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**Process Safety Competence Assurance**

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**Abstract**

Competence is a critical component of an organization's success—one that is also very relevant for process safety. In fact, process safety competence can help ensure compliance with regulatory requirements and can be an important business improvement driver, particularly when it comes to process safety risk.

Competence is often confused with knowledge; therefore, it can be difficult to assess competence levels. However, having a well-defined framework to assess process safety competence across the organization can offer many benefits, including helping the organization to:

- Identify gaps in organizational understanding and competence, and uncover opportunities to close those gaps;
- Ensure that personnel have the appropriate process safety competence levels (i.e., knowledge, experience, education and training);
- Ensure correct decisions and actions are taken to prevent incidents;
- Facilitate training to help effectively manage process safety in the workplace; and
- Create a sustainable model to support ongoing staffing and succession planning.

This paper introduces a structured and scalable approach to process safety competence assurance, which is modeled using recognized industry guidelines, publications, and experience. This approach is fit-for-purpose and provides a framework designed to encourage intentional learning and development to close identified process safety competence gaps. The ultimate outcome of this approach is a competent staff who help recognize and drive process safety improvement.

## **Introduction**

Process safety and the competence of the workforce are key to the success of any organization. Not only does staff competence help ensure compliance with regulatory requirements, it can help organizations more effectively manage process safety risk.

To understand how competence can positively impact an organization, it is important to first understand what is meant by competence. Competence can be defined as “the capacity of a person to understand a situation and to act reasonably.” A competent person is defined as “having suitable or sufficient skill, knowledge, experience, etc., for some purpose; properly qualified.”

Many organizations fall into the trap of believing competence can be achieved and knowledge gaps closed simply through employee training. While training is one crucial element of an individual’s ability to successfully perform in a job function or role, competence requires both knowledge **and** experience. Knowledge is most often gained from an individual’s primary education and training; experience results from direct and relevant participation in specific situations. For example, a person may gain valuable knowledge about conducting an incident investigation by completing a training course on that subject. However, they gain experience by using this knowledge to participate (and, possibly, ultimately lead) in an incident investigation.

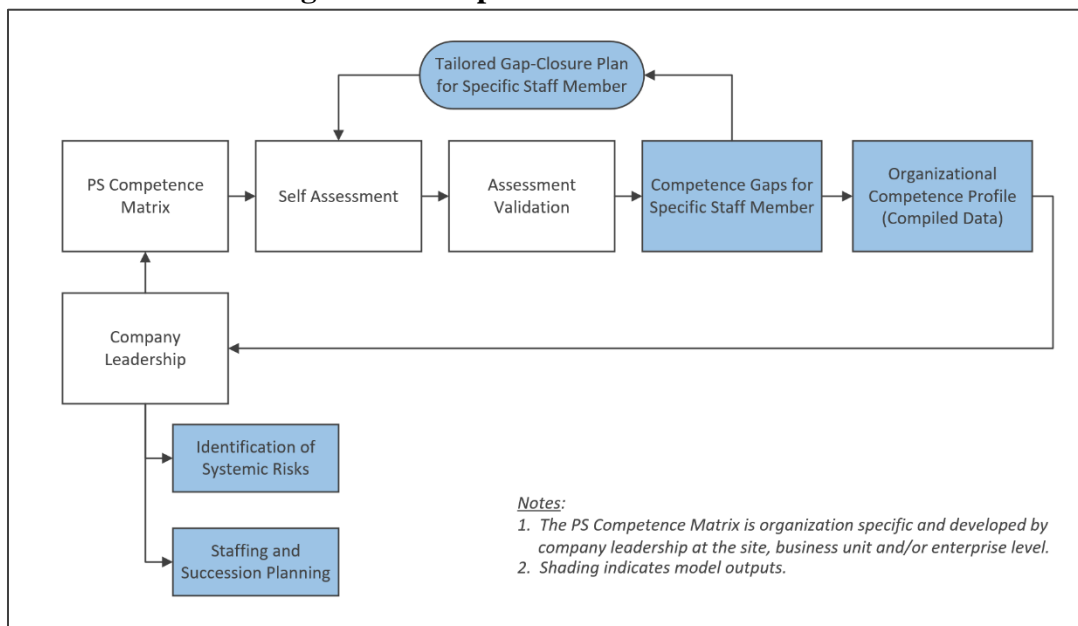
Specific to process safety, competence for individuals also requires understanding of:

- Applicable regulations;
- Identification, control, and mitigation of process safety hazards; and
- Ability to design, operate, and maintain hazardous facilities.

