WHITE PAPER

# The New Paradigm of Process Safety Competence Development

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## That was then, this is now

In a **white paper** published in 2019, we analyzed why process safety competence is so important and some of its biggest challenges. The main takeaways of this paper included:

- Insufficient process safety competence was mentioned as a root cause in 12% of the incidents investigated by the US Chemical Safety Board up to 2004.[1]
- Yet, there are a number of constraints preventing employers from implementing more intensive competence development programs. These include time limitations, difficulties in finding the right content and engaging workers, budget constraints and more.
- Most employees prefer learning at work, at their own pace and at the point of need, whether the subject is process safety or some other topic.

As a consequence, some authors forecasted the evolution of training: from traditional classrooms into more digitalized delivery vectors.

And then came the coronavirus.

On March 11, 2020 the World Health Organization declared COVID-19 a pandemic and urged countries to take "urgent and aggressive action" against it. What followed is very well known. Workplace learning was one of the hardest-hit business activities in 2020. In North America, for instance, roughly 50% of in-person programs did not take place. The disruption was not limited to workplace learning: school and university systems throughout the world experienced different degrees of interruption.

1 Blair, Angela S. "Management System Failures Identified in Incidents Investigated by the U.S. Chemical Safety and Hazard Investigation Board". Process Safety Progress, Vol. 23, No. 4, pp 232-236, 2004.

## Fast forward

We believe that the COVID-19 disruption did not introduce any major change in **process safety competence development**. Instead, it accelerated the transition that we had been observing for decades. As face-to-face competence development was severely impaired by sanitary restrictions, some companies turned necessity into a virtue and overcame the remote training stigma and the "we've always done it this way" mentality. We could call this the "normalization of remote training."

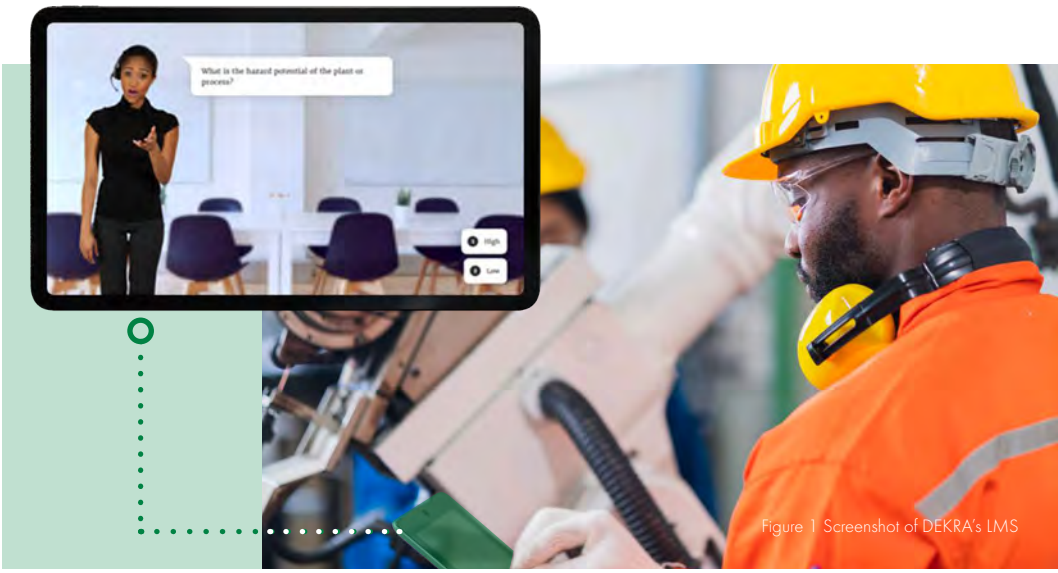

Figure 1 Screenshot of DEKRA's LMS

At DEKRA Process Safety we have observed exactly the same evolution worldwide, albeit at different points in time in different countries. As the lockdown wave spread throughout the world, all training first came to a standstill; then we observed a progressive increase in the utilization of digital resources to make up for lost time. Needless to say, our internal training programs have undergone the same transition, and are now fully digitalized and implemented in a state-of-the-art Learning Management System (LMS).

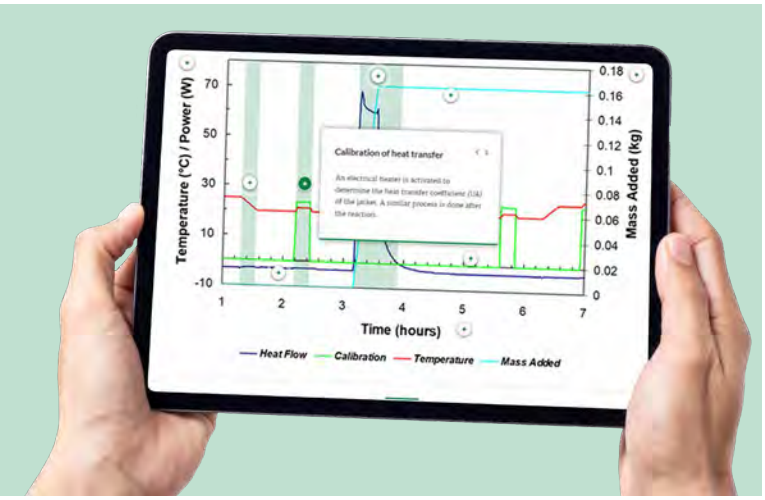


Figure 2 Screenshot of DEKRA's LMS

## Is remote training really here to stay?

Remote training is not an invention born of the COVID-19 pandemic. In fact, it has been around for more than twenty years, evolving alongside the technologies that support it. There is a growing body of research[2] that shows that remote education is at least as efficient in creating new knowledge as traditional, classroom-based instruction. In fact, in some cases, it might be even better.

