Demonstrating Management Competence in Process safety

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Lack of good corporate governance in process safety has been found to be a contributory factor in a number of major accidents over the years. A review of major accidents across hazardous industries revealed that a lack of effective leadership and management at various organisational levels contributed to many of the high profile incidents, including the Piper Alpha explosion and fire, the Esso Longford gas plant explosion, the BP Texas City Refinery explosion and the Buncefield fire. Operators of hazardous installations must therefore work to recognise weaknesses in the chain of command and take steps to ensure that those involved in PSM can demonstrate the competencies necessary for effective management of process safety issues.

In the UK the current efforts to improve competency are building but are largely focussed on improving technical knowhow, not management capability. Additionally, the movement of experienced personnel suggests that a method is needed to standardise, track and ensure a growing level of competence for management of process safety in the workplace.

Using examples, this paper discusses the far greater benefits that can be gained from vocational qualifications that use a mix of teaching methods (including directed self-study using web based tools) structured around the needs of the business and the individual, over those employing more traditional teaching methods. It explores ways in which learners can demonstrate capability by tackling and resolving real problems in the workplace to improve understanding and deliver business benefit aligned to corporate aims and objectives. Recognition of achievement is through a system of awards, certificates and diplomas.

Keywords: *corporate governance in process safety, management competence, demonstration, directed self-study, process safety, PSM, COMAH, directed self-study, qualifications, awards, certificates, diplomas*

Introduction

The Process Industry is a major contributor to the UK economy; it accounts for some 2% of Gross Domestic Product and employs an estimated 230,000 skilled managers, technicians, operatives and support staff. Whilst overall growth in the sector has been slow as a result of the economic downturn, recent production figures for chemicals (excluding pharmaceuticals) have been strong. The chemical sector is recognised as one of the key foundation industries that are essential to rebuilding national supply chains. Manufacturing currently accounts for only 10% of the UK economy but the government is working with a number of priority sectors to rebalance the economy towards manufacturing and re-shore businesses to the UK.

The pressures of growing global competition and the need to do more with less together with increased legislation and an ageing workforce have been particularly challenging, however, especially for operators of hazardous installations such as those regulated under COMAH where the need to demonstrate organisational competence has remained high.

Cogent Sector Skills Council figures from a 2013 survey show that from the 160 respondents taking part, representing over 33,000 employees, companies currently spend on average £2,000 per head on training each year and that greatest demand is now for health & safety, job-specific and behavioural training, across all levels. This is generally in line with the results of recent industry benchmarking activities focussed specifically on organisational competence, which suggest that even though businesses are prepared to invest heavily in training, when it comes to demonstration of competence, emphasis has mostly been directed towards upskilling those directly responsible for manufacturing output rather than on those in management and support roles.

Demand for Skills

The UK chemical and pharmaceutical industries have a strong record as manufacturing's number one export earner and accounts for 12% of manufacturing value added.

The Chemistry Growth Partnership (CGP) (CIA, 2015) is committed to delivering a 50% increase in the UK economic contribution of the chemical and pharmaceutical industries by 2030. Strategic priorities require supporting measures to strengthen the UK's competitiveness and growth potential, one of which is Demand-led skills development.

A survey of chemical businesses in the UK (HSE, 2009) found:

- 90% of companies reported some degree of difficulty in recruiting science graduates with 45% describing it as very difficult;

- only 5% of companies stated that graduates are very well equipped to perform at the required level ;

- 60% of companies are recruiting graduates from overseas, mostly Europe but also India and China;

- nearly 40% of these companies think the skills and knowledge of overseas graduates are stronger than those educated in the UK;

- companies reported problems finding graduate recruits with skills in problem solving(42%), report writing (36%), analysis (36%) and research (29%);

- nearly half of all available training budgets are needed to close essential skill shortfalls (46.09%); and

- 69% of companies feel that they are training their staff in skills that should have been learned in the education system at school, college or university.

