

## COMPETENCE ASSESSMENT AND MAJOR ACCIDENT PREVENTION

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Many duty holders base their safety case on the assumption that they have experienced and competent staff, particularly where the control of major accident hazards relies on people. Many major accidents have had competency deficiencies as a root cause. With the implementation of the Control of Major Accident Hazard Regulations 1999 (COMAH) on April 1st 1999, it is no longer acceptable to make untested assumptions about staff competence. The Health and Safety Executive has developed safety report assessment guidance that asks for a competence assurance system that includes the setting of appropriate competence standards, assessment and reassessment of competence. The HSE also asks that there be a specific link between identified safety critical tasks, roles and responsibilities at all levels and a targeted comprehensive management system. The report summarised in this paper provides (1) a review of current practice, (2) a view of what comprises good practice in the field of competence assessment in relation to major accident prevention, and (3) a body of advice, checklists and examples of assessment. The report has drawn together experience, standards and lessons learnt from a number of high hazard industries, particularly chemicals, offshore, nuclear and aviation. It has also given due regard to the guidance on competence assessment laid out by personnel specialists, national certification bodies and institutes. A draft version of the report was piloted and received positive feedback from Duty Holders.

Competence assessment, COMAH, Safety Case

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### INTRODUCTION

#### WHY IS COMPETENCE ASSESSMENT CONSIDERED IMPORTANT?

Review of past major incidents indicates that the lack of certain skills or knowledge has led to errors that contributed to the incident. For example:

- The supervisors with responsibility for inspecting and maintaining the automatic train warning system of the train involved in the Southall rail crash, did not correctly understand the test procedures;
- Events during the Piper Alpha disaster demonstrated that the ability of offshore installations managers to manage major emergencies was inadequate;
- Persons responsible for developing safe systems of work have been shown, by the occurrence of major incidents such as the Hickson & Welch fire and explosion of 1992, to lack a full understanding of how processes work and how hazards may materialise.

In each case, it was assumed that a person with a certain level of experience or training would be competent and/or that the simple dissemination of a procedure would be sufficient. The individual's actual competence was not sufficiently tested.

The most recent example entails the Esso Gas Plant explosion in Longford, Australia, wherein the loss of oil circulation resulted in the plant getting colder followed by the rupture of a heat exchanger on restart due to cold metal embrittlement. The inquiry concluded that there was ample evidence that operators did not appreciate the dangers of cold metal embrittlement despite being trained about it. The inquiry reports that operators were tested during training modules and that in the event of incorrect answers further coaching was provided. However, after coaching the "re-assessment" comprised asking the operator if they now understood the matter. If the operator indicated they understood the matter it was ticked off. According to operators it took courage to say you did not understand the re-explanation. The Commission found, during questioning, that operators still did not see what was wrong with their answers. In addition, the inquiry found that operators gave answers without actually understanding them. In particular, operators knew the correct answer to a question on the action of a valve was to prevent "thermal damage" but did not know what was meant by thermal damage. They gave the answer thermal damage because that was the answer in the training manual. The assessment tested whether operators could present information received from training back to the assessor, without testing understanding.

In addition, the concern about competence is further increased by the move towards multi-skilling, delayering and downsizing. Staff are increasingly expected to take on a wider range of responsibilities with less supervision. This increases the need to check competence.

It is also one of the so-called "Ironies of automation" that training and competency become even more important as automation increases. "Perhaps the final irony is that it is the most successful automated systems with rare need for manual intervention, which may need the greatest investment in human operators training" (Bainbridge, 1987, p7).

## HSE CONCERNS AND EXPECTATIONS

The Control of Major Accident Hazard Regulations 1999 (COMAH) came into force on April 1st 1999. They require that the major accident prevention policy statement (MAPPS) includes arrangements for the recruitment of competent personnel, as well as arrangements for meeting their training needs. The HSE has issued guidance that competence assessment be undertaken such that, through assessment of required skills and knowledge, it can be ensured that individuals are capable of performing their tasks safely and properly.

