UNIVERSITI TEKNOLOGI MARA

ANALYSIS OF WATER HAMMER BY USING PIPENET SOFTWARE AND MANUAL METHODS

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ABSTRACT

The lack of knowledge about water hammer phenomenon among engineers and operators can contribute to frequent occurrence of water hammer in industry. Water hammer is known can cause accident such as rupture of the pipe, flange and other components in the piping system or even explosion. Due to the impacts of water hammer, the safety officers from the industry together with the engineering consultant in this major have come out with variety methods that can reduce or eliminate the water hammer impact and occurrence. In this report, the methods used including the Pipenet software simulation and manual calculations. There are two objective of this report which are to investigate the effect of pipe length, valve closure rate and fluid flow rate on the surge pressure inside a closed conduits and to determine the applicable method in reducing the surge pressure. From the results obtained, the pressure surge recorded was becoming high as shorter pipe, rapid valve closure and higher fluid flow rate was used. As for the second objective, the installation of accumulator tank was found to be the most applicable method due to minimum cost and the effectiveness in mitigating the water hammer which at about 70% effectiveness. Therefore, it is proven that surge pressure or water hammer is affected by various factor such as pipe length, valve closure rate and fluid flow rate and many prevention methods exist but analysis shall be done before applying it to achieve optimum performance and costing.

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CHAPTER ONE INTRODUCTION

1.1 Summary

Water hammer is a phenomenon that occurs in a closed conduit of the piping system. However, this phenomenon is undesirable due to its effects in which it can range from minor to severe impact and even it will cause a catastrophic impact towards human and environment. Such phenomenon occurs when the fluid experience an abrupt change in velocity either the fluid is forced to stop or change its flow direction. The normal conditions that may contribute to this phenomenon such as pump starts or stops, valve opening or closing. Other than that, the unpredicted or abnormal condition such as power failure also will lead to this surge pressure to occur. Process engineers usually responsible in conducting the water hammer analysis in the design phase of the piping system. They need to ensure the material used and nominal thickness is at optimum with the service and design conditions. However, when it comes to the modifications or changes on the piping system, process engineer must perform the new analysis so that the new equipment/conditions will not produce pressure that exceeds the pipe strength. In order to conduct the analysis, the method used can be divided into two which are software and numerical solution. Software is known to be the faster method to get the results by just inserting all the required information. This research will use Pipenet software as modern simulation. Although the numerical solution need much more time, but it still can be used to compare the results obtain from the software simulations. The numerical methods for this research will use the Joukowsky expression and Allievi charts and expression. The scope of this research mainly will cover on the effect of valve closure rate. The other factors that possibly affect the surge pressure are shown in the following research scope. After carrying out the analysis, engineers must seek any possible way that may diminish or present the hammering effects so that the piping systems have longer life span.