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Assessing Operational Excellence

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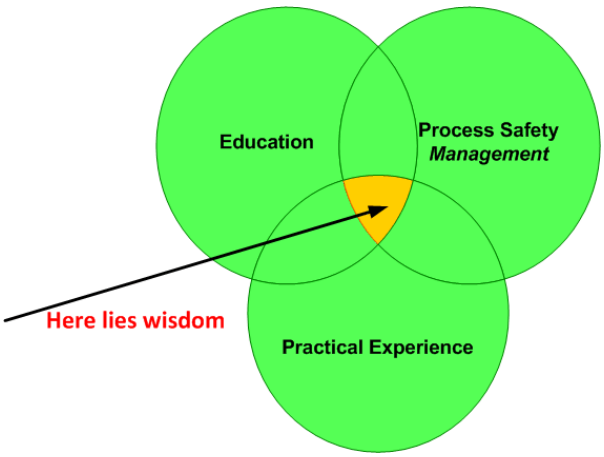
Abstract

The discipline of process safety management is mature. For example, the OSHA (the United States Occupational Safety & Health Administration) standard was promulgated in May 1992; the standard is older than people who are now entering the energy and process industries.

The elements of process safety management are just one aspect of an effective, overall safety program. Other elements include formal education and practical experience. When combined they create what can be referred to as process safety wisdom as shown in Figure 1. They also move the program beyond just safety into overall Operational Excellence in which issues such as production, productivity and efficiency are considered.

Figure 1



Of the three elements shown in Figure 1 the one that is most difficult to systematize is practical experience — the knowledge and insights built up by people who have worked in industry for many years. In order to gather and assess such experience an Operational Excellence Assessment system has been developed. It is buit up of hundreds of questions to which there is no "right answer" — merely an expert response. This response is supported by the guidance and suggestions that an expert might provide.

This paper describes the development and application of an Operational Excellence System.

INTRODUCTION

Shortly before writing this paper I received an email from a colleague who works as a process safety professional in the offshore oil and gas industry. He also offers training courses to do with process safety. In response to one of his proposals for training the potential client said that all they needed was a two hour high level introduction.

My colleague was, not without reason, somewhat exasperated at this response. But, as he and I discussed what had happened we noted that the discipline of process safety management is mature, and, in spite of its successes, maybe it has become "just another program", indeed maybe it is becoming somewhat stale.

If that is the case then maybe we process safety professionals need to take at least some responsibility for this lackluster attitude. In an email I said,

> *Maybe the responsiblility lies with us — we need to make the discipline more relevant and interesting.*

If such is the case, then one of the challenges and responsibilities of process safety professionals is to introduce new ideas and initiatives that make their work more relevant and useful than it is now. And one of those initiativies lies in the theme of "Operational Excellence".

The term Operational Excellence covers a wide range of topics. This paper considers one of those topics — the incorporation of operational experience with other parts of process safety management to create something that might be called "Operational Wisdom".

MATURITY OF PROCESS SAFETY MANAGEMENT

Process safety management (PSM) has always been integral to manner in which companies in the process and energy industries operate. For example, they have always written procedures, trained their work force and conducted incident investigations. But, if the discipline is to have an formal start date, then May 26th 1992 is a good candidate. It was on that date that OSHA (the United States Occupational Safety & Health Administration) promulgated its standard 29 CFR 1910.119. The new regulation required many companies in a wide range of industries to implement a comprehensive and formal process safety program in an expeditious manner.

The new rule, along with other similar initiatives, also led to the creation of a process safety culture, involving not only the companies directly affected, but also organizations such as the

Center for Chemical Process Safety, the Mary Kay O'Connor Center, and a wide range of companies offering consulting and software services.

OSHA's PSM program is now 26 years old. That's a long time. If most professionals in the process industries enter the business at the age of 22, then for anyone younger than age 48 process safety is is not a new initiative — instead it is a part of the established way of doing things. The discipline of process safety management is mature.

