The Book of Beacons: An Improved Resource for Learning Process Safety Lessons

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Prepared for Presentation at
American Institute of Chemical Engineers
2022 Spring Meeting and 18th Global Congress on Process Safety
San Antonio, TX
April 10 – April 14, 2022

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Keywords: Lessons Learned, Safety Messages, Hindsight Bias, Process Safety Beacon, CCPS Book of Beacons

Abstract

Humanity has been learning from history for over 50,000 years. Why then do we share process safety incidents only to see them repeated in a few years? There is a variety of reasons for the failures to learn. Several of them will be explored and potential improvements on learning from process safety incidents will be discussed in this paper.

This paper presents the function of the CCPS *Book of Beacons* as an enhanced learning tool that improves how the lessons can be internalized to improve retention of the key messages. The

1 Introduction

Telling and repeating stories has been the primary history recording method for over 50,000 years. Around 3,000 BCE, formal written communications were developed, and recorded history began. Some cultures were better at recording history while others relied on verbal transfer of knowledge and culture well into modern times.

The chemical process industries have been recording incidents for many years but sharing only occurred if the incident received broad media or regulatory attention. Those incidents were investigated by the companies but sharing those events outside the company was inconsistent. Even inside companies, lessons from past incidents were only discussed in informal settings with little technical explanation. While a benefit to safety culture, this

Unfortunately, in the petrochemical industry, the track record for learning from past events is not good. Repeated tank overfills, fires, explosions, and runaway chemical reactions are examples of failure to learn from others' mistakes. The goal of learning from others' events is to gain the information without having to experience the consequences firsthand.

CCPS has published two books that document incidents including analysis of the events. They are *Incidents That Define Process Safety*[1] and the second edition *More Incidents T*

A hot air balloon race ending in the middle of a chemical plant ("Mr. Potato Head Is Down!" April 2007) [4]. This Beacon explains the need for good emergency planning, even for events that are unforeseeable, such as a number of hot-air balloons landing in your chemical plant.

A tank failure from 1919 ("The Great Boston Molasses Flood of 1919" May 2007) [5]. A catastrophic tank failure sent a tidal wave of molasses through a neighborhood in Boston. While this happened in the food industry, tank leaks and failures occur in all process industries and, even though the material stored was not hazardous, it killed 21 and injured 150 people.

Potential injury or asphyxiation from cleaning chemicals ("Dangerous chemical reactions at home!" June 2016) [6].

c. A blame culture

There is a thin line between criticism and blaming, but the differences deserve mention. As noted above, the goals of incident investigations are to learn, correct deficiencies and prevent recurrence of similar events. Seeking to place blame on a person or group directly conflicts with this concept and can result in inaccurate causes and, therefore, incorrect remedial actions.

> A flash fire occurred when the operator was cleaning a blender after a batch; fortunately, the operator only received minor burns. The investigation determined that the tools used during cleaning provided the ignition sources and placed blame on the operator for using the wrong tools as specified by the cleaning procedure. When interviewed, the operator showed the cleaning procedure he had used; he was indeed using the correct tool per those instructions. In reality there were three procedures for cleaning that equipment, and there was no guidance for which cleaning procedure to use. The tool was correct for the procedure being used. Fortunately, this investigation went beyond placing blame and uncovered the real cause – poorly written instructions for determining the proper cleaning method.

What is often called the bad apple approach seeks to blame someone so they can be fixed or fired. By removing the bad apple(s) from the operation, the problem is supposed to be solved. In the example above, removing or disciplining the operator would have prevented the real root cause from being uncovered, and that event could have recurred. Are there frequently training deficiencies to be addressed following an incident? Of course, but when that is the only element that is addressed, the root cause(s) probably persists.

Another downside to placing blame is the negative impact on the process safety culture. Fear of being blamed discourages near-miss and incident reporting; potential safety improvements are missed; and confidence in the process safety systems is damaged. We all know that developing a positive process safety culture takes years, but it can be critically damaged in a few minutes.

d. Hindsight Bias.

In addition to the organizational factors listed above, hindsight bias is an individual condition. This mindset uses the advantage of hindsight. It is perfectly obvious why something happened once you know the outcome of the decision(s) leading up to the event.

This hindsight bias makes it difficult to objectively review a case study or incident without second guessing the actions taken by those involved. The fact is we cannot unknow information, so overcoming hindsight bias is perhaps more difficult that overcoming other types of bias, where knowledge that the bias is present can help to limit its impact.

In simplified terms this means that once we know the outcome of an event, we can see exactly what went wrong in leading to the outcome. We see this information with the benefit

of knowing the outcome, and therefore we do not see the events unfold in the context under which they occurred. This clouds our judgement with information that was not known to the people in the event [9]

There are two papers/articles that demonstrate how easily some biases can shortcut learning from case studies.

The first is a paper explaining a study done by IChemE Safety Centre (ISC). In this study, the audience was shown an incident scenario without knowing the final outcome. When a decision point was reached, the video was stopped, and the participants recorded their decision. Across the course of the scenario, the majority of the participants made the same decisions that led to the original incident!

The second is a recent article in *Scientific American* [10], which discussed cognitive bias. The article used the term "jumpers" to describe those who make errors in decisions based on the sparsest of information. The authors conducted a study that reveals the essence of this thought process. It used a thinking game where the study group "encountered a person fishing from one of two lakes. In one lake, most of the fish were red; in the other, most of the fish were grey. The fisher would catch one fish at a time and stop only when the players th

Presentations can be an effective learning method if they include a summary of the incident report. Retention of the messages is further increased if pictures are used and the summary discussion includes systemic deficiencies.
Reading the report or just hearing of the incident are the least effective

b. The Process Safety Beacon and the Book of Beacons

One of the tools CCPS has to present incidents and lessons is the *Process Safety Beacon.* For over 20 years, the Beacon has been published for a focus audience of frontline employees (operations & maintenance personnel). By design, the one-page document uses incident-based pictures or diagrams to highlight a process safety topic. It then presents key facts in the "Did You Know" section and possible actions in the "What Can You Do" section. Unfortunately, the single-page format limits the *Beacon* to around three hundred words. Also, the lessons focus only on what frontline personnel can do, not equipment or process design issues.

Some companies post the *Beacon* or send digital copies to a broad audience. Other companies

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