Against this background, it is pertinent to note that, from the experience of HSE Hazardous Installations Directorate inspectors, whilst many organisations have developed job – competence matrices, few Duty Holders have developed a set of competence assessment methods. The issues of concern include:

- It is common practice to assume a person is competent due to their completion of certain training courses or possession of qualifications and period of experience – without questioning whether their experience provides pertinent exposure to safety critical tasks, whether the training outcome is assessed or whether performance on the job in safety critical tasks was satisfactory;

- Lack of linkage between competence assessment and the COMAH major accident controls, and failure to recognise that this extends to all levels of management;
- Failure to identify tasks (and associated skills and knowledge) that could impact process safety, such as knowledge of safety critical valves, operating procedures etc;
- Adequacy of on-the-job assessment, including the competence, credibility, and independence of the assessor, what criteria are applied and the consistency in evaluation criteria;
- A presumption that achievement of general standards such as National Vocational Qualifications is enough alone to assure competence;
- A widespread view that training is a “one-off” and not part of an ongoing competency assurance process;
- Lack of systematic assessment on recruitment and little of ongoing assessment, and;
- Many sites view safety competence as “personal” safety rather than process/major accident safety.

Indeed, the HSE guide “Human Factors for COMAH Safety Report Assessors”, produced for use by HSE assessment teams, states:

“The relevance of training to a safety report is that there should be establishment and assurance of competence specifically for the key responsibilities and for key safety critical and safety related tasks. Too many reports give information just about general safety training which is often more about personal safety than major accident prevention.” (p6–7)

#### THE BENEFITS OF COMPETENCE ASSESSMENT

Competence assessment is intended to improve accident prevention in the following ways:

- Improved competency, appropriately linked to the control of major accident hazards, improves the understanding, knowledge and awareness of staff that is necessary to prevent or mitigate major accidents;
- The development of standards will provide individuals with a clear view of what competencies they need, and hence should encourage development of competencies;
- The requirement for Duty Holders to set performance standards should prompt them to provide appropriate training and, if incidentally, reveal where unrealistic performance expectations exist for staff;
- Competence assessment may reveal that sub-standard competence is occurring;
- The inclusion of competence assessment within a planned management system should reduce the likelihood of substandard staff performance being overlooked, and;
- The setting of standards and associated assessment of competence should mitigate the pressures arising from organisational change for staff to work beyond their limits and provide a baseline for change by capturing competences that need to be retained.

In addition, a demonstrable process of competence assessment should provide assurance to regulators and other stakeholders that a core aspect of the safety case, namely staff competence, is valid. This can be particularly important in the case of older plant, which can fail to meet latter-day operability standards and may lack up to date procedures, whose safety is based on the ability of staff to compensate for lower operability standards.

Furthermore, the cost of training can be significant – it is important for duty holders to be confident that finite training budgets are being deployed to best effect, and hence that they have available the means of assessing the effectiveness of their training arrangements.

#### HSE STUDY ON COMPETENCE ASSESSMENT

Accordingly the HSE commissioned Greenstreet Berman to undertake a study on competence assessment. The objectives were to identify good practice in assuring competence at hazardous sites, including identification of required competences, methods for their assessment, and management of the assessment/assurance process. To meet these objectives, the study included a review of competence assessment guidance in the field of Human Resources and Occupational Psychology and a survey of assessment practices in a range of safety critical industries, including chemicals, offshore oil and gas, water, aviation and nuclear.

From this work a set of practical guidelines has been developed covering;

- The link between COMAH and competence assessment, including the link between risk assessment and competence assessment;
- How you can identify appropriate competence assessment methods, and;
- Examples of appropriate competence assessment methods for tasks of varying degrees of safety criticality and complexity.

The generic guidelines are intended to assist a COMAH Duty Holder to appraise the full range of tasks onsite, to assess the safety impact of these tasks, and to identify an appropriate and practical level and approach to competence assessment.

#### WHAT IS COMPETENCE ASSESSMENT?

Competence is defined by the Department for Education and Employment as:

“the ability to perform the activities within an occupation or function to the standards expected in employment”.

This is an outcome-based view of competence. It leads to the view that competence assessment entails the collection of sufficient evidence of workplace and/or personal performance to demonstrate that the individual can perform to the specified standard. This definition of competence is important in two respects. Firstly, it highlights the need to recognise the difference between recording a person’s experience/training, and assessing their competence.

Secondly, this outcome-based view of competence assessment can be compared with the common objectives of selection and recruitment. That is, selection and recruitment processes often aim to predict whether a person has the appropriate underlying characteristics and knowledge for a job. Accordingly they test personality, aspirations, underpinning knowledge and attitudes with the expectation that they *will* be able to perform competently with the passage of time and appropriate experience and training. Standard selection processes do not necessarily require an individual to be fully competent at the time of appointment. This also highlights the difference between aptitudes and ability, wherein a person can have an aptitude but may lack the ability to apply it to good effect.

