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Safety change management – A new method for integrated management of organizational and technical changes

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ABSTRACT

Changes are a daily reality in the process industry and potential implications on major accident hazards must be properly managed. Management of change is a part of safety management, however, changes are often complex and usually involve both technical and organizational aspects. We present a new integrated method (to make a distinction, we name it a “Safety change management”) to evaluate and manage change proposals, considering both technical and organizational dimensions in an integrated way. This method includes the consideration of applicable management levels within the organization and follows a business process redesign model. A change is evaluated for its impacts and interactions between various management levels (using a set of checklists) and accordingly, planning actions are prepared for validation and monitoring. The method was subject to testing and validation by two industrial organizations via ex-post re-assessments of three recent changes. The proposed method was found detailed, effective, useful and transparent by the plant managers involved.

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1. Introduction

Management of changes in organizations subject to major accident hazards is recognized as part of the related safety management. The formal requirements for an explicit management of change process which are applied to technical or technology related issues are usually part of formal legal obligations for related process industries (e.g., in the EU, the “Seveso” directive (EC, 2012), in USA, 40 CFR Part 68.D (US, 1992), PSM Standard (OSHA, 1992), CCPS PSM elements (CCPS, 2007), etc.). Details how to implement a procedure for management of change are usually not part of the national legislations, which detail only the principles to be followed. Yet, applicable guidelines and textbooks provide some guidance (e.g., Sanders, 2005; HSE, 2016; Marsh, 2016). The changes in the process industry vary by frequency, scope and depth, related to production and market dynamics suggesting that their only constant is the persistence of changes in the production processes and their management (Keren et al., 2002).

In addition to the “pure” technical and technology related changes that occur whenever there is a need or motivation, the organizational changes also occur. For example, the organization/product value chain implications to materials quality change, production rate change (increase), etc., that usually also impacts to some extent the management of the plant or the management of the whole organization in question (e.g., roles and duties, staffing, qualifications needed, etc.). While it is clear that the quality of the safety management strongly affects the safety of the operations, the explicit need for the management of the organizational changes in major hazard industries is not yet widely recognized, or formally required. However, various approaches are suggested in guidelines and textbooks (CCPS, 2013; CSChE, 2004; HSE, 2003, 2001).

Surprisingly, there are not many scientific papers related to management of change as a part of safety management (Keren et al., 2002; Hoff, 2013; Koivupalo et al., 2015; Kitajima et al., 2010; in addition to above mentioned guidelines and textbooks) while the topic of safely managing organizational changes is a subject of some investigations reported in the literature. Lambert et al. (2001) investigated risks related to major acquisitions in the IT industry and suggested the development of alternatives in order to manage considerable risks. Zwetsloot et al. (2007) studied organizational changes in four case studies to identify patterns of difficulties encountered among them and pointed out the complex dimensions of decision making with changes (decision fragmenta-

Abbreviations: BPM, business process management; CCPS, Centre for Chemical Process Safety; COP, common operational picture; HTA, Hierarchical Task Analysis; ISO, International Standards Organization (www.iso.org); LPG, Liquefied Petroleum Gas; MS, management system; PSM(S), process safety management system (US, 1992); SMS, safety management system (EC, 2012).

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tion, undesirable side effects, ambiguity). Recently, [Zwetsloot et al. \(2014\)](#) quantitatively evaluated contributing factors to the workers' satisfaction in the process industry during organizational change, where the positives were found to be participative leadership and flexibility in team composition. The personnel requirements (staffing levels) affected by the operational change are suggested to be evaluated by [Reniers \(2010\)](#) using a structured questionnaire containing the measures that could be impacted by the change (checklist approach).

But, how are the organizations managed in the first place? Management science has been working for a long time in the field of business process management (BPM), which by definition includes changes. While this paper does not intend to excessively explore the management science aspects, some approaches and general ideas are worth mentioning. While there is an abundance of literature on this topic, the principal way to describe how companies or organizations plan to make money is the use of business models. The models could consider various management levels (enterprise/organization, process, implementation, resources), orientation approaches among levels/units vs. value chain(s), etc., however, it seems that it is about understanding the relationships among the processes that constitute the value chain (a very good introduction text is available in [Harmon \(2014\)](#)). To be brief, the potential general redesign method oriented towards business processes and involved levels in a given organization, shall build on modelling and analysis (of the existing processes), followed by generation of the redesign alternatives, and final selection and implementation of the changed business process ([Harmon, 2014; Chapter 13](#)) – illustrated in [Fig. 1](#).

