COMPETENCY IN POWER GENERATION AND DISTRIBUTION: FOUR KINDS OF KNOWLEDGE

Competence is a key issue for power generation and distribution, where core staff and contract staff work on sites where they or others could be injured, or where there could be a major accident. There are four kinds of knowledge that need to be understood in this setting, which may well apply to aviation personnel, as **Rob Miles** outlines.

KEY POINTS

1. **Many staff on power generation sites and distribution networks are employed by contractors. This makes competency management more difficult.**
2. **We can define four kinds of knowledge that are relevant and necessary for a job to be completed safely and effectively: task or trade skill, working safely on a site, major accident hazard, and plant history. It is necessary to pay attention to all of these.**
3. **While ATSEPs will relate to these, air traffic controllers and professional pilots may well be able to draw parallels.**

Introduction

While air traffic controllers and (most) pilots are employed directly by ANSPs and airlines, it is now common to find that many staff on power generation sites and distribution networks (the 'duty holder') are employed by one or more contractors. In some cases, the majority of staff will be employed by contractors. There could be a single contractor providing a range of services, a number of specialised contractors, or a lead contractor with a number of sub-contractors.

Contractors can specialise and bring expertise, economies of scale, and provide additional staff at short notice to meet operational needs. However, the success of these arrangements depends on the contractor staff being competent to carry out their contracted tasks safely.

While the competence of duty holder staff (the 'core crew') is addressed through the normal means of selection, training, assessment and development (under the direction of the company Human Resources [HR] department), the situation for contractors is more varied. Larger contractors will have HR departments but many smaller companies do not and so competence is often addressed via procurement contracts.

The engagement of many contractors to operate and maintain a plant, along with the communication and coordination required, presents many challenges. Many workers and supervisors arriving on site are often unfamiliar with the site, the site operator's safety management system (SMS), and site working practices. Competence changes from a procurement issue to an on-site issue, and key elements can get missed in this transition.

It is usually the case that a team, rather than an individual, performs tasks that involve significant health and safety hazards, major accident hazards, or that are complex or high consequence (e.g., in terms of economic risk). Where an individual completes a task alone, they work within a system of procedures, risk assessments, approvals and inspections. This work is supervised and managed. All of these activities and elements have so-called 'knowledge content'. The skill to do a task is included in this 'knowledge', as in 'knowing how to do the job'.

We can define four kinds of knowledge that are relevant and necessary for a job to be completed safely and effectively. In this context, 'safely' means the occupational health and safety of those undertaking the task and major accident hazard safety for the plant being worked on. While these concern engineering work, air traffic controllers, professional pilots, and other readers may be able to translate some of these kinds of knowledge into operational ATC and flying examples.

These four kinds of knowledge concern:
1. task or trade skill
2. working safely on a site
3. major accident hazard
4. plant history.