With an ageing workforce, demand for new recruits in the UK during the next ten years will be high, and employers will need to look beyond the traditional pool of candidates to find the talented people they need. In addition, the movement of experienced technical and engineering personnel within industry indicates that additional competence building could be beneficial. The supply of new people and the ability to quickly and easily up skill the existing workforce is a major challenge for chemical businesses in the UK.

Concerns over skills and competency are also shared by the Health & Safety Executive. The Health & Safety Executive is the independent regulator responsible for setting and enforcing health & safety requirements within the UK. It does this in part, through its sector strategies. The HSE Strategy, The Health and Safety of Great Britain - Be Part of the Solution (HSE, 2009) provides the overall strategic framework for maintaining and improving Great Britain's health and safety performance. It explains that to achieve this all stakeholders - be they employers, manufacturers, suppliers, workers, third-party organisations, HSE or local authorities - have to understand their role and discharge their responsibilities.

Within the framework of the HSE Strategy, individual sector strategies have been developed, with stakeholder involvement, to guide HSE's proactive work. Each sector strategy sets out a series of aims grouped under the goals of the HSE Strategy which, if met, would address 'what' needs to be done for each sector to improve its health and safety performance.

Some of the issues identified within the HSE chemicals sector strategy 2012-15 (HSE 2011) that impact on competence demonstration include the:

- gradual move away from production towards more storage / warehousing;

- financial constraints or ageing plant in declining subsectors;

- rapid development and supply demands in expanding areas;

- ageing workforce and loss of skilled workers. (maintaining sufficient process safety competence is essential to ensure that companies are able to deal with the technical and managerial challenges of operating a major hazard business);

- need for employer and employee recognition and acceptance of their responsibilities;

- trend towards the use of less skilled workers in SME's, who may lack a fundamental understanding of chemical / major hazard risks and control measures; and

- need for to be an increase in competence and an understanding of off-site risks (and their consequences) by SMEs, especially in the sub-COMAH sector.

The HSE Chemicals Sector Strategy, identified that maintaining sufficient process safety competence was a "key challenge for industries within the sector" but is essential to ensure that companies are able to deal with the technical and managerial challenges of operating a major hazard business and as a result Competency Management has been identified as one of the key HSE inspection topics for 2012-2015. (COMAH Competent Authority, 2011).

Process Safety Management Competence

There are many reasons why major accidents occur but with the exception of a few, they will invariably involve the failure of a person to do the right things, or make the right decision, at the right time. Whilst immediate causes will often lie with equipment malfunctions or errors made by front line staff in routine or emergency situations, the root causes are usually associated with a lack of involvement, or action, from the management team, which is evidenced in many accidents by poor policies, a lack of direction and corresponding gaps in the underpinning safety procedures.

In the process industries, arguably the single largest business risk is the potential loss of containment of hazardous materials or energy. The management teams, including the company boards, must therefore give due consideration to the controls necessary for the prevention of major accidents where loss of life or large scale damage of the environment could have a long-term and devastating impact on the business. Board members, especially those with a non-technical background, must be able to strike a balance to ensure that the risks to the people and the environment are adequately managed without over-stretching the business.

Assessing and assuring competence can be a large task, but one that is essential to maintaining site and process safety. People at all levels within the organisation have a part to play controlling Major Accident Hazards. When things go wrong and systems and processes break down, it is only competent people who can return the situation to normal. By thinking

about people as an asset – not just a potential source of failure – we can maximize business and safety performance.

Before looking at Management Competence in Process Safety we must first understand what competence is and more importantly what it is that drives managers to make the decisions they do on a day-to-day basis.

Competence is defined by the HSE as 'the ability to undertake responsibilities and perform activities to a relevant standard, as necessary to ensure process safety and prevent major accidents. Competence is a combination of knowledge, skills and experience and requires a willingness and reliability that work activities will be undertaken in accordance with agreed standards, rules and procedures.' (COMAH Competent Authority, 2011).