These distinctions are important in the context of COMAH, as it is insufficient to assume that a standard selection process (which focuses on aptitude rather than ability) ensures competence.

### **CURRENT PRACTICE**

Our review of current practices within and outside the onshore hazardous industries indicates that there is wide variation in the standard of competence assessment. In some cases Duty Holders have developed systematic approaches to competence assessment and even made explicit links between the COMAH safety report risk assessment and competence assessment. In other cases reliance is placed on unstructured on-the-job training and assessment.

The most frequent method of competence assessment is that of ‘observational assessment’ by a supervisor or appointed trainer. In some cases the assessment of operators and maintenance staff rely on unstructured peer review, a practice considered as poor by this study. However, in some companies this judgement is guided by the use of validated task descriptions, skill and knowledge inventories, verbal test questions, and guidelines on (for example) the number of times a person needs correctly to perform a task to be deemed competent.

Three of the surveyed onshore companies have used some form of task analysis in order to identify safety critical task and define the correct way of working for use in assessing their staff. Indeed, some companies carry out a form of risk assessment to identify safety critical tasks for which they require assurance of staff competence. Assessors can then test a person’s knowledge by asking them how they would carry out a particular task and probe their understanding of (say) the safety function of equipment and key safety procedures. However, two other surveyed onshore companies had no systematic approach for defining tasks.

Also, in the case of safety critical emergency roles, such as control room management of process upsets, there are examples of the application of “advanced” forms of assessment, such as the systematic use of simulator based assessment of decision making and command skills. Finally, in some cases assessor competence has been addressed by the use of trained assessors.

### **LESSONS FROM OTHER HIGH HAZARD SECTORS**

The review of practices in other sectors highlights a number of key points. First, there are examples of competence assessment being managed as part of a comprehensive, planned and managed process. In particular, the nuclear sector has developed a process of ensuring Suitably Qualified and Experienced Personnel perform all tasks. A competence – job matrix is used to determine competence requirements for each job against which staff are assessed.

Another example can be found in the aviation sector wherein there is a set of training, experience and assessment requirements for pilot qualification covering initial appointment, progression from one grade to another, transfer between aircraft types and ongoing competence assurance. The range of tasks, experience and knowledge required is laid out in standards.

Finally, the assessment of offshore installation managers, air pilots and submarine commanders provide examples of how to assess the competence of emergency response roles. In particular, these examples entail the use of simulators and exercises based on

accident scenarios taken from risk assessments, and the use of behavioural checklists by observers to guide the assessment of performance on “softer” competencies such as delegation, communication, decision making under stress, information acquisition etc.

### **COMPARISON OF “STANDARD” ASSESSMENT AND SAFETY RELATED COMPETENCE ASSESSMENT**

In many ways the recommended approach to the assessment of competence in safety critical roles does and should mirror the approach advocated for competence assessment in general. In particular, the concept of collecting evidence of performance, the need to set performance criteria, independent credible and competent assessors and the use of standards outlining key skills and knowledge are all equally pertinent. However, it is apparent that there are some particular requirements and practices in the context of major accident prevention. These include:

- A need to ensure that the process of competence assessment is managed in a systematic and proactive manner to a standard commensurate with major accident prevention;
- High-risk industries tend to place more emphasis on certain methods due to the relative importance of certain types of tasks and the need to provide a particularly high level of competence assurance for safety critical roles. In particular, high-hazard industries tend to place more emphasis on:
  - ⇒ The role of risk assessment in identifying competence needs;
  - ⇒ The use of task analysis to identify the skills and knowledge entailed in complex technical tasks;
  - ⇒ The development of techniques, such as the use of behavioural markers to assess “softer” skills such as communication in emergencies;
  - ⇒ Licensing – again reflecting the need for a high level of assurance and very high standards of competence in certain safety critical tasks;
  - ⇒ The role of simulators and exercises, due in part to the rareness of emergencies but again reflecting the importance of assessing competence for handling emergencies and rare events;
  - ⇒ The need to monitor and maintain competence, in particular recognising the need for skills to be maintained to handle infrequent events and to ensure staff maintain technical skills and knowledge to operate processes and equipment.

