Scenario Based Auditing

An Audit Methodology for Prevention of Major Catastrophes

Managing safety in any enterprise, large or small, starts with hazard identification. This is a fundamental principle.

(Hopkins).

Major incidents never happen suddenly and never because of a single failure. Every Incident investigation of major incidents reveals multiple failures and early pre-cursors that, if recognized and given the right relevance, could have triggered the people involved to make different decisions and take better corrective actions.
Scenario Based Auditing: Synopsis

Despite the implementation of Safety Management Systems and many (recent) regulations on Process Safety, major chemical incidents continue to happen. Within General Electric Plastics (GEP) a Process Safety Management System (PSM) has globally been implemented to avoid Process Safety incidents. This program has been adopted from OSHA’s 1910.119 PSM law and its implementation is driven and measured by the central EHS teams that are part of the headquarters in the U.S. (Pittsfield) and Europe (Bergen op Zoom, NL). A key task of the central EHS teams is to audit each GEP chemical facility in order to assess the level of implementation of PSM. These PSM audits are a major task and consume a large amount of time available to the central EHS teams.

A study was done to see how GEP’s current audit methodology could be improved. This was done by 1) looking at the causes of chemical incidents both at GEP and in the general Process Industry, 2) evaluating Process Safety Regulations and 3) evaluating GEP’s current audit methodology to assess whether this methodology sufficiently identifies potential major hazards. This document is the result of that study. The intent of the study was to develop an audit methodology that addresses the key factors that cause Process Safety incidents and that fixes some of the known shortcomings of the current audit methodology. The customers of this study are GEP’s EHS Headquarters, and the Global Manufacturing Staff. The result of the study, a proposal for a new audit methodology, which is called Scenario Based Auditing, is now being used in pilot version by the central GEP EHS team as a successful addition to better assess the control of major hazards. This document describes the both the research and the audit methodology that was developed as a result of that research.

Analyzing the wide range of available data on chemical incidents (both from literature and from GEP internally), and on current Process Safety Regulations and Process Safety audit methodologies the following conclusions can be made:

- Major incidents are rarely caused by single failures. They are usually the result of an interactive multiple failure scenario; a chain of errors that eventually results in a catastrophic incident.
- Key contributors to these incidents are Insufficient Hazard Recognition (either during design or operation) and human error.
- Humans make errors. Many data are available (mainly from the Nuclear Industry) that quantify the probability for human error during specific tasks under specific circumstances. However, little is done to systematically analyze and reduce the probability for human error while developing procedures.
- Current Hazard assessment methodologies look only at single failure scenario’s; “What if the feedflow increases...” type of failures. HAZOPS do not take multiple failure scenarios into account. They are also often equipment focused and hence rarely look into the aspect of human error.
- Regulations like PSM, RMP and Seveso II fail to bring clear guidelines on how to implement and how to assess Human Factors.
- Current Process Safety audits result in many findings, but these findings are often focused on the individual elements of the management system. In other words, the audits provide an overview of the level of implementation of each individual element (like MoC, Mechanical Integrity, Procedures) but fail to bring a coherent picture in terms of the likelihood to a major incident. Process Safety.
• Current audits do not look sufficiently into the Human Factor aspects.
• Audit reports often describe findings on missing paperwork and out of date procedures, and thus are perceived as bureaucratic. This sometimes results in low acceptance. Audit reports are seldom part of senior business reviews….Audit reports do not make it to the top.

In order to overcome the issues mentioned above, a new audit methodology was developed;

**Scenario Based Audits**

In a 5 step approach – 1) definition of the catastrophic top event, 2) definition of the direct causes/failures that lead to the top event, 3) definition of the barriers to prevent the failures 4) evaluation/audit of the quality of these barriers, and finally 5) identify and check management system elements - a very comprehensive and effective audit methodology has been created.

The new audit methodology has been piloted by General Electric Plastics in several chemical plants in Europe and the U.S. and the results are very positive. Summarized, with Scenario Based Audits for Process Safety:

• Some of the most frequent causes of incidents, Hazard Recognition and human error, are better assessed.
• A much better insight is gained on the likelihood and path to major catastrophes.
• Causal relationships between failures become clear.
• An assessment of Human Factors is included, something that is missing in conventional audit methodologies and legislation
• The relationship between elements of the management system and the effect of poor implementation of these elements in catastrophic scenario’s become more visible; you cannot define good operating procedures if you do not know your operating window. You do not know your operating window if you do not have accurate design and design data. Design data will be inaccurate if the MoC process does not work. Review by non-technical top management becomes easy, due to the easy to read format and the clear link to catastrophes that affect Operating Margin, Delivery Reliability and Employee Satisfaction.
• Single failure mode HAZOPs are amended with multiple failure scenarios that do not focus on equipment only but also include an assessment of barriers that are sensitive to human error.
• Plant personnel and management are provided a clear picture of the path to disaster, which will also bring a higher acceptance of the findings.
• Communication of the audit results and the potential impact of the findings become simple.

For a more detailed description on the methodology and results, please see the presentation that goes with this synopsis.

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