How can we use the information provided by process performance indicators? Possibilities and limitations

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ABSTRACT

All management planning, organizing, implementing, and control with feedback, the known Plan, do, check, and act cycle, require indicators on which to base decisions. There have been several recent publications with recommendations on which indicators to use for process safety management. In fact, CCPS guidelines on this topic results in a number close to 400. Of course, for the so called leading indicators, a company can freely select indicators it thinks are most helpful. Lagging indicators are based on incidents, small or large, so the choice among these indicators is more obvious.

What are we going to do with this abundance of indicators? A question that can emerge is: monitoring what number of indicators is sustainable or cost effective? One option is to aggregate to different levels so that operational level, middle management, and top management each monitor a limited set of indicators to provide information at different degrees of detail. Still another question arises: at what value level of a particular indicator is an alarm needed? The indicators have different influences on SMS elements. If we aggregate, what bundled or clustered indicator will that be? How are we setting weight factors? How are we setting a critical limit? What if only one of the many indicators goes through that limit? Details in safety are important, but after aggregation one does not need to see the effect of a detail. Moreover, indicators have effect at different time scales: the short (days, weeks), middle (months), and long term (years). Time is also a factor in setting the critical value for an alarm.

The paper will link indicators to process risks through the bow-tie approach in which beside the regular risk controls the safety barriers also are included. In bow-ties, all foreseen scenarios are presented. By applying component failure rates, event probabilities, and quantitative hazard effects, a full risk picture can be obtained. A Bayesian network is capable of describing the cause-consequence structure conveniently with modest effort, even using value distributions instead of point values. Because a Bayesian network is easily updated given new information, the expert weighed effect of individual (or clustered) indicator values on the reliabilities and probabilities together with the overall risk of an installation can be made easily and instantaneously visible. This approach will better enable decisions guided by acceptable risk level and time-to-possible event.