Taking control of the human element

A proven approach to control room performance assessment

Tony Atkinson

The importance of the control room operations team can never be overemphazied. This team needs to be alert, informed, supported and motivated at all times if dangerous, costly and reputation-damaging situations are to be avoided. The obligation then is on organizations and their management to ensure that control room operators are equipped to respond correctly to all conditions. This involves much more than just training and guidelines; the entire professional, physical, managerial and working environment needs to be looked at. In the long run, these are the things that make the difference between safe shutdowns and a potentially serious situation.

To help industries achieve the optimum control room environment, ABB Engineering Services has developed what is known as the Control Room Ergonomic Review. The purpose of this review is to examine and report on the factors that affect the performance of the control room operations team. The review is suitable for all control room environments and is applicable to control rooms in a wide range of industrial sectors, including oil and gas, chemicals and utilities.

Even though it is obvious that good working conditions bring out the best in people, it is often a forgotten or overlooked fact. While it is very important in all working environments, nowhere does this matter more than in the control of hazardous processes. When things do go wrong, very often it is not the people who are at fault, but rather external factors that affect their responses and lead to mistakes.

Control room operators need to be properly equipped if they are to respond correctly to all conditions, and this encompasses much more than training and guidelines. The entire working environment, both physical and professional, needs to be scrutinized. Every organization in the process industry needs to pay full attention to the human element, especially in control room functions. It is essential that managers, engineers and financial people inform, support, motivate and communicate with these key members of staff if disasters are to be avoided.

ABB's Control Room Ergonomic Review

To help companies create the right control room environment, ABB has developed a Control Room Ergonomic Review to examine and report on the factors that affect the performance of the control room operations team. The review conforms to internationally recognized standards and guidelines, as well as regulatory "best practice" guidance. Its role is not just to highlight areas that need attention, but to also provide an action plan that offers a clear way forward for the customer. The review is suitable for all control room environments, both legacy panel-based layouts and more modern screen-based designs. It is also applicable to control rooms in a wide range of industrial sectors.

The Control Room Ergonomic Review helps companies create the right control room environment by examining and reporting on the factors that affect the performance of the operations team.

A typical review involves a two-day site visit followed by a report which is delivered within a two-week period. The report highlights good practices as well as areas where improvements are needed. It can also be used to provide a baseline for improvements and further benchmarking. The review takes a disciplined look at eight main areas:

- Control room environment
- People/machine interfaces
- Alarm system performance
- Safety-critical communications
- Operational procedures
- The operators' physique and ergonomic needs
- Alertness and fatigue
- Training and competence

Each of these areas is scored to produce a visual model that shows compliance with what is considered best-practice 1. This not only gives an easy to understand picture of performance, it also provides a benchmark against which all the control rooms in a company can be monitored.

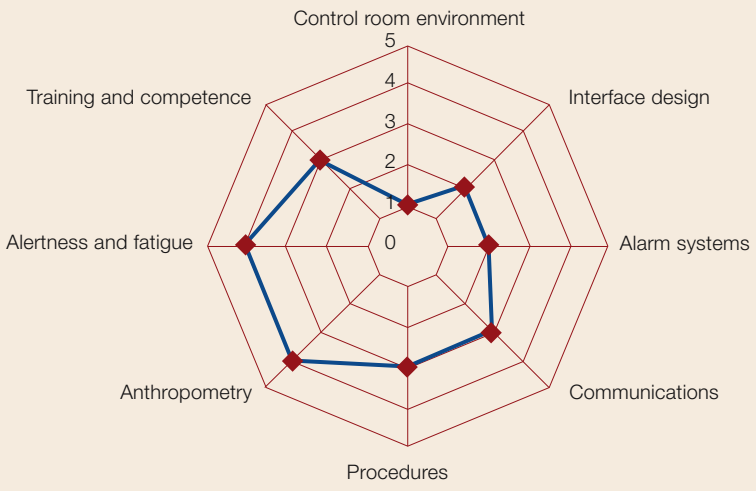
This structured approach involves all personnel directly involved in control room activities. These include the operators, operations team supervisors, health, safety and environment managers, plant engineers and operations management. The required data is obtained through questions and observations as well as a review of site information including design, procedures and guidelines. Participants in the survey must answer a series of questions that highlight their awareness and understanding of the main issues. These cover everything from management commitment to processes, performance, improvement strategies and routine performance.

