DYNAMIC SAFETY RISK ANALYSIS OF WATER PLANT CHLORINATION USING DYNAMIC BOW-TIE APPROACH

NOR AQILAH BINTI MUHAMAD NASIR

BACHELOR OF CHEMICAL ENGINEERING (ENVIRONMENT) WITH HONOURS

UNIVERSITI TEKNOLOGI MARA

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I declare that the work in the thesis was carried out in accordance with the regulation of Universiti Teknologi MARA. It is original and is the results of my own, unless otherwise indicated or acknowledge as reference work.

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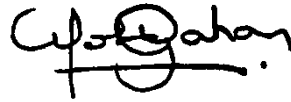
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Nor Aqilah Binti Muhamad Nasir

Student ID: 2017485244
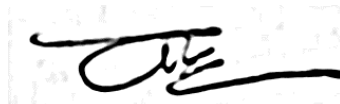
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Signed : ……………………

Date : ....07 September 2020

Main Supervisor
Ir Mohd Azahar Bin Mohd Ariff
Faculty of Chemical Engineering
Universiti Teknologi MARA
Cawangan Pulau Pinang
13500 Permatang Pauh
Pulau Pinang

Signed : ……………………

Date : ....07 September 2020

Co Supervisor
Noor 'Aina Abdul Razak
Faculty of Mathematics
Universiti Teknologi MARA
Cawangan Pulau Pinang
13500 Permatang Pauh
Pulau Pinang

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ABSTRACT

Chlorine is one of the hazardous materials and needs to be handled carefully. In water chlorination system at water treatment plant (WTP), there was potential hazard to the workers and the population nearby the water treatment plant. To identify this hazard, risk assessment is the one of the techniques that can be used to eliminate the hazard and measure the risk other than to identify the hazard. But due to the limitation of being static of conventional risk assessment, many researchers were study to update the conventional risk assessment to the dynamic risk assessment. This paper was aimed to update the conventional bow-tie analysis to the dynamic one by mapping bow-tie (BT) into bayesian network (BN) using Genie software. Posterior probability was used to replace the prior probability in this study to update the conventional to the dynamic. Three time interval was mapping into BN to show the dynamic risk assessment by assuming no maintenance for three years. To conduct this study, Kelar water treatment plant was chosen as the case study. Failure mode effect analysis (FMEA) was used to determine the potential hazard in the water chlorination system. Chlorine leakage from drum was chosen as the worst-case accident for this study of the top event to map the BT and BN. Besides that, ALOHA modeling software was also being used to determine the area concentration of chlorine emission nearby the population of Kelar WTP if there was a chlorine leakage. The worst cases of the accident was a leaking from 5 mm hole of body drum that would affect about 15 villages nearby the Kelar WTP. By implementing this approach, the accident can be prevented as well as eliminated.

Keywords: FMEA, Bow-tie, Bayesian network, ALOHA, Genie Software