2015

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Recommended Citation

Leva, M.C., Naghdali, F., Balfe, N., Gerbec, M.& De Michela, M. (2015). Remote risk assessment: a case study using SCOPE software. *CET: Chemical Engineering Transactions*, vol.43, 2015. doi:10.3303/CET1543203

CHEMICAL ENGINEERING TRANSACTIONS

VOL. 43, 2015

A publication of AIDIC

The Italian Association of Chemical Engineering
Online at www.aidic.it/cet

Chief Editors: Sauro Pierucci, Jiří J. Klemeš

ISBN 978-88-95608-34-1; ISSN 2283-9216

Remote Risk Assessment: A Case Study using SCOPE Software

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A thorough risk assessment requires input from experts in both safety analyses and the system under analysis. The cost of collecting together the required expertise for a short risk assessment may mean that for some small and medium enterprises (SME), the risk assessment is not deemed worthwhile or is completed using a generic form. This is despite the possible safety and performance benefits that can be identified via a thorough risk assessment. This paper presents a case study of a risk assessment on a rare periodic inspection & maintenance procedure planned by a LPG storage and distribution company in Slovenia. The company identified the need to risk assess this procedure and determine possible safety and performance improvements, including analysis of planned human activities. The expertise for this task was available through contacts spread across Ireland, Italy and Slovenia, but the costs of all the experts gathering together at the site were prohibitive. The solution was the use of SCOPE risk assessment software over internet video conferencing. All participants could share their expertise to identify the hazards and control the risks. This paper presents the method used and explores the requirements and benefits of this approach.

1 Introduction

Current techniques of risk assessment aim to take into account also human and organizational factors, as suggested by NORSOK Z-013. Representative examples can be found in literature: ORIM methodology (Øien et al. 2011) and Risk modelling of maintenance work (Vinnem et al. 2012). The integration of technical and organizational factors allows the definition of a more comprehensive risk picture. However, risk assessment is often separated by a feasibility evaluation of the actual tasks that are part of operating and maintenance manuals practically followed on the field. Assessing the Operations Manuals through a simple to apply risk assessment techniques can allow even small organizations to improve the reliability of company activities and tasks, updatable with the use of observational data.

The methods to be used for addressing risk assessment of operational tasks can be based on a functional description carried out through a detailed task analysis that can be used as a basis to perform then an Hazard Identification study HAZID (EN ISO 17776:2002), or a job safety analysis (JSA) (US Dept of Labor 2002), or a Facility Hazard Analysis (FHA) (Taboas et al 2004), or a combination of the above. These are some of the possible methods to systematically study and identify the hazards associated with certain operations. The results of such studies can be used to introduce safety measures to minimize the risks connected with human errors or technical failures. While some assessments are required to meet regulations or standards, and these assessments have necessary requirements and formats, risk assessments may also be performed voluntarily by organizations to better manage and control processes. These assessments may identify additional safety requirements, changes in the order of a procedure, or suggest additional training requirements. While the risks involved in the overall process may be low, the potential for safety and productivity benefits from early identification through a thorough risk assessment are high. A barrier for small and medium enterprises (SMEs)

to such use of risk assessment can be the access needed to risk assessment expertise. This is both in terms of structuring and running the risk assessment, and in terms of safety expertise itself.
Technology may provide an answer to both these issues; first, through the use of structured risk assessment software and second, through the use of online video conferencing software, allowing all the expertise to be gathered together at low cost. This paper presents a methodology and an example of a risk assessment performed on the envisaged periodic procedure using a tool called SCOPE (Leva et al 2014). The methodology is explained in order to provide a blue print for application on similar case studies, so as to provide a simple and well-defined structure for a remote risk assessment workshop, the scope is to provide a systematic base that can prevent a distributed team from missing possible issues. The software assist the assessment with a built-in risk matrix that can be customized. Other features of the system such as colour coding of risks and ranking assists with prioritization and structured management of risks. The process follows four main stages: preliminary data collection and task analysis, process mapping, risk assessment, and final report and verifications (Leva et al 2014).
This approach was applied as part of the EU 7.FP TOSCA project to the assessment of a rarely performed periodic inspection & maintenance procedure (cold water testing of a pressure vessel for LPG storage) at the Plinarna Maribor d.o.o. (Plinarna) liquefied petroleum gas (LPG) distribution facility located near Maribor, Slovenia. The TOSCA project aims to develop an approach to Total Safety Management, and this case study combined 4D simulation with task analysis to identify and assess possible improvements in terms of safety and performance. This paper will focus on the task analysis developed and risk assessment exercise undertaken as part of the wider case study.
Cold water pressure testing, or alternatively, acoustic testing for pressure vessels is required by law to be performed every five years, and if, as in this case, the organisation chooses to use acoustic pressure testing on several consecutive occasions, cold water testing may occur very infrequently. The gas product (LPG) needs to first be emptied, then the vessel is to be prepared for testing. The overall operation is logistically difficult and time intensive, and the operational experience from previous tests is limited due to the infrequency of conducting this specific test and staff turnover in the interim. The testing procedure therefore needs to be redeveloped and updated, and should aim to ensure safety completion of the testing procedure while also minimizing the downtime, as the vessel is out of service for the duration of the testing procedure. Any delays, whether resulting from safety or productivity issues, may impact on company revenue.

