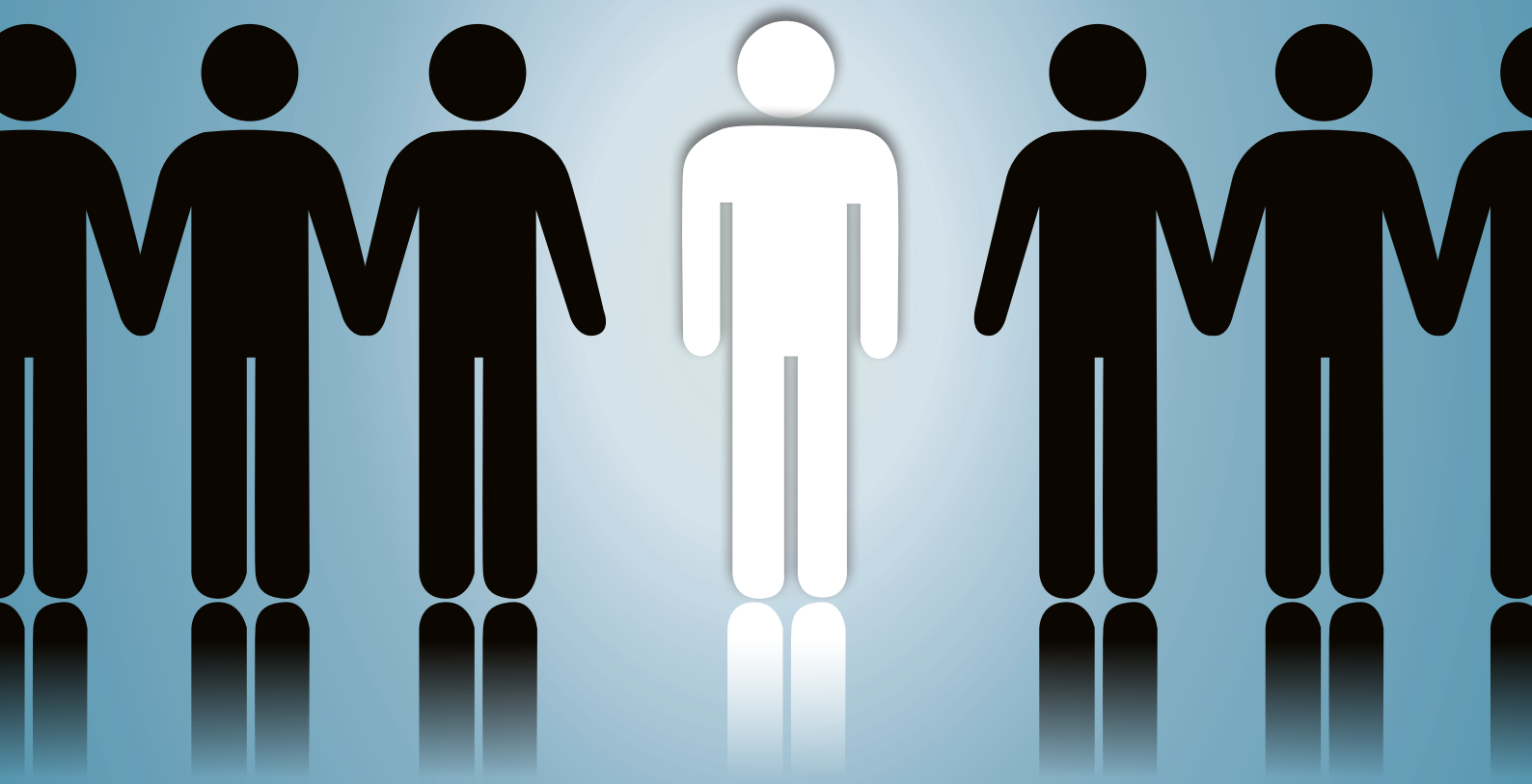
Investing in People



Allison Riser, Cement Performance International, UK, provides a perspective on training control room operators.

Introduction

This article highlights the unique training needs of control room operators, based on CPI's experiences in developing and presenting training programmes to all levels of cement plant personnel in many parts of the world.