The ABB approach is to consider the control room by its actual performance rather than as an abstract theoretical model. This ensures that the outcome is relevant to improvement and upgrade projects because it addresses real-world topics like performance targets and regulatory requirements.

Control room environment

At the heart of the ergonomic review is the physical layout and operation of the control room. The ABB consultant assesses the age, format and organization of the room; how it has changed over time and what other purposes it has to fulfill, such as meetings and relaxation. Because they tend to evolve over time, control rooms can easily accumulate a range of redundant equipment, unsuitable fittings and unnecessary functions, all of which need to be considered in the review. This might even extend to whether the area is tidy, hygienic,

1 The eight key elements in ABB's Control Room Ergonomic Review are assessed on a scale of 0 to 5 based on a word model



well cared for and comfortably furnished. Assessors will observe the subtle but notable impact of long established habits on the performance of the people and where necessary, recommend changes.

Management commitment

A key element in a successful and efficient control room is the commitment of management to continuous improvement throughout its lifetime. Unfortunately, it is very easy for a state of benign neglect to set in which, in turn, results in a slipping of standards. A feeling that there is a lack of interest by senior management in their workplace conditions can easily be reflected in a workforce's own attitude and commitment to their job. Therefore any changes in the plant that impact the control room and its staff need to be properly managed at higher and local levels. For any improvement or life-cycle plan to succeed, a number of elements need to be in place. These might include an integrated plan (with performance targets and purpose), a responsible nominated engineer, a budget and a communication program.

Lighting

Control room lighting makes a big difference to the performance and comfort of operators, as does screen glare. Lighting is not only necessary for the more obvious tasks (ie, reading), but it also affects operator alertness. This becomes especially important when people must work long hours and are subject to fatigue and pressure. Simple steps, like adding desk lamps can make a real difference.

Noise is another factor that affects comfort and performance. It is important to get the balance right by avoiding sounds that distract as well as low sleep-inducing sounds. An example of a distracting sound is voices and this leads indirectly to yet another area that ought to be considered: whether the control room should be allowed to become a thoroughfare with a constant flow of people dropping in to chat or simply passing through. While a punitive regime is not at all desired, it is important that operators remain focused and alert with the least possible distraction.

It should not be assumed either that air conditioning systems are necessarily performing adequately. ABB has found situations where additional heating or cooling devices have been installed, producing atmospheres that are too cold or too hot, neither of which will keep people at their peak.

Man/machine interface

A key part of any process overview is the "big picture" which enables the operator to keep tabs on all the main variables and statuses at all times. This is why the ergonomics and ease-of-use of primary DCS (Distributed Control System) equipment is critical. To be able to monitor key plant performance in normal, and more importantly, abnormal situations, such as start-up and shutdown, enough screens should be available, minimizing the need to switch between them. Consistent presentation of graphics across the systems is both good practice, and essential for ease-of-use and the avoidance of errors. This makes it easier for users to interpret new or unfamiliar situations quickly when they arise.

It is not unusual for significant gains in operator performance to be achieved through the creation of "task-based" graphics, thereby making it simpler to manage the tasks and integrate them with specific procedures. Setting key performance indicators (KPIs) and measuring the performance and effectiveness of communication is a vital success factor. This is not a once-only function but a continuing ongoing requirement. ABB can help by identifying best-practice indicators against which each installation can be compared.

At the heart of the ergonomic review is the physical layout and operation of the control room.

Efficient handover

Communication is the key to so many aspects of control room safety and efficiency. One area where this can be clearly seen is in the handover between shifts. This should involve all concerned and include operators and team leaders passing on information to each other. This communication should follow a proper format and be formally recorded. It not only makes good sense, it is one area where in

the UK, for example, the Health & Safety Executive is prepared to consider enforcement if an effective procedure is not in place and being followed.

Proper communication extends not only to the control room team but also to other operators in the plant with whom the team must work. ABB reports occasions when the basics of this process, reliable phone and radio systems have not been in place, making it virtually impossible to achieve the necessary degree of communication.