## **Kestrel’s Approach to Competence Assurance**

Kestrel’s approach to process safety competence assurance is outlined in the model below (Figure 1). This model consists of two inputs (the Target Process Safety Competence Matrix and the Process Safety Competence Assessment) and two primary outputs (Competence Gaps for Specific Staff and Organizational Competence Profile). Each of these elements, as well as additional outputs, are discussed in the following sections.

**Figure 1. Competence Assurance Model**



## Model Inputs

### *Target Process Safety Competence Matrix*

There are several tools needed and factors to consider when defining the process safety competence requirements for an organization. The Target Process Safety Competence Matrix (target matrix) forms the foundation of an overall Process Safety Competence Assurance Program. It establishes the benchmark against which the process safety competence of the organization will be measured. Accordingly, the target matrix is company-specific and should, therefore, be created by company leadership at the site, business unit, and/or enterprise level.

The organization must first decide on the elements (i.e., process safety topics) that will be included on the target matrix. Kestrel has defined 16 elements; however, each organization may choose to rely on other resources, such as the Center for Chemical Process Safety (CCPS) <sup>[1]</sup> and OSHA's PSM<sup>[2]</sup> elements, as well as using the organization's own internal management system elements. Elements should be aimed at broad topics and not around specific activities. For example, a strong element would be Hazard Identification & Risk Assessment (HIRA), as opposed to the narrower element of Process Hazard Analysis (PHA).

Once the number and naming convention for the competence levels have been defined (see sidebar), the

### How Many Levels?

Typically, four to five distinct levels of competence are recommended. Fewer than four may result in too large a jump in between competence levels, while more than five may be too granular. The levels should be named in a manner that is clear to understand and appropriate to the level. For example, Basic, Practitioner and Expert rather than PS Specialist I, II and III. There are industry guidelines available to provide recommendations, or organizations may develop their own.

competence requirements for each individual element must be established.

Figure 2 provides an example of a typical element (HIRA) and illustrates how an organization might define the competence requirements at four different levels. In this example, there are three progressive levels of competence (Basic, Practitioner and Expert). The fourth level establishes competence for Leaders, but is not intended as a progression from Expert. Leader competence is defined to ensure leaders in the organization have the appropriate knowledge and skills to provide guidance and oversight, and to set goals around process safety; however, Leaders may or may not be Experts in process safety competence.

**Figure 2. Example Competence Requirements for HIRA Element**

Level	Competence Requirements - HIRA				
Basic	Can define the principles behind a HIRA Program	Can describe the different high-level techniques available	Participates in qualitative assessments		
Practitioner	Has a full working knowledge of risk management principles, from hazard identification to risk reduction and ultimate review	Can describe the full suite of risk assessment tools available, including the differences between qualitative and quantitative assessments	Participates in and may lead simple HIRAs	Participates in complex risk assessments, including acting as scribe for PHAs	
Expert	Has knowledge and ability to lead and/or validate complex risk assessments	Has ability to interpret QRA studies and provide recommendations on risk reduction measures	Provides guidance and input on the development of a risk management program		
Leader	Has knowledge of company's risk management program	Has knowledge of the team/skills required to conduct HIRA	Has experience with the types of HIRA and when each may be required	Is knowledgeable about how to manage recommendations arising from HIRAs	Is knowledgeable about what options are available for replacing or declining a recommendation from a HIRA

The last step in developing the target matrix is to determine which employee job positions are in scope for the assessment. All positions in the organization that influence or impact process safety should be identified, considered relevant to scope, and included on the target matrix.