2 Task analysis: Preliminary data collection and documentation

The first step of the risk analysis on a procedure is to understand the operation, including the duration and required materials for each task. The duration of the task was collected for this particular case study to support a possible analysis of the timing for optimization purposes. Each task was identified from the start of the procedure (emptying the pressure vessel) through to the end (refilling the pressure vessel). For each task, the steps involved were identified and documented, along with an approximate duration, the operator (or 'actor') involved, and the materials needed or equipment acted on. Table 1 shows a spreadsheet version of this information for one task.

Table 1: Example of the spread sheet used

Main Task		Steps Involved	Duration	Actor(s)	Materials/ Equipment
Emptying the tank – liquid phase	1.1	Drive truck to the filling station	40min (for 8 tonnes)	Truck driver, SCADA	Filling station
1.	1.2	Attach hose to the truck		Truck driver	Truck
2.	1.3	Prepare SCADA transaction		SCADA Operator	SCADA
3.	1.4	Start filling process		SCADA Operator	SCADA
4.	1.5	Fill truck		-	-
5.	1.6	Stop filling process		SCADA Operator Driver	Filling station SCADA
6.	1.7	Detach hose		Driver	Truck
7.	1.8	Drive truck away	8.	Driver	Truck

In this methodology, the data for the task analysis was collected in collaboration with plant engineers. Pictures of the site were provided to give more of an understanding of the context for the experts preparing the task analysis remotely. The data collected in this phase can be modified according to the needs of the particular analysis. For example, it may not be necessary to collect information on task duration, but communication and coordination between actors might be vital and should be recorded. Whenever possible it would be best to collect the information on site following on site observation, however whenever this is not practical, the information can be collected remotely in consultation with operators and engineers.

3 Task Modelling

The task analysis data can be represented in a process map or other tool. In this case, the SCOPE software for task modelling and hazard assessment was used (Leva et al 2014). This software provides the basis for the HAZID analysis and consequent risk prioritization. The main tasks recorded in the task analysis, as in the example shown in Table 1) were used to create the main process map underpinning the analysis. Figure 1 shows an example of the task model created in SCOPE working environment.

