Our People are our Most Important Asset: Making Money Between the Safety Limits

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Abstract

Globalization has left only one sustainable route to profitability for firms operating in high-wage nations: basing their competitive advantage on exceptional human capital management (HCM). 1

The topic of Human Capital Management is broad. However, one particular aspect is of particular interest and relevance to the managers of process facilities: the ability of skilled operators, maintenance workers and engineers to quickly diagnose and fix problems, thereby saving money through avoiding unnecessary downtime, product quality problems and wasted energy usage.

How this can be done is illustrated through Figure 1, which shows the major control points for a critical variable such as pressure, temperature or level.

Figure 1
Operating, Safe and Emergency Limits

The innermost range of Figure 1 shows the optimum value for this particular parameter (in this case 239 to 240). This optimum point may change as target conditions for production rates, yields or product quality change. On modern process facilities this target value is tightly controlled by distributed control systems.
Moreover, sophisticated algorithms are frequently used to determine what the optimum set point should be. These algorithms can incorporate a wide range of goals covering parameters such as product quality, energy consumption and production rates. In other words, the achievement of optimum operations in real time is being increasingly left to the facility’s computer control systems. The operator has little input to the operations at this level.

Figure 1 also shows the range of operating limits for the variable in question (235 - 245). Operators and supervisors are allowed to move the value for this variable to any point in this range, knowing that doing so will result in operations that are safe and trouble free.

The next limit values are the safe range (210 - 275 in Figure 1). If the value for the variable crosses the safe limit boundary then the process is, by definition, in an unsafe condition and action must be taken to return the value to within the safe limits. The option of doing nothing is not an option. (If the operations personnel decide that they would like to operate outside the range then the Management of Change process has to be followed).

The outer values are the emergency limits (with an upper value of 310 in Figure 1). If these limits are reached then urgent and swift action is required. This is no time for thinking or problem solving. On modern facilities the emergency action is directed by high integrity safety instrumented systems and by dedicated mechanical devices — particularly safety relief valves. Once more, the operator should have little to do during an emergency — the system should bring itself quickly and reliably to a safe state.

If it is accepted that the operators’ role is indeed becoming increasingly restricted during both normal operations and emergency operations, then the question as to the operators’ role has to be raised. In fact, the operator has a vital role, but it lies between the safety boundaries — the ranges that are designated as “trouble” in Figure 1, i.e., the range that goes from the operating limits to just beyond the safe limits. A key feature of “trouble” is that it is often qualitative in nature, and even ambiguous. Examples of trouble include the following:

- The product is contaminated;
- A compressor is making an unusual noise;
- Steam consumption is up 5% and no one knows why;
- There is a strange smell; or
- The bearings on a pump are having to replaced much more than usual.

It is when problems such as the above arise that an experienced operator or maintenance technician can help his or her company save large amounts of money, often at very little cost. However, he or she does so not through the use of a formal logic process; instead he often works on hunches, intuition and experience of similar events in the past. This means, therefore, that if management is to harness this important trouble-shooting capability, systems need to be in place for capturing and understanding human expertise and for analyzing qualitative information.

This paper addresses three ways of capturing and using expertise. The first is the use of expert systems for problem solving. Prior to the occurrence of the event, the company sets up an expert system based on a logic tree. The expertise is developed through interviews and discussions with those with considerable experience on the unit in question. Then, when a live situation arises, the operators work through that built-in logic to analyze the system for which they are responsible.

A second approach is to analyze the system using expert engineering and expert judgment (the term RAGAGEP, Recognized and Generally Accepted Good Engineering Practices, is sometimes used to express
this concept). Such an approach is not directed toward solving a specific problem. Instead it helps operators and engineers ensure that their facility not only meets code, but that it does indeed meet generally accepted engineering and technical standards. So doing minimizes the chances of “trouble” developing.

The third approach to troubleshooting is analogous to the RAGAGEP technique, except that it analyzes management systems — particularly process safety management (PSM) systems. This technique analyzes the elements of a facility’s process safety management systems using expert judgments which are rolled up to provide a quantitative score based on the opinions of experts. The system use of thousands of questions that are structured into a hierarchical family of spreadsheets according the elements of PSM (management of change, asset integrity, operating procedures, and so on) as shown in Figure 2. This approach provides insights as to how systems can fail regardless of the occurrence of actual events. Hence operating difficulties can be addressed before any incidents occur.