It is a given that any company can improve its process safety performanc — after all, in a performance-based system the only way to achieve success is never to have an incident. And no company can claim to have reached that goal. (Which is why no company can be "in compliance". The only way of achieving that goal is never to have an event — something that can never be achieved.)

Nevertheless, in spite of the fact that some companies still have a lot of work to do, there have been major improvements in the quality of process safety programs since the year 1992. And, although catastrophic events occur only rarely, thus making it is difficult to measure progress with statistical confidence, the number of serious incidents does seem to have declined.

OPERATIONAL EXCELLENCE

A phrase that has gained increased use in recent years is "Operational Excellence" (OE). Although there is no universally agreed upon definition for this term an OE program is generally comprised of the following components:

1. A right or correct culture;
2. Continuous improvement;
3. An integrated management system; and
4. Operational discipline.

All four of these elements are part of process safety management (PSM). Therefore an existing PSM program can provide a sound basis for developing Operational Excellence.

Operational excellence goes beyond safety performance. If a company has a good process safety management program then it will also have a good overall management program — one that will help in other areas such as production, productivity and environmental compliance.

The Institute for Operational Excellence defines the operational excellence as follows.

> *Each and every employee can see the flow of value to the customer, and fix that flow before it breaks down.*

This definition bears similarities to the Employee Participation element of the OSHA PSM regulation. Paragraph (c)(2) of that element states,

Employers shall consult with employees and their representatives on the conduct and development of process hazards analyses and on the development of the other elements of process safety management in this standard.

So, if process safety already provides the basis of an OE program, what is needed is not a new management system *per se*, but better ways of "consulting with employees", such that every employee can see the flow of value to the customer (or organization).

THE REFINERY SUPERINTENDENT

A mid-sized refinery suffered an unexpected shutdown due the failure of a major piece of equipment. (There were no safety issues associated with this event.) The equipment was repaired and the refinery was ready for restart.

The refinery superintendent — who knew the facility intimately — had recently retired. But management knew that his expertise would be invaluable during the restart, so they asked him to return and direct the start-up activities. He did so, and, for a period of two days stood in the control room successfully directing the start-up just from memory — he did not need procedures or documentation.

This situation presented a huge opportunity for enhancing the process safety program and employee participation in particular. If management had installed a video camera in the control room and recorded his every command they would have had a wonderful training program for future operations personnel.

But they did not — the opportunity was missed.

This was just one incident. But it is probably fair to say that few companies have a system for capturing and recording the insights and wisdom that their highly experienced employess have garnered over many years of experience in the "School of Hard Knocks". Were they to do so they could make significant strides toward Operational Excellence.

