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Operational readiness for the integrated management of changes in the industrial organizations – Assessment approach and results

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ABSTRACT

Management of change (MOC) is part of process safety management. Traditionally, MOC is related to technical changes. Safety implications from organizational changes have recently led to proposed integrated management of both types. Inadequate or absent MOC is often among of the causes of major accidents in the process industry, as a plethora of textbook and recent cases clearly demonstrate. Despite the lack of attention in industry and in the scientific literature, complexity in MOC plays an important role in ensuring process safety. We propose a new approach for the evaluation of the organizational readiness on the key principles and essential features of the safety change management (that integrates technical and organizational changes). We build on a merge of the Nertney's wheel principles of assessing the pre-defined stages of operational readiness of the elements of the system in question – safety change management (based on the literature/guidelines). The approach and prepared audit type tool were applied and tested in six case industrial organizations in Europe. Results of the testing suggest that the approach can reveal potential specific gaps in MOC procedures and practices, as well as provide aggregated results (e.g., for the purpose of reporting, benchmarking and risk communication, alignment of management activities). The obtained results also re-confirmed the literature that the overall readiness of safety change management in industry is in its infancy. The research contributes to the literature and practice by pointing out how to assess, aggregate and possibly align the MOC performance data for better risk management.

1. Introduction

Management of changes (MOC) in organizations, subject to major accident hazards, is one of the main elements of a safety management system (EC, 2012; US, 1992; CCPS, 2007; CSChE, 2004; Sanders, 2005). Technical change is any addition, process modification, or substitute item (e.g., person or thing) that is not a replacement in kind (CCPS, 2007), while organizational change is any change in position or responsibility within an organization or any change to an organizational policy or procedure that affects process safety (CCPS, 2013). Traditionally, the term MOC is related to the safety management of technical changes. Interestingly, as pointed out by Gerbec (2017), there are not many scientific papers related to the management of change as a part of safety management (Hoff, 2013; Keren et al., 2002; Koivupalo et al., 2015; Zwetsloot et al., 2007). Keren et al., 2002, performed a survey, of how often changes occur in the industry, and found among the respondents the rate between 1 and 37 changes per annum per ten employees (with an average at about 10). The lesson here is that changes in organizations can go to the hundreds per site per annum and thus, in a long term, the plant/installation renders itself to something completely different from the initial design. How does this reflect on the process safety risks? Obviously, that depends on how well the changes are managed and documented (e.g., updated process safety knowledge) and considered in updated risk assessments. While the situations before and after might be the subject of risk assessments considering a specific change proposal, the analysis of the quality of the management of change activity and its safety implications are yet to be developed and proposed. Unfortunately, there seem to be a plethora of past major accidents, where serious deficiencies in the management of technical and organizational changes were involved. Illustrative textbook examples include accidents in Bhopal, India, on 3.12.1984 (Shrivastava, 1987, p. 49), Seveso, Italy, on 9.7.1976 (Jain et al., 2017, Section 7.4.2) and Flixborough, UK, on 1.6.1974 (Mannan, 2012, Section A2.8.16). Accident databases (e.g., eMARS (EC, 2018), ARIA (BARPI, 2018) and

Abbreviations: CCPS, Centre for Chemical Process Safety; ID, Identifier code; MS, Management System; MOC, Management of Change; MOOC, Management of Organizational Change; SCM, Safety Change Management (Gerbec, 2017)

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agencies (CSB, 2018)) are not best suited to search specifically for the more recent specific examples. However, lessons learnt[1] from the ARIA database (consisting of almost 49,000 events) mention examples of 28 events where MOC was reported deficient/absent. Our review also found that 8 out of 15 closed investigations by the CSB, in the period from 2015 till today, explicitly list MOC issues among the causes (Flash Fire at the Delaware City Refinery, 29.11.2015 (CSB, 2017a); ExxonMobil Torrance Refinery, 22.11.2016 (CSB, 2017b); Air Gas, 28.8.2016 (CSB, 2017c); Williams Geismar Olefins Plant, 13.6.2013 (CSB, 2016a); Tesoro Martinez Refinery, 10.3.2014 (CSB, 2016b); US Ink/Sun Chemical Corporation, 9.10.2012 (CSB, 2015a); Macondo well, 10.4.2010 (CSB, 2016c); Caribbean petroleum corporation, 23.10.2009 (CSB, 2015b)). Of those, the first six are reportedly related to the deficiencies or absence of the management of the technical changes, and last two are reported in the relation of the governance issues on the details of the prescribed MOC (e.g., relevant, but legally not required at the time). In addition, reports, as a rule, do not relate possible human & organizational issues encountered (e.g., inadequate staffing, etc.) to the deficient/absent management of organizational changes (MOOC) as proposed by CCPS (2013). Thus, MOC/MOOC issues are likely underreported. The overall conclusion at this point is that MOC plays a much more important role in process safety as considered by the industry and also by the scientific literature today.