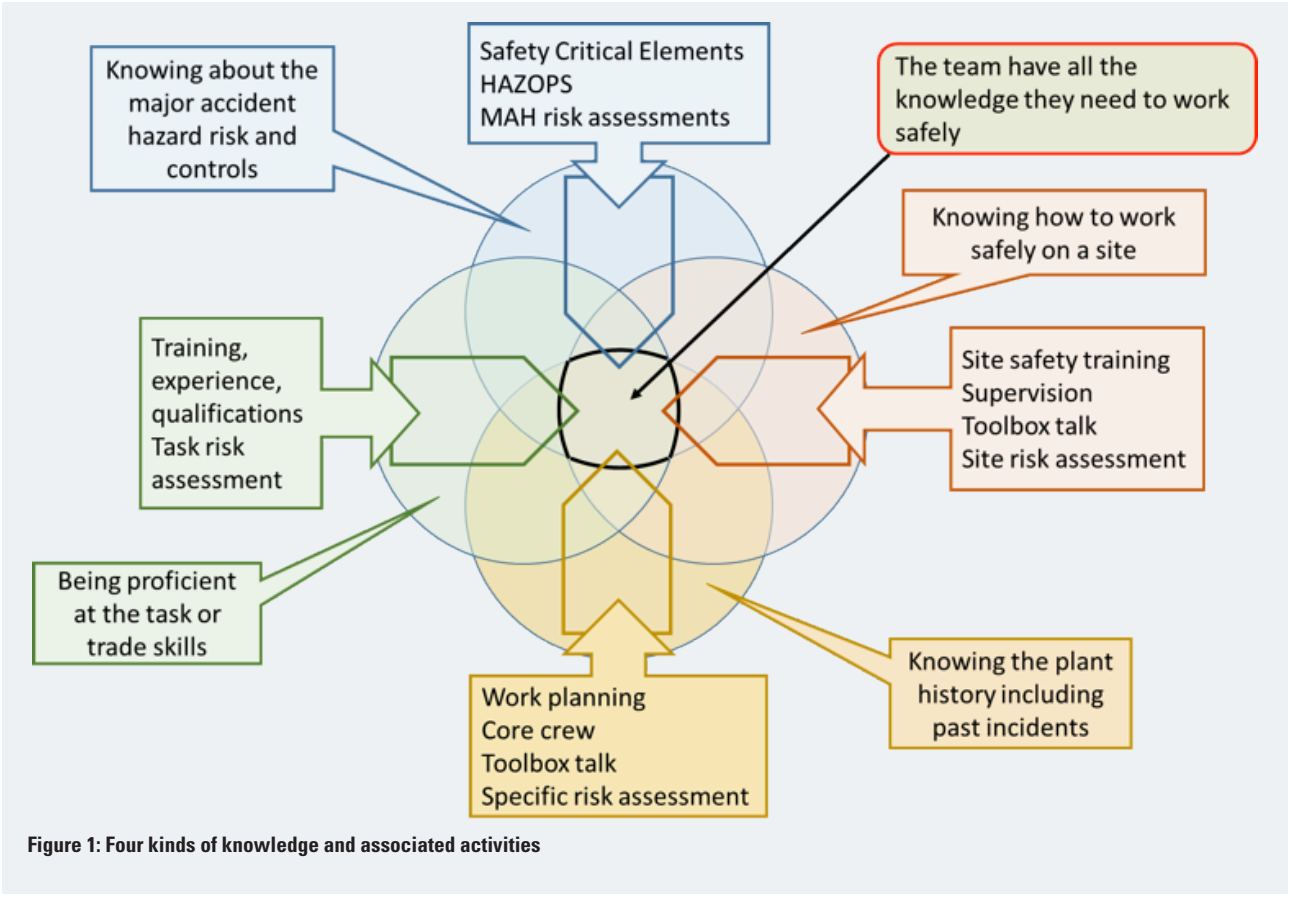

Figure 1: Four kinds of knowledge and associated activities

Knowledge 1: Being proficient at the task or trade skills

This refers to the skills and knowledge to complete the job – trade or professional skills and the knowledge of tools and techniques specific to a trade or area of expertise. Trade and task skills ensure that the person can do the job well and work safety within limits. Examples would be:

- making up bolted joints and flanges
- repairing rotating machinery
- electrical cabling and wiring
- pump overhaul
- pressure pipework repair or installation.

These are a few examples from a very wide range. What they share is a requirement for skills learned through practice and a significant degree of knowledge about the chosen area. These skills are usually externally assessed and validated by trade or technical institutions. The technician must work within their area of competence and their supervisor, manager or client must recognise this.

Knowledge 2: Knowing how to work safely on a site

Safe working practices form part of all basic skills training, and contractor staff must be familiar with relevant health and safety regulations and legal requirements relevant to the task or trade of their direct employer. In addition, the site operator will have company-specific and site-specific health and safety procedures and requirements.

Some examples are:

Company specific:
- permit to work system
- behavioural safety program
- work-safe or 'golden' rules
- company safety rules brought in after incidents or accidents.