Additionally, the competence requirements for each position should be clearly defined.

## *Developing Knowledge Learning Tools*

The organization must also provide knowledge development tools and guidelines—in alignment with the target matrix—which offer direction and learning opportunities that enable employees to advance competency. Such guidelines should outline examples and/or establish requirements that illustrate how to build competence for each element outlined on the matrix.

For example, if an employee is at a Basic level on an element but the job requirement calls for competence at a Practitioner level, then guidelines for both training and experiential learning must be defined and implemented to close competence gaps.

An example of knowledge development opportunities for HIRA is detailed in Figure 3 below.

**Figure 3 – HIRA Example of Knowledge Development Opportunities**

Level	HIRA Knowledge Learning Opportunities				
	Training	Experiential Learning			
Basic	Complete online process safety risk awareness training	Participate in 4 low complexity facility risk assessments (e.g., What Ifs/simple PHAs)	Review facility/company procedures associated with HIRA		
Practitioner	Complete classroom risk-based process safety training	Participate in 5 mid-level complexity PHAs	Act as a scribe for 2 HAZOPS		
Expert	Complete HAZOP Lead course	Lead 5 HAZOPs for complex facilities/high-risk scenarios	Participate in the review and updating of facility risk management plans	Provide facility/company leadership with risk reduction plans resulting from completed HIRA activities	Mentor/train workforce on participating in PHAs
Leader	Complete CCPS PSM Bootcamp (or equivalent) - ½-day course	Review facility/company procedures associated with HIRA	Participate in 2 PHAs	Review 2 completed PHAs and recommended risk reduction action plans	

## *Assessing Process Safety Competence*

Once the organization has developed its target matrix and the associated support tools, it is time to begin the Process Safety Competence Assessment (competence assessment) process. As shown in Figure 1, the competence assessment is comprised of two distinct steps:

1. Self-assessment; and
2. Validation of assessment through interview.

This two-stage approach, as opposed to simply interviewing each candidate, is preferred for the following reasons:

- The self-assessment allows candidates to actively participate in the process, and gives them time to think about and evaluate their own knowledge and experience in a non-threatening environment.
- This approach saves time and conserves initial staffing resources (i.e., conducting interviews and documenting) through the self-assessment.

The first step in completing the Process Safety Competence Assessment is the self-assessment. This process begins by identifying the job role against which the candidate is to be assessed. It is important to note that the self-assessment process does not intend for the individual to “rate”

their own competence level against the desired level. Rather, the goal is for the candidate to evaluate their current knowledge and skills.

The most effective approach for conducting a self-assessment is to create a series of statements, relevant to knowledge and experience, for the candidate to review. These statements should be mapped to the specific defined competence levels and will ultimately indicate competency based on the candidate’s responses. By establishing this series of statements and avoiding “rating,” this approach allows for the individual to most accurately and honestly assess their own level of competence. An example self-assessment for HIRA is detailed below in Figure 4.

**Figure 4. Example Statements for Self-Assessment**

Level	Assessment Statements - HIRA				
Basic	I can describe the definitions for both hazard and risk.	I can describe the hazard identification and risk assessment process in my company.	I can describe the different HIRA techniques.	I participate in hazard identification and risk assessments.	
Practitioner	I can describe the process for the identification of hazards from process equipment and facilities, including the techniques available to complete hazard identification.	I can describe the process of risk reduction, including examples of the hierarchy of control and their relative merits.	I can describe the process for the identification of hazards from process equipment and facilities, including the techniques available to complete hazard identification.	I can describe the process of risk reduction, including examples of the hierarchy of control and their relative merits.	I can describe the merits of the differing qualitative, semi-quantitative, and qualitative assessment processes, and determine when a qualitative assessment needs to progress to a more quantitative method.
	I have facilitated qualitative risk assessment as part of my job scope.	I am involved in the closure of recommendations (e.g., does the closure address the cause or consequence of the item, is there any risk reduction from implementing the recommendation).	I use results of HIRA in stakeholder engagement at local level.		
Expert	I have led quantitative studies or validated them as part of my job function.	I have a full understanding of the quantitative risk assessment process, including the use of F-N curves, and I have the skills to	I have participated in the development of risk management programs for my facility/company.	I develop guidance of risk ranking for qualitative studies to ensure consistency in ranking against	
Leader	I have knowledge of the most significant risks at my facility/company, as well as current mitigation measures.	I can describe the facility/company risk management program.			