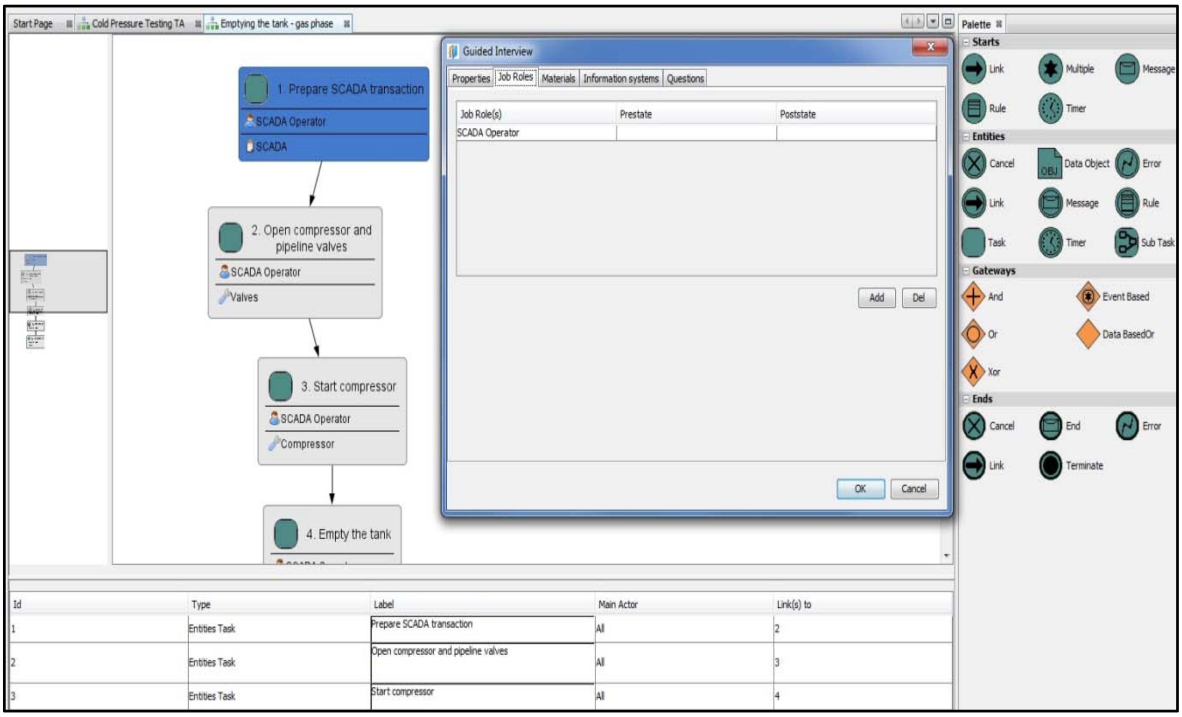

Figure 1: Example of SCOPE working environment

In Figure 1, the chart on the left shows the high-level process map showing the main tasks and the chart on the right shows the detail of the specific steps involved in the first task. This configuration allows the team to understand at which stage of the overall process a certain task is located and what are the actions involved in each sub task group. It also allows the risk assessment team to focus in on manageable chunks of the process to analyse each chunk in sequence. After collecting the data and creating the task model in SCOPE, the task analysis report was circulated to the risk assessment team. This team included three risk assessment experts (one of whom was familiar with the specific site), a human factors expert, the site manager, and a scribe. The team checked and validated the data in the task analysis before proceeding to the risk assessment. This resulted in some early modifications to the task model, preventing time-consuming late modifications. The advantage of this structure for the task analysis is the fact that it can be very easy to work remotely on the data and collect the necessary input from all the participants without needing to come together in time or space at this stage of the analysis. After the final validation on the task analysis data the final SCOPE model was defined. Figure 2 shows a screenshot of the SCOPE software. It is possible to add very detailed specifications regarding each task, such as cost of the operation, benefit of the operation, importance, job roles involved, materials required, the status of the materials before and after the operation, information systems involved, and even possible questions to be asked later during the risk assessment. This can help the risk assessment team to structure the work to minimize the mistakes and missing points later in the analysis and utilize the time and budget required for risk management process. The structure provided by the task model can play a key role in optimizing brain storming sessions for the HAZID study.

4 Risk Assessment in SCOPE

Once the process map is complete, the risk assessment can be performed following a structured process to investigate possible deviations from the planned process. Guidewords may be applied to better structure this

process, although in this case study no guidewords were used. The SCOPE software captures the hazards identified and links them to the overall process map. It can also record the suggested countermeasures. The risk assessment team must fill in the required information based on built-in table.
The risk assessment team for the Plinarna case study met online, using video-conferencing software. The scribe shared his screen so that all participants could see the process map and corresponding risk table (as shown in Figure 2 above). This approach allowed the expert input from participants in three different countries to be shared and discussed as in a normal risk assessment workshop. The process map helped participants to follow the process and provide their inputs as required. The participants were able to meet at arranged times over the course of two weeks until the assessment was complete. This allowed them to fit the assessment around their existing activities, without needing to travel or dedicate whole days to the risk assessment. The assessment of the risk index for each identified scenario is based on a simple risk matrix of severity and likelihood. Predefined categories for likelihood and severity are provided in SCOPE and were used for this assessment, although these can be modified according to the analysis undertaken. Both severity and likelihood tables that have been used for this case study are presented in Tables 2 and 3.

Table 2: Example severity table of SCOPE software

Severity	Delays	Damage level	Costs
Minimal	Delay up to 1 hour	Slight Damage/Distress	No cost
Moderate	Delay up to 8 hours	Minor Damage/Injuries	From 0K to 5K euro
Medium	Delay up to 1 week	Localised Damage/Serious injuries recoverable	From 5K to 10K euro
Serious	Delay up to 1 month	Major Damage/Permanent damage to health	From 10K to 50k euro
Extreme	Delay over 1 month	Extensive Damage/Death, lethal effects	Above 50K euro

Table 3: Example likelihood table of SCOPE software

Likelihood of the hazard	Scale
Very Rare	Once every 10 years
Rare	Once every 3 years
Occasional	Once per year
Probable	More than once per year
Frequent	Once per month or more

SCOPE uses colour coding to display the level of risk associated with each task, providing an overall image of the risk profile of the operation. Figure 3 shows an example of the implementation of risk assessment in SCOPE software.