Site specific:
- site routes for safe vehicle movements
- site emergency alarm, response and evacuation procedures
- site or equipment specific procedures in response to incidents
- PPE and clothing rules and location of PPE
- hazard zone (e.g., noise) areas
- barrier and exclusion zone procedures.

It cannot be assumed that contractor health and safety training and procedures will cover the full range of health and safety issue required on any specific site to ensure safe working. There can be significant gaps.

Knowledge 3: Knowing about the major accident hazard risk and controls

The term 'major accident hazard' (MAH) is usually associated with major fire and explosion, but it includes any incident capable of causing significant harm to people and the environment and so it includes such events as:

- fire
- explosion
- major release (flammable, toxic, asphyxia)
- pollution of a water course
- large dropped object
- structural collapse during construction
- legionella, norovirus or other disease related to site practices.

Work with a MAH must be properly risk assessed and effective control measures must be put in place before work starts. However, contractors might not have access to the necessary hazard information or the expertise to evaluate it. When this occurs, the contractors' risk assessment will be strongly biased towards occupational safety and may omit completely the MAH risk and controls. This will then carry over into the permit to work (where used) and the 'toolbox talk' or pre-work briefing.

MAH information is typically found in hazard analysis studies, risk assessment studies, and process control diagrams. If the risks from these hazards are to be controlled while the work being done by the contractor takes place, then this makes demands on contractor competency. There are a limited number of ways to ensure MAH is effectively represented in work planning, risk assessments and on site work control (PTW and supervision):

- Make MAH documentation and other information available to the contractors, ensure they are competent to understand and use it, and monitor to ensure that they do.
- Retain ownership of the MAH by thorough planning and control of all the MAH in every task, and define clear boundaries to ensure this control is maintained. This will include early warning when a contractor moves outside their boundary and into the MAH zone.
- Have experienced staff participate in every stage of the work to explain and ensure control of the MAH.

Sometimes, MAH information is intentionally withheld because this can be commercially sensitive and confidential to the operator's senior management team and the relevant regulator. Regulators often treat MAH submissions as 'confidential' and not disclosable to third parties. Many operators would be reluctant to disclose hazards as this may alarm the local community and investors. This kind of disclosure may and require detail that they would view as commercial information that could be exploited by competitors.

Knowledge 4: Knowing the plant history including past incidents

Work on complex plant does not take place in isolation. Regardless of whether it is repair, overhaul, replacement or modification, there will be a history and a reason why changes have to be made. Working on plant without understanding why it needs to be worked on is to be blind to an important part of the job.

The history includes:

- The work method. Why does the work need to be done in this way?
- The equipment history. Why does this work need to be done to this equipment?
- The history of past repairs and reworks. Did they last or fail? Do we know why?
- Accidents that have occurred relating to this task or equipment in the past. What happened? Why did it happen?
- Early service failures after repair. Do we know why and are we about to cause a repeat?

In general, this knowledge is held by the operational and maintenance staff responsible for the equipment. It should be recorded on logs and manuals but often it is not and can only be found in the recollections and experience of core crew (i.e., core staff, not contractors). If the same contractor has always worked on it, they may have the knowledge. In both cases it is clear that handover of experience and long-term involvement are key issues.

The problem with this kind of knowledge is that it is often exposed after an incident, when people come forward with examples of how this has occurred before. The objective is to get this information before things go wrong, not after.

The risk assessment and toolbox talk (briefing) is where this history can most help to prevent an incident. In this context, an experienced person is likely to be more effective than documentary history.

Conclusion

It is necessary to pay attention to all four kinds of knowledge. Air traffic safety electronic personnel (ATSEPs) will probably relate to all four kinds directly, and will also understand some of the issues of contractor management. Air traffic controllers and professional pilots may also be able to draw parallels, and consider where more knowledge may be needed for certain situations and staff.

The work described here is explored in more detail in an up-coming report on contractor competence to be published by the Energy Institute (London) in the course of 2018 (the Figure is adapted from the Energy Institute report).
https://www.energyinst.org

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