasise that "now is the time when you start to really learn to drive" – even though, worryingly, it tends to fall on deaf ears. Do we do the same with newly 'qualified' workers?

The ability to develop and maintain competence, and to instil an accurate self-perception of competence levels, is an essential element of a good competence management system. The nuclear industry is working towards this.

How far does your competence management system go in making people aware of knowledge and competence gaps? How well do the competencies and their assessment relate to the actual safety claims that are being made? It is the regulatory requirement for the licensee to 'make the case' for the suitability and effectiveness of their competence management system which generates confidence in the high standards within the nuclear industry.

References

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