Let us examine the broader context, under which the needs for changes arise. In the field of management, the management of the organizations and management of the changes are almost synonymous. In that respect, there is an abundance of literature on the topic. However, to undertake the change, it should be planned like a journey: including its purpose, the route, with whom – in simple words about its evaluation, planning and implementation (Paton and McCalman, 2008). Similarly, it is about the changes in an organization's strategy, structure or culture, due to changes in its (business) environment, technology or employees (Reiss, 2012). As pointed out by Gerbec (2017), the changes usually involve many management levels and a holistic approach should be applied in their evaluation and planning. In that respect, the conventional management of change procedures usually consider only the technical & technology related changes and it has been suggested that the organizational changes are important as well (Keren et al., 2002; Zwetsloot et al., 2007; Koivupalo et al., 2015; CCPS, 2013; HSE, 2003; HSE, 2016). Furthermore, both types are obviously interrelated and should be evaluated for impacts and planned for implementation in an integrated way (Gerbec, 2017).

How should current procedures for the management of change (MOC) of the technical changes in industrial organizations incorporate the principles and scope suggested for management of organizational changes (MOOC; see CCPS, 2013)? As a target, that should be done using an integrated approach (to make a distinction we name it a “safety change management” (SCM); Gerbec, 2017). The answer is, by an initial gap analysis of its own procedures and practices against the specifications using an audit technique.

As one of the imperatives of this study, the authors of the paper have been involved as consultants to various industrial organizations (internationally) for the purpose of the implementation of their formal safety management systems. In that respect, we repeatedly found that managers are also interested in a comparison (benchmarking) of their safety management systems performance against other industrial organizations (not necessary in the same country or in the same type of the industry). Such a request brings an analyst to the issue of business data confidentiality and how to compare the findings on a common scale to ease the communication of the results.

To date, reported research or available guidelines do not explicitly address systematic evaluation approaches that would offer identification of the possible gaps in SCM, their profiling (reporting, aggregating, trending applications), use of the common scale (e.g., overall SCM readiness scale for the purpose of intra and inter organizational benchmarking) and allow sharing a common picture among the various stakeholders (e.g., for the purpose of aligning horizontal management activities, as recently proposed by Karanikas (2017)). The above brief review of the past and recently reported accidents where issues in the performance of the management of change activities have been revealed, clearly suggests that there is a burning need for a structured pro-active evaluation approach and subsequent corrective actions.

This paper contributes to the research and industrial practice and introduces an approach and tool that can be used to evaluate to what extent the principles of SCM are incorporated in industrial organizations. We envisage that, in addition to the needs outlined in the previous paragraph, this approach should add to the better recognition of possible gaps among the necessary elements of the SCM and serve the safety management practices (e.g., as structured and coordinated input to the audits, management reviews and investigations, at different management levels (Karanikas, 2017)).

In Section 2, we will explain the approach used in the proposed assessment method for organizational readiness for safety change management and its testing. Section 3 will present the results of testing of the method at the case anonymous industrial organizations. Section 4 will provide conclusions. In Appendix A, details of the method are presented, and in Appendix B, the spreadsheet tool implementing the method is provided as supplementary material.

2. Approach

A review of the available literature has led us to the concept of operational readiness as a design philosophy proposed in the military domain to describe the developmental state, in essence, the state of the managed change (project) (Nertney, 1987; Frei et al., 2015). By definition, the operational readiness ensures that the right people are in the right place at the right time, working with the right hardware according to the right procedures and management controls, and are functioning in a favourable physical and psychological environment. The concept has recently re-emerged in the contexts of operational system dynamics, retaining organizational memory and was proposed for the application on the issues of ageing process plants and key emerging/enabling technologies (Kingston-Howlett et al., 2016), and is used also in accident investigations (Bonsu et al., 2016).

As mentioned above, the concept comprehensively considers people – hardware – procedures (more will be explained in the following section), considers development dynamics and incorporates pre-defined stages of the operational readiness (to be used for the common reporting scale). Specific evaluations should be done using the audit technique. Having thus adopted the concept of operational readiness as suitable to work on, on the other side, it does not go to the specific details/criteria to be assured for the management of change activity as such. In that respect, we applied the essential features of the MOC as proposed by CCPS guidelines for process industry (CCPS, 2007), as well as considered the issue of the organizational changes (CCPS, 2013; Gerbec, 2017). That allowed us to build from the readily available list of the necessary activities, terminology, key & essential features, and performance criteria. Details on the merge of the readiness concept and specifications for MOC and MOOC are given in next section.

2.1. Method

We built the proposed method for the assessment of the organizational readiness of the safety change management based on the Nertney's principle, that industrial organizations shall treat their operations and their parts as a whole: people, procedures, equipment and conducive conditions (Nertney, 1987; Frei et al., 2015). The “whole” of

[1] https://www.aria.developpement-durable.gouv.fr/wp-content/uploads/2017/06/Brochure_IMPEL2017_EN.pdf.