Thus, whilst there are many commonalities between “standard” competence assessment and assessment for safety critical tasks, the characteristics of high hazard tasks and the need for a high standard of assessment does mean that specific attention must be awarded to the design of competence assessment for major accident prevention.

### **COMPETENCE ASSESSMENT ADVICE**

In order to develop a process of competence assessment, it is necessary to answer the following points:

- What competencies (at all levels) need to be assessed to ensure that error or sub-standard performance will not contribute to a major accident?

- Are the competence expectations realistic?
- What assessment criteria and competence standards, including what level of performance evidence, are required to ensure risks are ALARP?
- What method(s) of assessment are required to acquire evidence of competence?
- What qualifications and experience do assessors need?
- How often should performance be reassessed, reflecting the level of risk and possibility of skill decay?
- What method(s) of reassessment are needed?

This entire process should be managed proactively as per any aspect of accident prevention, thereby bringing about continuous improvement. Figure 1 illustrates the process. A self-assessment checklist is provided in an annex to this paper.

#### IDENTIFYING SAFETY CRITICAL TASKS

It is envisaged that competence assessment commences with the identification of safety related tasks using techniques such as risk assessment and task analysis. Where necessary there should be justification for reliance on human performance, as opposed to engineered safeguards. Such an assessment should cover all forms of activity, including normal process operation, process upsets, planned and unplanned maintenance. At this stage the analysis may simply provide a task or activity inventory for which assessment is required in the context of major accident prevention.

#### DEFINE PERFORMANCE STANDARDS

Next, a set of performance standards and assessment criteria is defined. This entails analysing the types of competencies required, describing what comprises adequate performance and defining measurable criteria by which to judge performance. At this stage a more detailed task analysis and/or specification of competences may be required to help develop testable competence standards. The task or competence description should provide a view of:

- The correct way of doing a task (against which a person's performance can be judged), and;
- Key competences (Skills, behaviours and underpinning knowledge).

The task need only be decomposed to a level that enables the production of testable task/competence descriptions. As befits the task, competence standards tend to cover:

- Skills, such as being able demonstrate an ability to (say) interpret process instrumentation readings, diagnose faults, operate controls, enact a procedure;
- Underpinning knowledge, such as understanding the chemistry of a reaction;
- Safety behaviours and attitudes, such as safety leadership, communication, teamwork.

It is reiterated here that assessment should aim to acquire performance-based evidence that a person can carry out a task, rather than just collate evidence of underpinning knowledge. Thus, standards should denote demonstrable skills and testable definitions of what comprises "competent" performance. Examples of competence assessment criteria are given below.

- Operators involved in emergency response need successfully to carry out an emergency response procedure on three separate accident scenarios selected from the safety case;

- Supervisors must correctly manage an operation, such as removing a hydrocarbon pump, starting from developing the plan of work, specifying a permit to work, instructing staff, monitoring their work, checking pump integrity prior to start up ... etc;
- Safety engineers must be able correctly to interpret a piping and instrumentation diagram, identify all (contrived) engineering defects and specify safety devices and engineering modifications as noted in company standards;
- A maintenance technician should be able to recollect all key safety actions required in the isolation of a hydrocarbon pump, its dismantling and restoration.

These may be augmented by “tests” of underpinning knowledge, such as:

- Minimum periods of “observed” experience – taken to be indicative of competent performance;
- Qualifications and training – used as an indication of the level of underpinning knowledge;
- Verbal or written examination of a person’s knowledge and/or attitudes.

Thus, a range of criteria may be devised, each matched to the type of competence (observable skills and behaviours versus underpinning knowledge).

The competence standard may assume or require a certain level of supervision, and hence there may be a scale of competence standards for people of varying competence. This is illustrated by the Institute of Electrical Engineers competency guidelines for use with safety practitioners working on safety related Electrical, Electronic and Programmable Electronic Systems. The standards of competence are graduated for supervised practitioners, practitioners and experts.

It is common practice to use national qualifications as a means of demonstrating skills and knowledge. Whilst this is entirely reasonable it is important to:

- Ensure that the national qualifications cover the specific skills and knowledge required by the site’s processes, equipment and activities, including specific safety matters;
- Recognise that NVQs by their nature are limited to assessment of on the job performance and hence may not cover infrequent safety critical activities, such as emergency response, process upsets, infrequent maintenance activities etc;
- Ensure that the form of assessment and level of performance evidence collated matches the safety criticality of the processes, equipment and activities.