PROCESS SAFETY WISDOM

The well-known literary critic, Harold Bloom of Yale University, once asked,

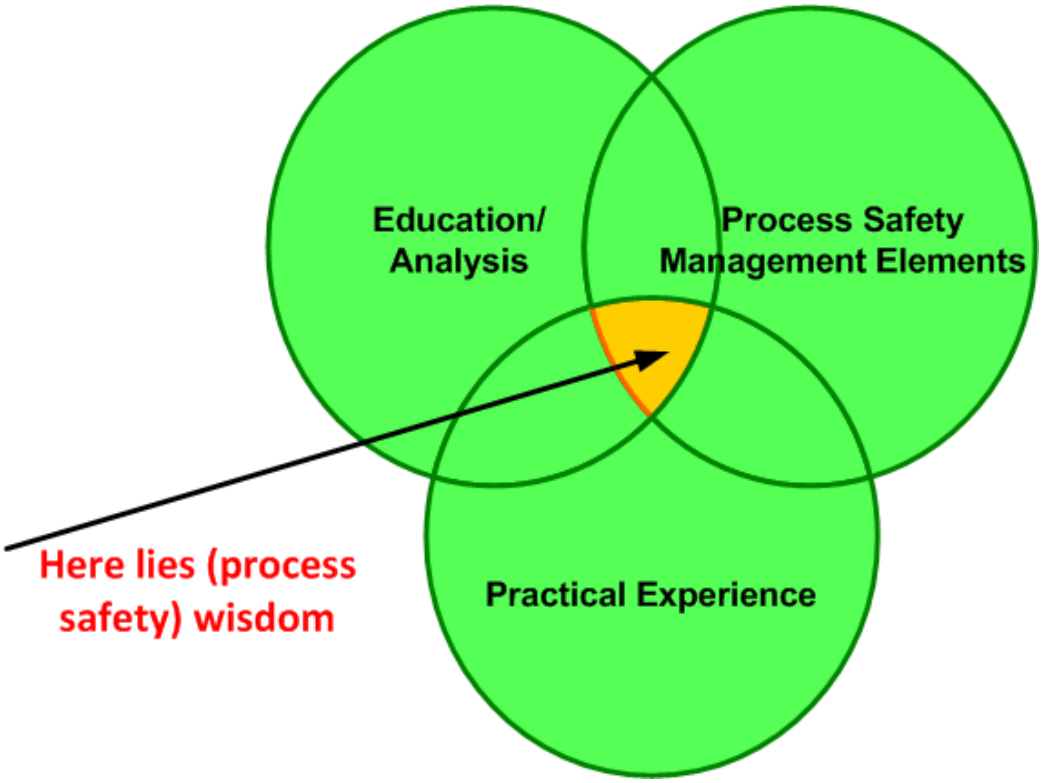
Information is endlessly available to us; where shall wisdom be found?

He posed that question in the early 1990s when the Internet was still in its infancy. The question possesses much greater urgency now than it did in those days.

Applying his insight to the world of process safety, information does indeed seem to be "endlessly available to us". But to what end if we do not know how to understand, digest and apply that information?

Or, to put it another way, "where shall process safety wisdom be found?"

One possible answer to this question is to divide the world of process safety into three areas, as shown in the Venn diagram.



The sketch consists of three overlapping components:

1. Education and analysis.
2. The elements of process safety management.
3. Practical experience.

Combined they create “Process Safety Wisdom” — the foundation for an Operational Excellence program.an Operational Excellence program.

1. Education and Analysis

The first source of knowledge — direct education — is the simplest to define and understand. For example, if a hazards analysis team has a question to do with the capacity of a pressure safety relief valve then someone with an education in fluid flow can calculate the rating of the valve and determine if it meets requirements or not based on well-established engineering standards.

Direct education is also needed when responding to regulatory requirements. Someone who wants to know if their system is in compliance with a regulation or standard simply needs to read the relevant documents and apply them to the current situation (although some interpretation is usually required).

Analytical techniques supplement the educational process. For example, in the case of the relief valve being reviewed by the hazards analysis team, the application of standards can be supplemented with detailed mathematical analysis.

2. Elements of Process Safety Management

Process safety programs are generally organized around management elements such as hazards analysis, operating procedures, prestartup reviews and management of change. The number and scope of the elements varies from company to company and from regulator to regulator. (The OSHA standard has fourteen.) In spite of detailed differences, they are all dialects of the same language.

It is in the development and implementation of these programs that great progress has been made in the last 26 years. And doubtless there will continue to be improvements in each of the elements. For example, the Bow-Tie and Layers of Protection Analysis methods for determining hazards and risk are both quite new and have both gained acceptance in recent years. Nevertheless, it is unlikely that there will be major changes in the manner in which the elements of process safety are managed. This is definitely an area of maturity.

3. Practical Experience

Education and an understanding of management principles are a vital and necessary part of any process safety management program. But they are not sufficient because they are general in nature — they cannot cover the details of every situation; they cannot provide specific guidance for all situations.

People who have worked at a facility or in a design office for many years generally have a good, almost intuitive, understanding of what works and what doesn't. (Which is the reason for telling the story about the refinery superintendent.) They have learned from their own mistakes and from the mistakes of others. They are graduates of the School of Hard Knocks.

Experience enables you to recognize a mistake when you make it again.