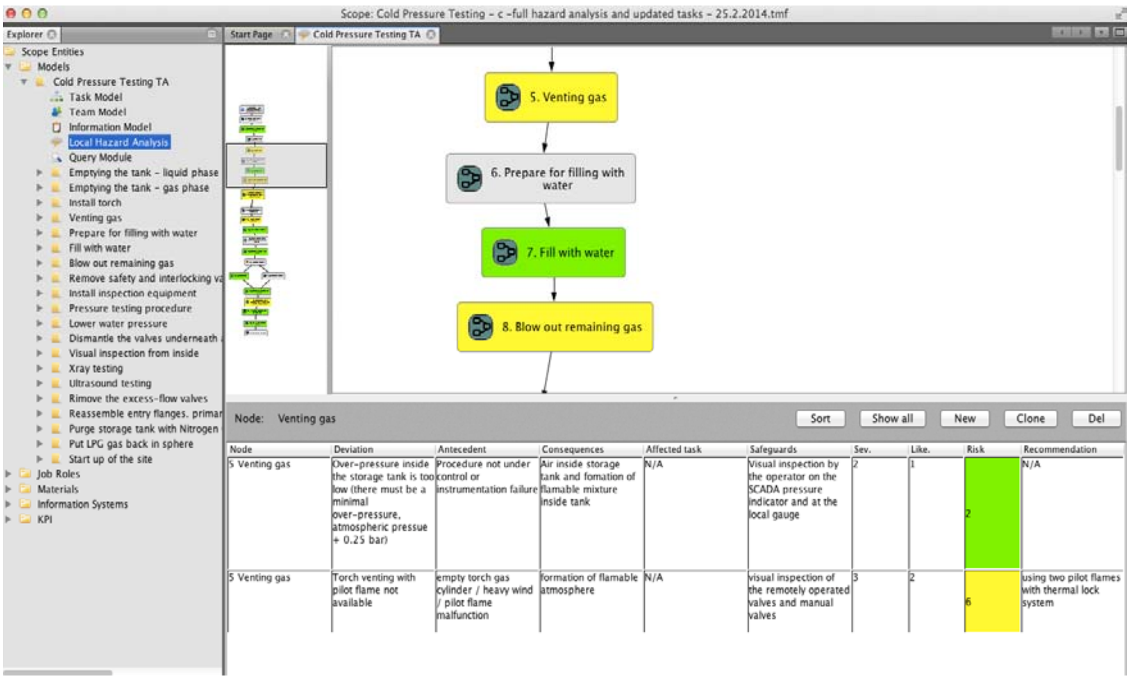

Figure 3: The SCOPE model used for the remote Hazard Analysis

After conducting the risk assessment in SCOPE and gathering the necessary information for the risk assessment a report was produced. The risk assessment table can be exported from SCOPE as a spreadsheet and may be used for reporting. The team can then have easy access to details of task analysis while reviewing the report. The rationale behind the review at task analysis stage and risk assessment stage is to ensure that all the hazards are accounted for and relevant recommendations are identified and duly defined. Even though the structure of the this methodology is designed to minimize any missing points, a review of the collected data and the brain storming session for risk assessment can ensure that the outcome of the study meets the requirements of the end-user.

5 The methodology

To provide an easy and understandable overview of the methodology, a schematic flowchart is presented here to summarize this methodology.