It is pertinent to note that in some case studies the implementation of NVQs is guided by in-house assessment of the specific skills and knowledge associated with the site’s processes, equipment and activities. In addition, it should be noted that some organisations have felt that their assessment process has been “NVQ driven” rather than driven by their range of activities. Finally, as NVQs are designed to cover all aspects of task performance, they may include tasks and activities that have relatively little bearing on major accident prevention. Hence, whilst NVQs may assist with the demonstration of safety related competences, major accident prevention may not by itself require completion of the entire NVQ syllabus.



### SELECT ASSESSMENT METHOD

Once the task and type of competences are understood, an appropriate assessment method can be identified. The method of assessment should provide a valid and reliable measure of the type of competence in question, such that two different assessors would give similar results. Ideally the reliability of the assessment process would be monitored by review of actual performance, i.e. does the standard of staff performance accord with the results of competence assessment. If sub-standard performance is observed, in contrast to acceptable assessment results, the validity and reliability of the assessment process should be reviewed. In summary:

- Physical/sensory-motor competences can be demonstrated by practical “show me” assessments wherein people either complete the real task or a component of it, such as driving a road tanker to demonstrate steering skills.
- The ability to carry out a prescribed procedure of work can, usually, be demonstrated by a “show me” test wherein you attempt to complete the task.
- Cognitive skills, such as the ability to (say) assimilate process control information from a VDU and thereafter interpret it might be demonstrated by the candidate talking through the interpretation of displayed information. However, such verbalisation may interfere with some cognitive skills whilst it may not be possible to verbalise other cognitive skills, such as mental arithmetic. In these cases post-task debriefing of candidates may be appropriate.
- Whilst satisfactory completion of a task that requires the use of knowledge, such as fault diagnosis, may be indicative of underpinning knowledge, it is possible that the correct action was by luck. Accordingly, knowledge tends to be assessed through verbal or written questioning.
- Whilst psychometric personality tests may provide a prediction of interpersonal, team management and safety behaviours, observation of actual behaviour in the real or simulated work setting using behavioural observation tends to provide a more valid measure.

### ASSESSOR COMPETENCE AND CREDIBILITY

Assessors should be competent in the process of competence assessment and have a certain level of knowledge and experience of the tasks being assessed. The level of expertise in assessment should be matched to the form of assessment. For example, in-house coaching on how to complete assessments may be adequate for “on the job observation” of simple operation tasks, but completion of NVQ units D32/33 may be needed for (say) assessment of more complex operational tasks. In the case of behavioural competences such as team coordination and communication assessors may need to be trained on what comprises “good performance”, what are the behavioural markers and how to gauge performance against these markers. Assessors should also be credible in the eyes of the assesseees. This tends to require assessors to have sufficient knowledge and experience of the operations to pose insightful questions and judge the validity of answers.

### ONGOING ASSESSMENT

Finally, ongoing “competence checking” needs are determined by consideration of how competencies may decay over time and the safety criticality of the task. More frequent assessment tends to be required for higher risk tasks and tasks wherein skills may decay sooner. All persons tend to be assessed at least annually in the form of a performance appraisal based on line management observations. People involved in complex safety critical tasks, such as process managers or control room operators, may be appraised more formally every 1 to 3 years. The highest risk tasks may be assessed every six months.

There are a number of considerations regarding the form of reassessment to apply. In the case of infrequent tasks, such as emergency response or response to a process upset, normal day to day work may not provide any opportunities for performance to be demonstrated. In such a case, it may be necessary to set tasks, run simulations or exercises. On the other hand, day-to-day work may provide a valid indication of performance in the case of routine frequent task, such as road tanker driving. However, there is an additional array of sources of evidence of performance available once a person is in post. These can include:

- Standard SHE audits can cover the performance of safety critical tasks, specifically the level of adherence to safe practices and individual performance;
- The contribution of individual competence to an incident can be assessed as part of the incident analysis process;
- Many companies use behavioural observation schemes that can provide observations of safety related behaviour that can be used as the basis of one to one coaching – assuming the scheme covers behaviours that effect process safety.
- Peer review: On the job performance can be monitored and appraised by line managers.

The latter sources of evidence may compliment more formal forms of assessment.

### RESPONDING TO SUB-STANDARD PERFORMANCE

It is clearly important to have a pre-planned response to the identification of sub-standard performance to enable the company to act purposefully on the results of competence assessment. The response to sub-standard performance tends to vary according to the purpose of the assessment and the safety criticality of the task.