One large energy/chemical company demonstrated this insight in an ingenious manner. When a young professional first entered that company, no matter what their job was, no matter who their boss was, and regardless of the work that they were doing, for his or her first year their paycheck said, "Training Department". This was a neat way for the company to tell its new employees that they were not actually making a contribution because they knew very little about what they were doing in the "real world".

In the words of the bumper sticker, "There's no substitute for knowing what you're doing".

Industrial, practical experience includes not only a hands-on knowledge of industrial processes and equipment but also how to work with colleagues, subordinates and bosses; understanding the realities of client/consultant/contractor relationships; the resistance that managers can have toward spending money on safety; problems at the management/union interface; and how government agencies actually enforce regulations.

Therefore, perhaps the biggest opportunity for achieving "process safety wisdom" lies in finding ways of capturing and transmitting industrial, "real life" experience to those who are new to the business.

COMPLEXITY — NOT COMPLICATION

In order to capture the experience of seasoned professionals it is important to distinguish between the words 'complicated' and 'complex'. A complicated system has the following features.

- It is predictable; it can be understood by breaking it down into smaller parts, and then determining how those parts work, and how they interact with one another.
- A complicated situation can be quantified and understood through the use of metrics.
- A Command and Control management structure is effective at managing complicated systems.

Most process safety work addresses itself toward the management of complicated systems. For example,

- Once a method for writing operating procedures has been developed, then that method can be used throughout the organization for writing procedures for all types of facility and activity.
- Once a hazards analysis team has identified how a pressure vessel may rupture they can apply that insight into the operation of all other pressure vessels.
- Once an effective technique for analyzing incidents has been developed, that technique can be used for all future incident investigations.

A *complicated* system is 'understandable' and 'repeatable'. A complex system, on the other hand, is based on relationships, interconnection and evolution. It is fundamentally unpredictable. (Any system which involves human behavior — particularly the behavior of people in groups — will be complex.)

Complex systems do not have to be complicated — although most are. (Climate change is a good example of a system that both complex and complicated.)

Key aspects of a complex situation include the following.

- It comprises relationships that cannot be understood just by breaking a system into its component parts.
- The situation is fluid — surprises happen.
- 'Command and Control' structures will be limited in their effectiveness.
- It cannot be easily quantified — there are no effective metrics.
- It will often involve the unpredictable behavior of human beings, both as individuals and in groups.

Adding experience of the “real world” to Operational Excellence means understanding that the new management system is not just complicated, it is complex.

OPERATIONAL EXCELLENCE ASSESSMENT SYSTEM

One way in which experience can be captured is through the development of an Operational Excellence Assessment program. Such a program mimics the behavior of a professional if he or she is asked to evaluate a facility’s performance. It consists of a large number of questions that are representative of what the expert would ask were he or she on site.

There are no right or wrong answers to the questions — opinions and judgment are welcome. The key to such as system is that the expert records what he or she is thinking and looking for when responding to each of the questions. His insights can then be structured in a manner suitable for educating personnel with less experience.

The Table illustrates the concept, in this case for when an expert is evaluating a Prestartup Safety Review program.

Question Number	Question	Response (Y / N / NA)
2.1	Are reviews conducted by a team?	
Discussion		

The question in the Table is a simple one: “Are the reviews conducted by a team?” In the discussion box the expert can speak to issues that would concern him. These could include:

- Is a team review always needed?
- Who should be on the team?
- What should their experience be?
- Who will lead the team?

The aim of these questions is to capture the experience of the expert and to understand why he answers the questions in the way that he or she did.

CONCLUSIONS

The following conclusions can be drawn from the above discussion to do with Operational Excellence.

- Process safety management programs already are, to a considerable degree, operational excellence programs because they incorporate the need for employee participation.
- An opportunity and a challenge will be determine how to capture the experience and insights of experienced employees in a system that is not only complicated, but complex.
- It is suggested that one way of achieving this goal is to develop an Assessment System for capturing the knowledge, opinions and judgments of experts in specific areas of process safety management.