

Process safety improvement—Quality and target zero

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Abstract

Process safety practitioners have adopted quality management principles in design of process safety management systems with positive effect, yet achieving safety objectives sometimes remain a distant target. Companies regularly apply tools and methods which have roots in quality and productivity improvement. The “plan, do, check, act” improvement loop, statistical analysis of incidents (non-conformities), and performance trending popularized by Dr. Deming are now commonly used in the context of process safety. Significant advancements in HSE performance are reported after applying methods viewed as fundamental for quality management.

In pursuit of continual process safety improvement, the paper examines various quality improvement methods, and explores how methods intended for product quality can be additionally applied to continual improvement of process safety. Methods such as Kaizen, Poke yoke, and TRIZ, while long established for quality improvement, are quite unfamiliar in the process safety arena. These methods are discussed for application in improving both process safety leadership and field work team performance. Practical ways to advance process safety, based on the methods, are given.

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1. Introduction

“No great improvements in the lot of mankind are possible until a great change takes place in the fundamental constitution of their modes of thought.”

John Stuart Mill

English economist & philosopher (1806–1873)

Application of process safety principles has promoted significant reductions in disabling injuries, with many companies reporting lost workday cases one-tenth of that experienced only 10 years ago. The severity of major accidents, when they do occur, has been markedly improved by more sophisticated response activities. Various analytical tools, techniques, and approaches have been standardized to underpin the improvements in safety performance. Many companies express a corporate safety vision and in various forms: “No one gets hurt”, “No harm to people”, “Zero Tolerance Target Zero (0TT0)”

reflecting the view that all accidents are preventable. While there has been very good progress toward this vision, many organizations are finding that the accident and incident rates are beginning to level off. This suggests that the gains made by existing activities are providing sustainable levels of performance, yet there remains the potential for further gains in pursuit of the corporate vision.

Often, improvements in a field of study are made through adaptation of methods in a related field. This paper explores several analytical methods that have been used for improvement of quality management systems. The following methods are examined:

- Kaizen: A method for applying continuous incremental improvement of business processes. This is an adaptation of the Plan-Do-Check-Act (PDCA) cycle.
- Poke yoke: A method for mistake proofing a product or process.
- TRIZ: A systematic approach for stimulating innovation in design.

For each of the methods, an overview of the history, approach, and traditional applications is given. Following that, discussion

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of its possible application for process safety is described. Full treatment of the methods in the context of process safety cannot be achieved in a short paper; however, this discussion is intended to stimulate thought and encourage those seeking the objective of “target zero”.

2. Kaizen

Sometimes big events result in significant course corrections in safety management. Major process events have prompted very big leaps of industry safety practices, such as with the promulgation of the Process Safety Management (PSM)¹ Standard in the United States, which mandated a collection of activities following the 1989 Phillips Refinery incident which claimed 23 lives.

The industry response to PSM was to invest heavily in risk analysis, training programs, procedure development, emergency planning, and maintenance practices. This investment of capital and manpower produced a surge of improvement in technology and practices, with apparent improvement to safety performance regarding major accidents. However, some organizations lost momentum in their approach to managing major accident potential—growing complacent with the daily attention to risk controls. For some manufacturing sites, the safety shortcomings raised by Lord Cullen in the investigation of the Piper Alpha disaster of 1988 hold eerily true today:

- *“It appears to me that there were significant flaws in the quality of the management of safety. . .”*
- *“Senior management were too easily satisfied the permit to work system was being operated correctly. . .”*
- *“They adopted a superficial response when issues of safety were raised by others. . .”*

The direction of process safety has historically been set by industry events, but sustaining that progress and improving upon the approach may come from within the manufacturing organizations themselves. In the absence of major industrial events, significant improvements to process safety may be made through the combination of many small improvements in contrast to major change initiatives.

Kaizen [1–3] was designed to drive overall excellence through incremental improvements to work processes. It is a process based on improving quality, cost and delivery by the elimination of waste (muda). It is characterized by high-energy problem solving improvement teams that help ‘good ideas’ become reality.

Kaizen has its roots in post-WWII Japan when the economy was in shambles and product quality was shoddy. Toyota, among other manufacturing firms, was struggling to stay afloat and major layoffs were carried out. This shakeup left the businesses with reduced labor force and slim capital—consequently, a better way to do business was desperately needed. The resulting Toyota Production System borrowed from principles of statistical qual-

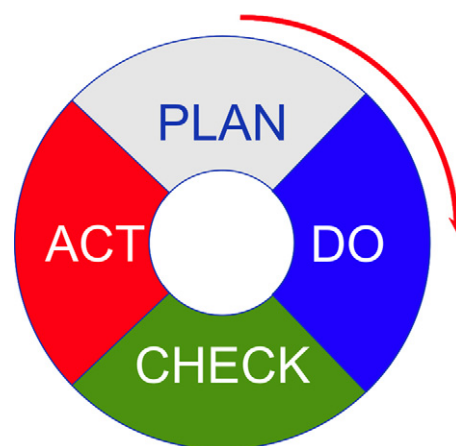


Fig. 1. Continual Improvement Loop, Deming.

ity control of manufacturing processes, and embraced methods to reduce the waste in manufacturing. The Japanese further consulted with Dr. William E. Deming from the United States, who was advocating a continuous improvement process for quality management. This process is widely referred to as the Plan-Do-Check-Act model, Fig. 1, encouraging continual improvement and verifying that improvement is retained. Kaizen emerged as a fusion of the Deming continuous improvement process and the Japanese philosophies for management and manufacturing.

The continuous improvement model, shown at right, forms the basis of the Kaizen work process. The intent of the improvement loop elements is given below:

- **PLAN:** Analyze information, solicit ideas, and select best plan for improvement.
- **DO:** Implement the plan (either as a pilot or fully deployed).
- **CHECK:** Gather information to verify that the desired effects of change are seen.
- **ACT:** Sustain gains made, make course corrections needed.

This improvement loop is well known among designers of safety management systems. The PDCA loop is imbedded as a part of the management system design, usually in connection with medium to long-term safety planning, implementation, and audit/review cycles. In Kaizen, the continual improvement usually takes place at the “shop floor”, where incremental change can be more effectively, and immediately, realized. A Kaizen Event may progress through the PDCA cycle in a matter of hours.

Kaizen is rarely used to “re-engineer” an organization, since this leads to significant disruption of an organization, where the seeds of distrust may be planted. The destabilizing changes in workforce, management structure, and labor agreements should be resolved prior to undertaking Kaizen.

Kaizen, in practice, takes many forms, but all seem to have the following attributes:

- Engagement of management and employees in teams, as peers, identifying possible improvement areas.

¹ 29 CFR 1910.119.

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