But being able to follow procedures or holding specific qualifications is not the same as being competent. Competence requires an understanding of the reasons for specific procedures and the consequences of not following them correctly. It includes the ability and confidence to effectively problem solve and make decisions. It assumes an awareness of the immediate environment, the skills and ability to operate and manage the plant to keep risks as low as reasonably practicable and the experience to act safely and appropriately in unfamiliar situations.

A legal definition, also referred to as legal capacity, takes these things into consideration, describing competence as 'The capacity of a person to understand a situation and to act reasonably'. Disputes regarding the competence of an individual are settled by a judge and not by a professional. The judge may seek expert opinion before delivering a judgment. (Business Directory, 2015).

Primarily, the focus of any company board will generally be on setting and delivering strategic aims and objectives of the business, responding to changing market conditions, strengthening the performance and profitability of the business in order to ultimately maximise the return for shareholders. The focus of management will accordingly be aligned to the board aims and objectives but can be significantly influenced by the senior management behaviours and attitudes towards certain topics and the underlying business performance. The challenge therefore is for management to make valued judgements, based on all of the risks at the current time for the long-term sustainability of the business.

Given that competency requirements will differ for those in leadership, management and supervisory roles and so the challenge for operating companies is one of how to demonstrate competence in 'management' of process safety at every level.

Vocational Qualifications

As already stated, in the UK there is a reported lack of industry-preparedness among young people coming into industry compared with other countries. They have the academic qualifications but often lack the supporting skills such as problem solving. Organisations will also think hard about training new recruits as often they are seen to leave after what may have been significant investment.

Furthermore, consideration needs to be given to teaching techniques used within industry. Post-secondary learning and personal development is considerably different from the learning needs and learning methods of those in primary and secondary education. Adult learners bring experience whether from industry or academic study and this needs to be valued and respected. Malcolm Shepherd Knowles, (Knowles, 1984), champions andragogy in adult learning. Andragogy, in contrast to pedagogy, moves the learner to independent learning and a trainer should encourage this. For example, when teaching process safety management, further reading references are provided to the learners to enable them to extend their knowledge and use these resources to provide independent evidence. Andragogy recognises that the learners experience is a rich resource for individuals and the group so teaching methods used include discussion amongst learners encouraging participation by all. If learners are not participating open questions are used to encourage involvement and ensure that the group remains focused and does not digress. Andragogy assumes there needs to be a willingness to learn so orientating the teaching on what the learner needs to know and relating this to life application and their social roles. In vocational training specific lessons and group work is built in which allows the learners to recognise the use of the learning relative to their role rather than it being only interesting or intriguing. The key for the trainer in these scenarios is to aid the debate with probing questions. This is further emphasised in orientation to learning, in that as a person matures their time perspective changes from postponed application of knowledge to immediate application. Knowles fifth assumption is around motivation to learn and states that as a learner matures, the motivation comes from within rather than external pressures and therefore independent learning becomes more attractive.

The Wolf review (Wolf, 2011), reviewing vocational education and training in England identified that there are few vocational programmes within the English systems designed to deepen the professional skills which, in contrast, represent a substantial proportion of post-secondary vocational provision in Germany, Austria and Switzerland, for example.

Vocational qualifications convey information ensuring that a qualified person has a package of knowledge and skills, relevant to a particular occupation or career which include the hard technical skills and softer skills, less tangible skills in a real-world context. Vocational programmes can be designed to include a considerable amount of work-based learning where the learner applies their knowledge within their organisation. Technical skills can be more readily tested in scenario based assessments to prove competence however the softer professional skills are more difficult to assess to prove competence without real life situations.

The workplace provides a strong learning environment because it offers real on-the-job experience making it easier to acquire and assess both technical and soft skills. The acquisition of a more rounded set of skills requires practical training on

equipment, communication and negotiation with other stakeholders such as customers, colleagues and management, along with exposure to working within management system frameworks, many of which can only be obtained in real working situations. Vocational training can therefore often be effective, since it makes use of actual equipment and systems in use within the learners organisation and has the added benefit of linking the knowledge gained to real life situations.

