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HAZOP study with qualitative risk analysis for prioritization of corrective and preventive actions

L. Kotek a*, M. Tabas

Brno University of Technology, Technicka 2896, Brno 616 69, Czech Republic

Abstract

The objective of the Traditional HAZOP study is (with collaboration of multidisciplinary team of employees of contractor) to identify potential hazards operability issues in process (Hazard and Operability Analysis) and to propose preventing actions. But there can be used also quantitative HAZOP study, which is able to estimate the risks in accordance to multi-factor Risk Assessment. The qualitative HAZOP analysis technique uses a systematic approach to identify possible deviations from normal operations and ensure that appropriate safeguards are in place to help prevent accidents with keywords for generating deviations from safe condition. Quantitative HAZOP is based on development of scenarios and finding the causes deviations, to identify safety functions and estimate the final effects, but it more complements the assessment of severity and probability of each scenario - it allows selecting the most important preventive recommendations for implementation.

Keywords: HAZOP; qualitative risk analysis; risk prioritization

* Corresponding author. Tel.: +420 5 4114 2391; fax: +420 5 4114 2449.
E-mail address: kotek.l@fme.vutbr.cz.

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1. HAZOP study

1.1. Introduction

Basics of the method HAZOP originated from the need to identify hazards of handling of hazardous substances in the chemical industry. The aim of the method is to identify hazards and with the proposed measures to minimize or completely eliminate potential sources of risk.

After more than 30 years of using HAZOP method [1], this method is widely accepted standard and has extended to other industries (now used in a wide range of businesses from pharmaceutical companies, through mechanical engineering to electrical engineering). For practical applications, it is clear that if HAZOP is used to a complex technology as a whole, the result is a wide range of scenarios.

Since the implementation of all recommendations of the HAZOP analysis can be very expensive, selection of these scenarios with regard to their relevance to safety and operability of technology assessment is a logical requirement of the sponsor of HAZOP study.

Similar effort to supplement HAZOP method with risk assessment occur in some contributions, see article [2], which deals with the possibilities of linking approaches HAZOP and FTA or article [3], which is aimed at merging method HAZOP with checklists.

Efficient possibility for selection of important scenarios identified by HAZOP study is adding of qualitative risk analysis - as described in this article.

1.2. HAZOP Study

HAZOP (Hazard and Operability Study) is a systematic safety study, based on the systemic approach towards an assessment of safety and operability of complex process equipment, or the production process.

Table 1. A dictionary of the keywords for a HAZOP study

Keyword	Logical meaning	Example
NO	Total negation of the original function	No flow
MORE	Quantitative increase	Higher flow
LESS	Quantitative decrease	Lower flow
AS WELL AS	Qualitative increase (occurrence of another case)	Penetration of a water into the reactor
PART OF	Qualitative decrease	A compound is missing
REVERSION	Opposite function (activity)	Reverse flow of a medium
OTHER THAN	Total substitution	Presence of other substances
EARLY	Premature function (activity)	-
LATE	Delayed function (activity)	-
BEFORE	Relating to order or sequence	
AFTER	Relating to order or sequence	