The position of control room operator is arguably the most important job on the cement plant. For many people working in the cement industry, becoming a control room operator is the pinnacle of their career. The role is quite rightly held in high esteem and is a goal that a lot of people strive towards.

Many people think that the position of control room operator is a relatively easy job. The perception is often that the operator is in a clean, air-conditioned environment and spends much of their time sat down drinking coffee or talking to others around them. The reality is that the

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control room is a highly pressurised environment where the operator has to maintain an overview of the operation of a significant number of pieces of equipment, whilst maintaining their operation in the most appropriate/optimum manner, at the same time as responding to numerous queries from around the plant.

With great power comes great responsibility

Control room operators are entrusted with the care of hundreds of millions of dollars of equipment and the difference between good and bad operators can have a huge impact on plant profitability, particularly when you think about fuel consumption, kiln output and runtime, refractory life and maintenance costs. The difference between well informed and well trained operators and operators who have had little or no formal training can run to millions of dollars per year. Other considerations are the avoidance of catastrophic failure of equipment and, perhaps most importantly, the impact that the operators have on the safety of operations and plant personnel.

As cement plant control has become more sophisticated, so has the need to provide suitable knowledge based training to kiln operators and yet it is often an area that is not given the priority or investment that it should. If you think about engineers on a cement plant, there are endless opportunities for them to learn about cement technology as well as specialised technical training, whereas, maybe because the classic profile of an operator is not that of someone who is necessarily considered academic, their 'formal' training is sometimes overlooked.

Quite often, in succession planning, the responsibility for training new operators is given to existing operators. The first essential part of training is familiarisation with the control system, displays and start stop sequences. This is done most easily by working with an experienced operator. The second part is the development of an understanding of the meanings of the available signals and what may be happening within the process. Using experienced operators as the trainers for this part is likely to result in training based on 'what works here', rather than theory, whereas a combination of the two is necessary.

If the existing operators have not been given comprehensive training themselves, they pass down their level of understanding, which may not always be accurate, and so the cycle continues. In addition, kiln operators do not always have the necessary skills to undertake training of their peers. Furthermore the training occurs 'on-the-job', with limited time for the experienced operator to explain why they are reacting or making certain changes. Just like learning by rote, there is no real understanding and if at a future date plant modifications are made, the chances are that the operators will carry on the same way and risk operating in a sub-optimal manner.

Prior to the introduction of sophisticated control systems, there were normally multiple operators each responsible for a separate section of the plant, such as raw milling, the kiln or cement milling. They had sufficient time to study the reactions of the equipment in their area and were expected to develop an understanding of how each system operated and what responses they should expect from changes in certain conditions.

Nowadays, there are fewer people employed on a cement plant and a single operator may be responsible for all sections of the plant with less time to develop their own knowledge of how the kiln system responds to certain changes, for example in kiln feed chemistry or fuel quality. With limited knowledge, it is not possible for the operations to be optimised.

Today, a good operator needs to understand a certain amount about chemistry and the reactions in the kiln and how changes to one parameter can effect operation around the whole system. It is also a requirement for them to know, for example:

- How different fuels can have different combustion characteristics and how these may affect the process.
- What options there are to estimate local process conditions if any of the process signals fail.
- What the possible consequences of a hang up of material in a feed hopper are.

If we look back to 40 years ago, most cement kilns were wet process with maybe oxygen and CO analysers and a back-end temperature reading. The operator would look at these signals and then look into the kiln before deciding what action to take. Compare this with a modern plant today and there are huge banks of screens with thousands of signals/readings. The majority of cement kilns are now dry process with reaction times much quicker than wet kilns. A modern operator also has to be able to identify when conditions change and make a signal meaningless. An example of this could be a calciner that is controlled by a temperature loop. Normally, this loop controls the temperature by modifying the calciner fuel rate. However if the oxygen level in the calciner drops too low then we get incomplete combustion. Adding fuel in this situation will probably not improve the calciner temperature but may simply increase the tower exit temperature and so waste fuel.

As we strive for reduced kiln downtime and to extend the time between major repairs, it is inevitable that process signals will not have the same value at the beginning and the end of a campaign and an operator will have to be able to adapt to signal drift.