It is important to ensure that written and actual procedures for start-up and shutdown operations are the same. It is easy for these procedures to change over time and for these changes not to be recorded. ABB has discovered situations where different shifts have different ways of performing the same tasks, something that should not be allowed to develop. This is another area where firm management and clear communications are vital. The teams concerned should also be required to confirm their receipt of new instructions.

Anthropometry

Anthropometry involves relating the physical layout and organization of facilities to the people that work in them. Physical characteristics, such as size and mobility, of the control room staff need to be taken into account. In the end, anthropometry is a matter of personal comfort and convenience, and getting it right can significantly affect working efficiency. Anthropometry is particularly relevant to the layout of workstations in the control room. As well as covering furniture and screens, it also looks at the availability of artificial and external light. For example, the ISO standard recommends that the operator is approximately 900 mm from the screens he is using.

The real secret of safe, efficient control room operation is understanding and managing the human element.

The control room layout design affects many aspects of performance and no single design is perfect for all circumstances. Screen layouts arranged in an arc formation facilitate performance from a single operator, but impede communication with other operators. Linear layouts improve communications, but present difficulties in reaching multiple interfaces, while stacked screens can aid issues of reach, but block line of sight.

Clearly the design of the control room cannot be considered separately from the tasks undertaken and the necessary team dynamics within that control room. And, of course, all systems should be adequate in an emergency and not just under normal operating conditions.

Alertness and fatigue are other important issues that need to be actively addressed. Factors affecting these issues, such as the physical environment, and work patterns and hours must be closely examined.

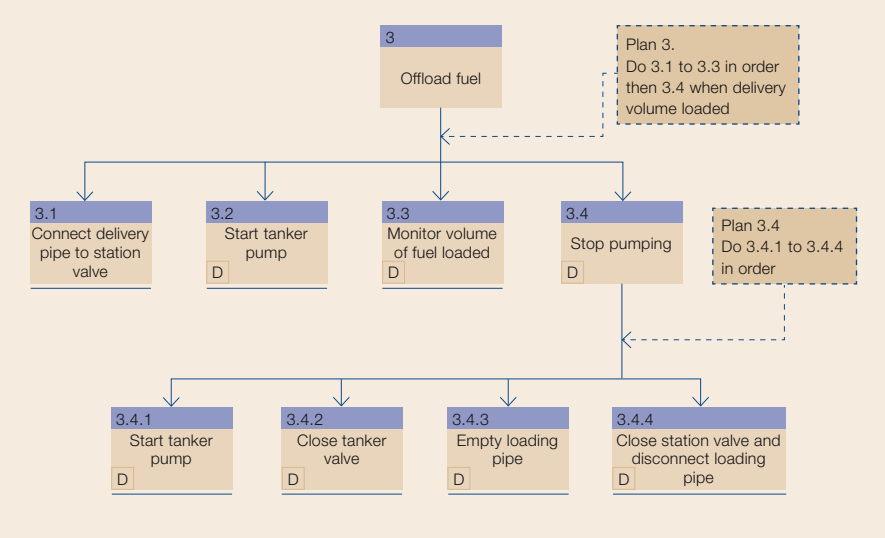
Control room technicians are required to be competent in the individual areas of a process plant prior to being trained and assessed for their role in the control room. Achieving and demonstrating this competence requires more than just training. Issues of job design, experience and assessment are key to ensuring competent staff in this key role 2. Competence extends beyond the technical, and may include the ability to manage diverse and conflicting data and to take complex and critical decisions. Therefore, like many of the issues previously mentioned, training and competence must be constantly monitored, reviewed and recorded and not allowed to drift over time.

Managing the human element

The real secret of safe, efficient control room operation is to understand and manage the human element. The way people are managed and motivated can make all the difference to the success of an operation and this is never more true than when an emergency arises.

ABB expertise in understanding and working with the human element in process industries is reflected in its Control Room Ergonomic Review. The consultant's role is not just to review and comment on the existing environment and procedures but to deliver an action plan as a way forward. This enables customers to make quick and informed decisions to meet all the issues raised in the review.

2 Hierarchical Task Analysis (HTA) can be used to assess the role of an operator's job



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