The investment of employers for vocational training can also be recouped. Learners can undertake productive work providing the crucial link between newly learnt theoretical knowledge and industry practice whilst delivering real benefit to the organisation.

The OECD Reviews of Vocational Education and Training : A skills beyond schools review of England (Musset 2013) has identified the value obtained from vocational training recommending that it is necessary to take strategic measures to encourage the expansion of high quality post-secondary vocational programmes reflecting both labour market demand and learner needs. A key recommendation was also that quality workplace training should form a substantial and mandatory part of post-secondary vocational education training programmes, building local partnerships between employers and training providers. This is an area which is seen to be developing within the processing industries over recent times.

In July 2014, the Science Minister David Willetts announced a £52 million investment in new and emerging science talent, creating more than 7,800 education and skills opportunities over a 2 year period. (ref) The Science Industrial Partnership (SIP) board led by industry, is targeted at designing the vocational training and skills programmes required by the life sciences, chemicals and industrial science sectors in order to compete in the global economy.

ABPI Chief Executive Stephen Whitehead said of the SIP programme , "The UK's traditional strength in science has been eroding; science graduates often lack skills useful to industrial research, particularly practical skills, so the focus on high quality training through apprenticeships and other programmes is welcomed. "

In December 2014, Kirklees college announced their bid had been successful to create an employer-led national training centre which meets the requirements of process manufacturing industries with common processing technologies and needs. A project that has been welcomed by industry in order to address the ageing workforce issues through succession planning and development of the existing workforce locally along with equipping new employees with the appropriate skills and knowledge required to enter industry and add real value from day one. Many of which can only be really developed through real life situations in the workplace.

Partnerships between training providers and employers can maximise the opportunities to demonstrate management competence in process safety by designing the training in such a way that is builds on the learning in order to sustain and update knowledge of modern industry practices along with examples relevant to the sector or organisation they are working within.

Effective Process Safety Management Training

In light of recent accident investigations, for example following the Texas City (CSB, 2007) and Buncefield (HSE, 2008) incidents in 2005, many organisations recognise the need to work harder to improve process safety management and although great progress has been made to improve technical competence relatively little appears to have been done to provide vocational based, validated training to drive competency in the management aspects of process safety.

Many training programmes have focussed on improving knowledge and understanding of technical process safety issues such as HAZOP, LOPA and SIL assessment, leaving out the key aspect of good leadership and management in process safety. Fewer still can provide adequate demonstration of competence in the workplace. These being the very skills that are required at the front line when it comes to detecting failures and preventing accidents.

Recognising this as a growing problem, HFL Consulting carried out what was the first ever process safety management benchmark for UK hazardous installations regulated under the Control of Major Accident Hazards, COMAH, regulations in 2011 covering Asset Integrity and the Issues of Ageing Plant (Hought, 2012) and subsequent global benchmarking studies including Competence, Management of Change, Process Safety Culture and Human Factors (Grindrod, 2012) Using their own Insight Lifecycle ® auditing and assessment tool, the HFL team were able to accurately identify areas where management practices could be improved. Taking into consideration legislative requirements and best practice from around the world, including CCPS Guidelines for risk based process safety (CCPS, 2007) and Energy Institute High Level Framework for Process Safety Management (EI, 2010), the study provides a detailed understanding of the workings of systems and underpinning processes to develop strategies for sustainable safe and efficient operations.

In addition to specific technical aspects, all of the benchmarking studies revealed a clear need for businesses to set their own policies for process safety management to ensure that their own programmes of work are aligned to attendant risks, accepted standards and the business case, rather than allowing their systems to develop as a result in response to interventions from the regulator. Following on from this, the benchmarking activities also highlighted a lack of corresponding targets and objectives, poor use of process safety performance indicators to monitor and drive behaviours and a lack of structure in management reviews.