As mentioned in our previous white paper, we have observed that professional training is evolving from pre-scheduled lectures into on-demand learning nuggets. Once again, the COVID-19 pandemic only served to accelerate this trend.
Of course, there are some limitations to digital learning. Broadly speaking, the most important is limited access to digital resources. This is clearly not an issue in an industrial context where digital resources are readily available, but digital training may nonetheless fail to capture and maintain the attention of the trainees. Quality issues of this nature are not insurmountable as we at DEKRA have proven with solutions designed to address them.

It is clear that the easing of COVID-19 restrictions will allow some gradual return to conventional instruction. However, since scientific research demonstrates that digital training can be at least as effective, it is important to take advantage of the tools we have to

2 Among others:

Scott D. Johnson, Steven R. Aragon, Najmuddin Shaik, and Nilda Palma-Rivas. "Comparative Analysis Of Learner Satisfaction and Learning Outcomes in Online and Face-to-Face Learning Environments". Journal of Interactive Learning Research, 2000.

Linda A. Dimeff, Melanie S. Harned, Eric A. Woodcock, Julie M. Skutch, Kelly Koerner, Marsha M. Linehan. "Investigating Bang for Your Training Buck: A Randomized Controlled Trial Comparing Three Methods of Training Clinicians in Two Core Strategies of Dialectical Behavior Therapy". Behavior Therapy, 2015

overcome its challenges. And we firmly believe that there is no way back to the *status quo ante*. Most companies have learned that good quality professional training can be achieved remotely and that there are additional benefits in terms of financial savings (mainly travel costs) and convenience.

## Digital training, the DEKRA way

Quality digital training is not a matter of copying and pasting slides into an LMS; it takes thorough analysis and planning. At DEKRA, we believe in starting with the goal in mind: what do we expect the participants to achieve by completing the training? After that, we can define:

- The content required to achieve those outcomes.
- The optimal methods and tools to convey the content.

We have developed a fairly simple taxonomy of competences, skills and knowledge, that works in three steps (see Figure 3).

In step one, we define the competences that we want the trainees to acquire. A competence is the ability to use and apply certain knowledge and skills in a specific context. In the context of process safety, some examples could be:

- Specify a rupture disc for a reactive scenario using the DIERS methodology.
- Facilitate a HAZOP.
- Do a **hazardous area classification** for a plant handling combustible dust.

In the second step of the analysis we need to describe the skills necessary to achieve a specific competence. We classify skills in the following categories:

- **Cognitive**: these skills require people to make a comparison, assess a condition or evaluate an action, as in "divide a plant in nodes," or "calculate the extent of a hazardous area."
- **Psychomotor**: these are physical, manual, motor, sensory or technical skills. They are rather uncommon in process safety, but we can always find examples like "safely open a flame-proof enclosure."
- **Affective**: these involve attitudes, interests and values. An example could be "apply process safety management principles to your day-to-day professional life."

Finally, in step three, we determine the knowledge that the trainees need in order to develop the required skills. Knowledge can be theoretical or factual, and includes concepts, rules, procedures, principles, etc. Some examples from the world of process safety are:

- Rules for node division in a **HAZOP**.
- Procedure to calculate the extension of a classified ATEX zone.
- Procedure to calculate the required diameter of a rupture disc.

Only after this analysis has been completed can we consider the optimal delivery vector for each piece of knowledge and skill: learning nugget, conventional classroom, flipped classroom, workshop, etc. Today's LMSs allow us to introduce interactive learning elements to capture and retain the attention of trainees (see Figures 1 and 2).

Figure 3 Competence analysis process

1 Competences

2 Skills
Cognitive
Psychomotor
Affective

3 Knowledge

## Thinking forward: What comes next?

Just as we have observed, over the last decades, an evolution from "scheduled training" to "on-demand training," we at DEKRA are attuned to how this trend will continue to develop. Clearly, using an LMS as a knowledge delivery system is just one stage of the journey. Technical developments continue to shape and improve DEKRA's competence development services in process safety and beyond. For instance, we are investigating the use of virtual and augmented reality to build "virtual classrooms," where trainees are able to interact with a trainer, with other trainees or even with virtual pieces of equipment. And, of course, there are new and exciting tools still in the pipeline. Thinking forward is how we maintain our role as safety leaders, and we know that the ever-expanding toolkit of digital technologies will ultimately lead to even more efficient, employee-friendly competence development programs. We plan to be at the forefront.


### DR. ARTURO TRUJILLO

Dr. Arturo Trujillo is Global Director of Process Safety Consulting. His main areas of expertise are diverse types of process hazard analysis (HAZOP, What-if, HAZID), consequence analysis and quantitative risk analysis. He has been involved in many projects over the last 35 years, especially in the oil & gas, energy, chemicals and pharmaceutical industries.


### DEKRA Process Safety and Chemical Safety

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