Sophisticated equipment requires knowledgeable operators

There is a possibility that plants that successfully apply an expert control system and control loops may end up with weaker operators, as all the time these systems are running, the operator can run on auto-pilot and does not need to think about what is happening or react to system or material changes.

At any one moment on a shift, an operator will generally be dealing with numerous alarm conditions. Without an understanding of how changes in one part of a plant can impact other parts of the plant it is not possible for them to prioritise and deal with the most important event.

So, who should be responsible for training kiln operators and what format is the most effective?

The experienced operator best manages the essential familiarisation with the features of the individual control systems. He or she can also start to pass on process knowledge. In CPI's experience, however, classroom training, such as formal presentations (lectures), reading papers and even e-learning, in combination with group training is an effective format for training and developing a broad knowledge in kiln operators. An additional step of one-on-one training following group training has added benefits and can help to reinforce the trust between trainer and operators and ensure consistency between operators (and shifts).

We all know that every cement plant is unique; group training comes into its own when the operators as a group are encouraged to talk about the perceived problems on a site. Discussions can then focus on why their kiln or milling systems do not perform as is generally expected or as has been described in the classroom training sessions. There could be a number of reasons for this, such as equipment limitations, poor or incorrect control loops or maintenance issues (e.g. tertiary air dampers not functioning, in-leaking air). It is important to distinguish between theoretical and actual operations and to develop an understanding of the reasons for this gap, and also whether actions can be taken to reduce the effects.

It is also possible during group training to identify in the individuals areas that are less well understood or perceived problems in a relaxed environment. This can allow individual training plans to be developed.

As an additional element and a follow on from group training, one-on-one training from an expert kiln burner on shift immediately or soon after the group training can be used to ensure consistency from one shift (and therefore from one operator) to another. This training format is useful to reinforce the concepts and topics that were generated as part of the group discussions and allow the quieter members of the group to voice any concerns or raise issues that they might not have been comfortable airing in a group.

It is interesting to note that, in CPI's experience, it can sometimes be the more longstanding operators who are most reluctant to discuss any concerns in a group setting because they are the people who are supposed to have all the answers. If, however, they have never been given any 'formal' training themselves there may be gaps in their understanding of some technical factors. They may well have an effective reaction to a set of circumstances, but this may not be the best reaction.

E-learning case study

'E-learning' is a relatively new development in formal training. CPI has recently developed a self-paced online learning course of operator training for a client in North America. The client has made a significant commitment and investment in its employees to give them knowledge and tools to help them achieve success. Furthermore, they have recognised the value of having a training system that can accommodate a high number of participants simultaneously (200+) and the training has been customised to be company-specific (it is, in effect, bespoke, as it relates to the particular unit operations in the group). As new operators are developed, the classroom element of training is available for them to begin their education; there is no need to wait for a critical mass of trainees. The system can be updated and adapted as plant conditions change. Participants can get a sense of achievement that they have passed individual elements as each section is graded. Supervisors/managers can monitor individuals' progress and identify areas where further explanations may be necessary. Within the course, practical exercises are set, which means the operators have to liaise with members of other departments and get an appreciation of their roles and priorities.

In developing the online system, CPI has had to overcome a number of challenges including the fact that the UK and the USA really are two countries that are separated by a common language and the use of colloquialisms has had to be reigned in. CPI had to produce a script to accompany presentations (later converted to an audio recording of client employees), which has taxed some of the company's engineers who are used to, and are very comfortable with, talking to slides in front of a live audience – but, as we all know, producing literary masterpieces is quite a challenge for most engineers.

Conclusion

Operator training should not just be about technical training; an effective operator should have the ability to operate under pressure, multi-task, prioritise handling of alarms, and be effective and clear communicators.

The difference between optimised and running operations is millions of dollars of profit on an annual basis. The contribution of kiln operators in whether an operation is optimised or simply running should not be underestimated. The Control Room operators are the one group of people who can do the most to improve the day-to-day operation of the plant and who can identify the early onset of changes in the operations and so give early notice to the other groups – technical, laboratory, mechanical, and electrical – of a need to investigate the causes of change. However, in order for the operators to fulfil their potential, they have to be given training and the knowledge to understand what is happening in the process that they are in charge of. In the same way that cement companies invest in capital equipment, training should be considered as a valid investment with a definite payback.