If competence management in process safety is to be an integral part of managing a business then all personnel, at all levels from all functional groups must understand what is involved and the role they have to play to ensure success and sustainability. This requires training providers and businesses to look beyond the technical aspects of process safety and

work together to provide effective management training programmes capable of equipping learners with the knowledge, skills and confidence they need to deliver and demonstrate competence in process safety.

For effective process safety management the board must set its process safety policy on an understanding of the hazards and risks to provide a shared vision that can be deployed throughout the entire organisation by means of common objectives, creating alignment through involvement and cross-functional team working, and ensuring that resources are directed appropriately.

Recognising a gap in the area of training which allows the learner to demonstrate competence in the area of process safety management, HFL Consulting developed the QCF (Ofqual, 2014) based Continuous Improvement in Process Safety, CIProS™, qualification series. The CIProS™ qualifications outlined here promote understanding of good management practice to grow confidence so that the learners can actively participate in the management of cross-functional teams of professionals, technicians and operators in a way that is aligned to the business aims and objectives. The qualifications have also been deliberately aligned to support the Cogent Sector Skills Council's Gold Standard, which is a competency framework for individuals in the science based industries. It sets an aspirational industry standard for work-based performance, in key areas such as technical competence, business improvement and compliance (Cogent, 2007).

Nationally Recognised Qualifications in Continuous Improvement in Process Safety, CIProS™

The CIProS™, qualification series are delivered in a flexible modular format that allows learners to study at a time and pace that fits in and around working hours and personal commitments. What's more, to avoid expensive duplication, they can be tailored to support corporate programmes, whilst the choice of in-house and open courses can be offered to reflect budgets and learner availability. The combination of mandatory and optional units provides a comprehensive syllabus that eliminates potential knowledge gaps in a company's process safety programme. A mixture of teaching methods are used including interactive presentations, mentoring, coaching, workshops along with self-study and assignment work designed to complement industry-specific learning.

The CIProS™ Qualification Series currently covers Levels 3 and 7, allowing for attainment of Unit Awards, Certificates and Diplomas at both levels (Tables 1 & 2). Although additional qualifications are now in development and will be available shortly, it is considered that the programme as it stands can be used to support senior management to supervisors within most organisations.

The awarding body for the qualifications is PAA\VQ-SET, a UK independent specialist Awarding Organisation that is recognised and regulated by the UK Qualification Regulators. The regulators include the Office of Qualifications and Examinations Regulation (Ofqual), the Welsh Government and the Scottish Qualifications Authority (SQA).

Whether at Level 7 or Level 3, successful completion of both Certificates leads to the automatic award of the Diploma in Continuous Improvement in Process Safety at the corresponding level by virtue of the credits acquired. At this point it is expected that the candidate will have the knowledge, skills and confidence to actively help implement, embed and sustain a culture of Continuous Improvement in Process Safety within his or her own organisation.

Table 1: CIProS™ Qualification Series Level 7

Title	Mandatory units	Optional units
Certificate in Understanding Continuous Improvement in Process Safety	• Understand the business case for Process Safety Management • Understand Compliant and Sustainable Process Safety • Understand Effective Process Safety Management • Understand Leadership and Culture for Process Safety Management	• Understand Commitment to Process Safety Management • Understand the impact of Major Accident Hazards and Risks on Process Safety Management • Understand a Risk Based Approach to Process Safety Management • Understand Best Practice and Deficiency Correction to Improve Process Safety Management
Certificate in Leading Continuous Improvement in Process Safety	• Present the Business Case for Process Safety • Embed Sustainable Process Safety Management • Manage and Assure Process Safety • Leadership and Culture for Process Safety Management	• Embed Process Safety Management Commitment • Maintain Understanding of Major Accident Hazards and Risks and their Impact on Process Safety • Demonstrate a Risk-based Approach to Process Safety Management • Implement Best Practice and

		Deficiency Correction to Improve Process Safety Efforts
Diploma in Continuous Improvement in Process Safety	Awarded on attainment of the two Level 7 Certificates	