Once the self-assessment is complete, the results must be validated for accuracy. Validation is accomplished through a simple interview process to test the individual’s competence level for each element. Interviews must be conducted by personnel with competence in **all** elements; therefore, several staff members with subject matter expertise in specific areas may be required to participate in the verification process.

## Model Outputs

### *Identifying, Closing, and Verifying Process Safety Gaps*

Once the assessment process is complete, it becomes possible to identify the candidate’s competence gaps (Figure 1) by comparing the individual’s competence levels (as determined from the self-assessment and verification) against the competence requirements for the specific position being assessed. With competence gaps identified, an Individual Process Safety Development Plan is created to address gaps for each element.

The Individual Process Safety Development Plan provides the candidate direction and offers the necessary training and experiential learning opportunities needed to close identified gaps in each element (Figure 3).

Quality experiential learning opportunities are key to effectively closing the competence gaps. Additionally, selecting first-rate mentors should be considered a crucial component of the process for producing overall competence improvement.

Once the candidate has completed the activities offered in the Individual Process Safety Development Plan, a closeout validation of competence in the areas addressed by the Plan should be re-assessed to confirm that the individual has achieved all necessary competence levels required by the position.

### ***Identifying Systemic Issues***

As the majority of individuals are assessed, potential systemic issues become evident as a parallel output of the assessment process. These systemic issues illuminate organization-wide gaps, creating an Organizational Competence Profile. If the assessments uncover a particular element with a high percentage of individual gaps, it is likely that the root cause is an issue with the associated management system process. For example, if most of the assessments highlight gaps with candidates' competence regarding incident investigation, then the overall incident investigation program and/or its implementation may need to be reviewed and revised.

### ***Staffing and Succession Planning***

Guidance for staffing and succession planning are additional benefits of completing the Process Safety Competence Assessment. Employees that have completed the process and achieved the defined levels of competence for each element required of their specific position offer insight in terms of meeting process safety competencies for other positions, as well. Competent staff recognize process safety issues, help address these issues, and assist in preventing process safety incidents.

In some cases, an individual may be assessed to meet or exceed process safety competencies for other positions within the organization. As such, this individual may be considered a suitable candidate to take on a new role with more advanced process safety competencies. In addition, the assessment process can be used as part of the job selection process to identify whether candidates have the required process safety competencies to fulfill the available roles.

### **Conclusions**

The process safety competence of staff who influence or impact process safety within an organization is a critical factor in determining success; these employees must recognize and address process safety issues in order to prevent process safety incidents.

To ensure staff have the process safety competence required for their roles, organizations must build the framework to assess and evaluate compliance. The Process Safety Competence Assurance process must:

- Define process safety competence requirements through the development of a Target Process Safety Competence Matrix and Organizational Process Safety Competence Map;
- Develop and implement knowledge learning tools to help close competence gaps;

- Assess and verify the current competence levels of personnel holding roles identified as process safety-critical against the required competence levels;
- Create Individual Process Safety Development Plans to close the identified process safety competence gaps through a blend of training and experiential learning; and
- Verify process safety gaps are closed on completion of the Individual Process Safety Development Plan.

This process not only closes competence gaps for current roles, it can be used as a valuable tool in staffing and succession planning for roles that influence or impact process safety within the organization. The overall improvement of staff process safety competence will provide significant mitigation and prevention of process safety incidents.

### **References**

[1] Guidelines for Defining Process Safety Competence Requirements, Center for Chemical Process Safety.

[2] Process Safety Management, Occupational Safety and Health Administration, OSHA 3132.