The actual application of organizational change management as a business redesign project in major hazard process industries (following management of change principles) seems to be missing. Thus, integrated management of all changes, both technical/technological and organizational, due to obvious interconnectedness is yet to be proposed, developed and implemented in industry.

In Section 2, this paper will explain the proposed method for integrated management of organizational and technical changes. Section 3 will present the approach, results of testing and validation of the method in three recent change cases. Section 4 will provide conclusions and finally, in Appendix A and supplementary material, details of the method and a set of the operational candidate forms are provided.

2. Proposed method

2.1. Approach

The above mentioned papers among other things suggest that the following issues are important:

- The technical/technological and organizational changes are interconnected in an organization, so changes should be managed in an integrated way.
- The complexity and propagation of the impacts likely spans over more than one organizational level, so the changes shall be managed considering implications on all relevant levels.
- The “pure” technical/technological impact(s), as well as organizational issues impacted at various management levels, shall be clearly identified, categorized and subject to careful safety evaluation, planning and documentation.

An integrated approach is needed that will consistently consider issues a, b. and c. above, and in addition build on the general management categories. This means that common categories shall be used considering the relevant management aspects in a given organization. The use of standards can be a solution. For example, use of the ISO family of management systems standards comes to mind here: the recent ISO 9001:2015 standard for quality management ([ISO, 2015](#)) can serve with categorized requirements for the aspect of general management; related to the specific risk management aspect the ISO 31000:2009 standard requirements can be considered. In a similar fashion, other relevant aspects can be considered by adding suitable schemes (e.g., ISO 14001:2015 related to environmental impacts, ISO 50001:2011 related to energy aspects and coming ISO 45001 related to health and safety at work aspects, etc.).

The overall purpose is to prevent risk information gaps among the stakeholders in a change, thus the proposed approach will build on the concept of situational awareness/Common operational picture (COP; [Endsley et al., 2003; Seppänen et al., 2013](#)). A COP among the stakeholders/management levels involved in a (proposed) change shall include early characterization, analysis of the potential change implications and provision of understandable information to all, especially decision makers, managers and operational personnel. As in principle many different decision/management levels can be involved in the scope of a change, the scoping shall consider explicitly: organization policies, organization (general) management system, specific management aspects (e.g., process safety management system) and operations levels – as illustrated in [Fig. 2](#).

[Zwetsloot et al. \(2007\)](#) found that changes are complex, patterns of changes are changing, thus considering the need for permanent performance improvements, the change management process shall be a subject of review, related to challenges that organization is experiencing in a wider social context. The proposed principles that an organization shall follow within change management process according to the PDCA loop ([ISO, 2015, 2009](#)) are graphically illustrated in [Fig. 3](#).

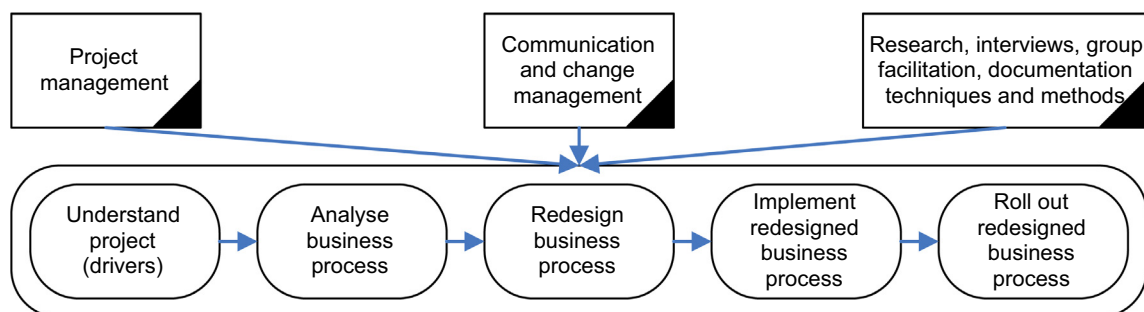


Fig. 1. Potential general phases and skills needed for business redesign project (according to [Harmon, 2014, p. 329](#)).

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