Table 2: CIProS™ Qualification Series Level 3

Title	Mandatory units	Optional units
Certificate in Continuous Improvement in Process Safety Fundamentals	• Understand the key factors of Process Safety Management • Understand Hazard Identification, Risk Assessment and Management of Risk • Understand Process Safety Culture and Commitment • Understand how to Implement Sustainable Improvements in Process Safety Management	• Understand Process Safety Competence Management • Understand Human Factors in Process Safety Management • Understand Standard Operating Procedures for Process Safety Management • Understand Asset Integrity in Process Safety Management • Understand Process Safety Accident and Incident Investigation • Understand Emergency Response Management
Certificate in Applying Continuous Improvement in Process Safety	• Establishing requirements for Process Safety Management • Carrying Out Process Safety Gap Analysis Studies • Identifying Process Safety Improvements • Effective Communication of Process Safety Information	
Diploma in Continuous Improvement in Process Safety	Awarded on attainment of the two Level 3 Certificates	

Unlike other process safety management training courses, the CIProS™ qualifications have been designed specifically to help those from both technical and non-technical backgrounds to gain a much deeper understanding of policy deployment to support implementation of continuous improvement principles across all aspects of process safety management.

The qualifications focus not only on understanding hazards and risks but on the linkage to the key risk control systems necessary for sustainably safe operation. After comparing and contrasting different frameworks for process safety management and examination of risk control systems in detail, learners will know how to critically assess the systems, policies and procedures present within their own workplace to identify gaps and make valued judgments on how best to improve them for the long-term benefit of the business. Improvement plans are then developed and submitted for assessment to demonstrate an understanding of policy development, and approaches to setting of targets and objectives, and setting of process safety performance indicators to monitor and drive behaviour to close any gaps identified in order to meet the wider needs of the stakeholder group.

In addition to providing for flexibility by allowing units taken at different times to build qualifications over time, adopting the QCF system allows for variation in delivery models. Providers can therefore accommodate differing learning needs and the availability of individuals through a range of open courses and flexible learning arrangements with employers. But whatever the delivery model, the courses will always encompass communication of fundamental concepts and principles in the classroom, and exploration of best practice principles through directed reading, work-based assignments and workshops. Testing of understanding is achieved through a combination of examination of learner statements, questions and answers, and work-product, all supported by professional discussion, observation and viva voce.

Building on new technologies, the programme also offers individuals and employers the opportunity to learn anywhere, anytime. In particular, online and distance learning is an important aspect when serving multinational organisations and partnerships with global providers can contribute to meeting the needs of a global audience.

The 34 Chapters of the Process Safety Management eBook™, (Cutshall 2013) provide an innovative way for self-directed and distance learning delivery. The eBook is an interactive tool that integrates voice overlay explanations, web-links to key global websites, and links to explanatory documents and photographic subject matter. The material stays up to date as the Internet updates information. The content is a blend of US and European process safety and risk management requirements. Essay and multiple choice questions along with exams are built into the learning and can be managed by the course administrator. He/she can receive learner test results electronically after each assessment, as well as monitor how the learners are progressing through their study of the material. The assessments measure comprehension, and in-progress and outcome metrics can be collected by the administrator.

Concluding Remarks

As public scrutiny continues to grow on the manufacture and distribution of hazardous materials, discourse has become more unforgiving towards any loss of containment, with many lessons learned repeating themselves following major accident investigations.

All parties, from producers through storage and distributors, are facing and will continue to face questions and pressure around the actions being taken internally to address the process safety management competency of all personnel. The UK QCF based vocational qualifications can allow industry and educational institutions to quickly move forward with a proven credential that addresses the plaguing issue of demonstration raised by societal and governmental stakeholders.

Vocational qualifications are designed to deliver reliable and robust assessment of competence, against criteria specific to the subject and industry sector including understanding how the knowledge fits in its widest context. This supports the mobile workforce seen in the process industries, saving unnecessary training costs and linking the training and qualifications to vocational skills leading to sustainable growth and competitiveness required for businesses.

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