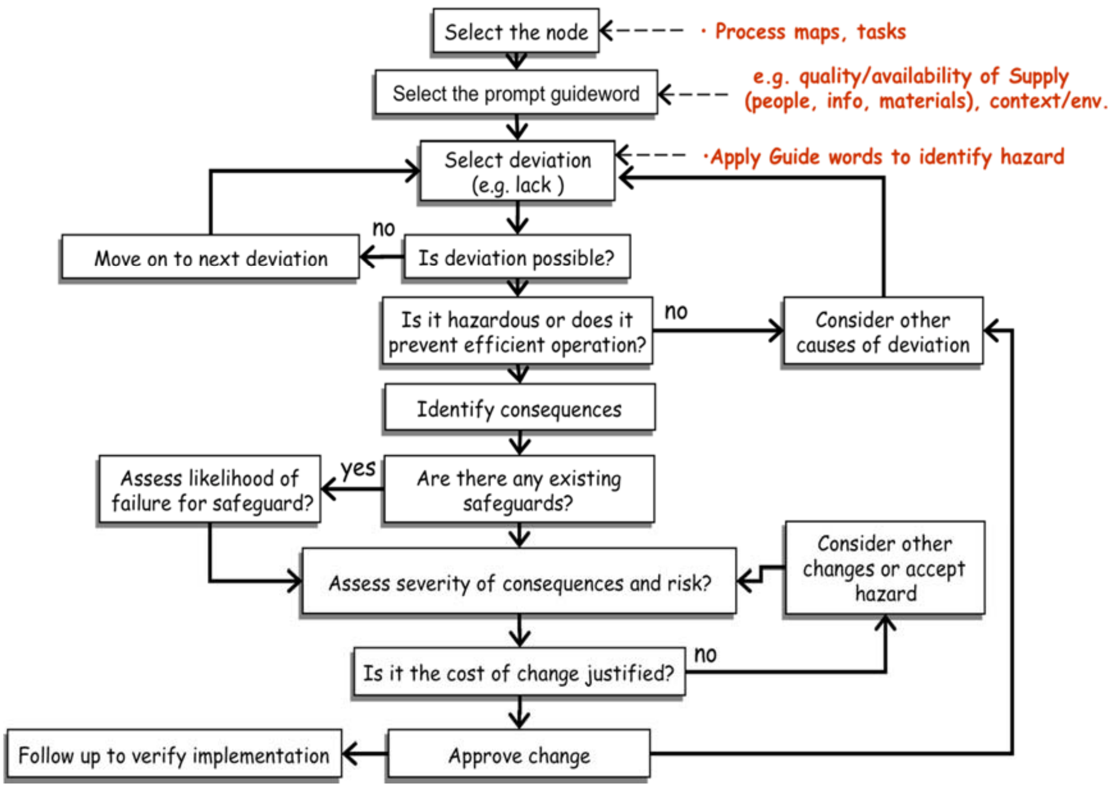

Figure 4: Schematic flowchart of the Methodology

6 Conclusions

The presented the methodology in this paper has a clear and well-defined structure for conducting a remote risk analysis. This approach can assist the risk management team in better identification and prioritization of hazards and thus a better understanding of the actual risk profile of the operations. In safety critical industries the human action is one of the areas that requires attention and good safety consideration (OGP, 2011). This methodology can be beneficial for industrial companies to capture the potential human errors and control the risk in a more reliable manner.

Specifically in the example provided the risk assessment was able to restructure the task itself and make it safer and more efficient. In overall, that let to about 25 specific operability and safety related recommendations to be considered further on at the inspection and maintenance procedure detailed planning level. Examples are i.) A better logic sequence of the tasks and sub-tasks, for each to consider validation criteria for completeness; ii.) To anticipate suffocation hazards and required work permits; iii.) To prepare a more detailed nitrogen purging protocol; iv.) Consider the provision of back-up fixed piping - in a case of hose pre-maturely ruptures during pressure testing; v.) The involvement of contractors in a pre-operations safety briefings on the specific task(s), and vi.) The specification of the safety-envelopes for safety relevant parameters (at specific procedural steps), and clear decision criteria for next procedural steps (“go/no-go” decisions).

SMEs (Small and Medium Enterprise) may not have the essential resources within the organization to conduct such a workshop onsite, but this new approach can help the SMEs to receive the required support remotely from a relevant expert. This has been particularly tested during the case study, where different experts from various locations (three different EU member states) joined the session remotely and participated to the risk analysis workshop. Only one experienced engineer from the site was involved in the workshop. The group was able to consider all the hazards and the results were received with open hands by the plant personnel. The transparency of the results/recommendations obtained was clearly noted. This was facilitated by the use of structured risk analysis tools such as SCOPE. Thus, the method does not require any new knowledge or enhanced training for the end-user team, or the user organization. It is based on utilizing existing knowledge and expertise to optimize the efforts of the risk management team. The benefits of the approach include time and cost savings and although the remote method may not be suitable for risk assessing high-risk operations, it is well suited to improving safety and productivity on smaller projects.

Acknowledgements

The above-mentioned research has received funding from the European Commission's Seventh Framework Programme FP7/2007-2013 under grant agreement FP7-NMP-2012-SMALL-6-310201 “TOSCA” and it is © copyright of TOSCA project consortium) and also in collaboration with the Marie Curie ITN Project called InnHF under grant agreement 289837. We also kindly thank Mr. Fabio Mattei as the IT developer of the Software tool used (SCOPE) and Mr. Janez Sužnik from Plinarna Maribor d.o.o. in Slovenia.

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