In the case of selection, promotion and recruitment decisions the discovery of sub-standard performance tends not to pose a significant “policy” problem, in that people are simply not appointed to the position and/or required to undergo further training/experience. Once a person is in post, the discovery of sub-standard performance tends to pose a more difficult challenge. First, it is important to check whether the sub-standard performance arises from omissions in training, supervision or other factors such as inadequate procedures or equipment. If the sub-standard performance is attributed to the individual, there are at least three common responses, namely retraining staff, increasing the level of supervision and placing limits on the scope of an individual’s role and responsibilities. In the case of the most safety critical roles, it is likely that a person will be required to demonstrate competence, perhaps by undergoing re-assessment, before they are re-authorised to take on their normal duties again, especially if they normally work unsupervised or are a key decision-maker such as a process supervisor.

## CONCLUSION

Organisations operating high-hazard plant recognise that safety relies on the experience, commitment and competence of their staff, and this remains true. Indeed, reliance on staff competence is perhaps even greater in latter day downsized organisations and the use of automated systems for control. The COMAH regulations and the lessons learnt from major incident indicate that it is not enough to assume that exposure to training and experience assures competence. There are already examples of good practice in the development and application of competence standards and systematic assessment methods. This report provides a summary of these practices in a sufficiently general way that the diverse range of sites regulated under COMAH can apply.

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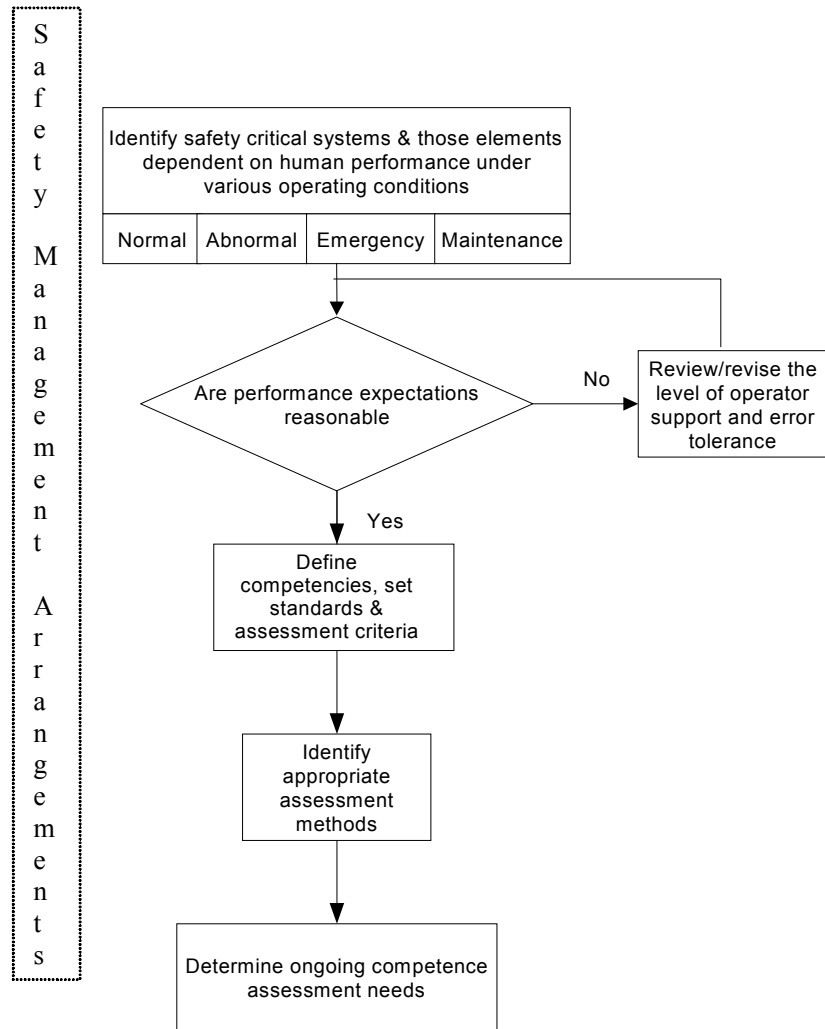
## APPENDIX: SELF-ASSESSMENT QUESTIONS

### QUESTIONS FOR PROBING THE PROCESS OF COMPETENCE ASSESSMENT

1. Is the assessment of competence proactively managed as part of an integrated selection, training and assessment process? For example:
  - Is the need for competence assessment stated within (training) policy?
  - Have roles, responsibilities and adequate resources been allocated to the process of competence assessment?
  - Is the level of training and supervision matched to the level of individual competence?
  - Does the management of change process address issues of competence assessment (during delayering and downsizing)?
  - Are the results of competence assessment recorded?
  - Is the system of competence assessment audited and reviewed?
2. Have all those activities and tasks that have the potential to contribute to a major accident been identified?  
Have task inventories been prepared for all those activities and tasks that have the potential to contribute to a major accident been identified?

4. Has the task analysis been cross-referenced to a risk assessment (such as a HAZOP, What if analysis or safety review) or safety case, or has an error analysis been carried out – such that the safety criticality of tasks is validated?
5. Has the safety case been reviewed so as to identify emergency scenarios (and process upsets/abnormal operating states) and safety critical tasks for which staff competence needs to be assessed?
6. Are there a set of valid and comprehensive descriptions of safety related tasks, covering operations maintenance and abnormal events, for use in assessing a person's performance?
7. Do the task analyses identify the necessary underpinning knowledge of equipment, processes, hazards and consequences?
8. In the case of supervisory and managerial roles/activities, does the task description cover specific safety tasks such as risk assessment, developing safe systems of work, effective communication, etc?
9. In the case of tasks such as emergency response and supervision, does the task analysis cover the “softer” (non-task specific) competencies of team management, communication, event recognition, delegation and so on.
10. Is competence assessment supported by a set of standards that cover:
  - A list of those tasks that staff need to be competent in;
  - A specification of the skills, knowledge, behaviours and correct working practices/procedures against which performance can be judged;
  - Guidance on what constitutes acceptable evidence of performance, such as written tests, on the job observation, simulated exercises, minimum periods of experience and qualifications;
  - Measurable criteria for judging adequacy of performance during assessment, such as correctly completing a task three times.
11. How have NVQs or any other national standards been adjusted to match site hazard/risk profile?
12. Have the standards been “graded”, as appropriate to allow for different individual levels of competence and supervision?
13. Has the level of error tolerance (in the system) been taken into account in setting competence criteria? Such as:
  - Hardware or software interlocks, and automatic shut down systems;
  - Supervision.
14. Has the realism of performance standards been reviewed to ensure that competence expectations reasonable and realistic?
15. Is the scope of assessment adequate? For example, does it cover, as appropriate:
  - Process knowledge;
  - Understanding of hazards associated with the process/equipment/plant;
  - Understanding of correct operating procedures and practices;
  - Safety behaviours and attitudes;
  - Demonstration of correct performance, and;
  - Softer competencies such as safety leadership, as appropriate

16. Is there a suitable match of assessment methods to the different types of competencies?  
For example:
  - On and offline observation of task performance for operational skills;
  - Simulation based assessment of process upsets and emergencies;
  - Behavioural observation for “soft” competencies such as safety leadership, communication and teamwork;
  - Question/examination based assessment of knowledge.
17. Is on the job assessment guided by a set of standards and assessment criteria?
18. Is on the job assessment independent?
19. Is assessment carried out by accredited or otherwise trained trainers/assessors with pertinent process experience?
20. Have minimum “check and train” requirements and frequencies been set for staff in post?
21. Is the frequency of re-assessment matched to the frequency and safety criticality of tasks, with for example, annual simulator assessment of complex control room tasks and, annual on the job appraisals for routine plant operation?
22. Is an appropriate set of assessment methods used to check ongoing competence?  
Such as:
  - Simulation/exercise based assessment for infrequent tasks;
  - Verbal or written tests of retention of knowledge and/or up to datedness of knowledge;
  - On the job observation of routine tasks.
23. Is appropriate use being made of safety audit and other performance review systems to identify individual competence problems? For example:
  - Is there a system in place to report and review the cause of significant errors and refer, as necessary, people back to a “check and train” process?
  - Are the results of behavioural safety observation used to identify individuals behaving unsafely and providing them with coaching?
  - Do general SHE audits report individual competence issues?
24. Are appropriate standards used to guide the assessment of “on the job” performance of staff in post?
25. Does the company have a planned approach to the identification of sub-standard competence, such as retraining, demotion and/or increased supervision?



**Figure 1.** Overview of competence assessment process