BOILER INCIDENTS IN PROCESS INDUSTRY SEQUENCE ANALYSIS

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ABSTRACT

This paper presents a quantitative risk assessment-based approach for assessing and evaluating the plant safety involving boiler failure in process industry. Lists of contributory and sub-contributory factors of boiler failure incidents are developed. These factors are grouped under more general categories; Human Error (HE), Management Error (ME), Equipment Error (EE) and Design Error (DE). Boiler failure incident sequences are developed using Event Trees (ET). A combination model of Event Trees and Fault Trees are developed and has been applied to Loy-Lange Box Company Boiler Explosion Incident for validation of resulting model. From the calculation, it can be seen that the percentage for a boiler failure incident to occur in process industry is 0.187% while the percentage for the boiler to stay at safe condition is about 50%. This shows how important it is to improve the efficiency of prevention barrier in order to keep the boiler under safe and good condition.

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CHAPTER 1

INTRODUCTION

1.1 Summary

Boiler is widely used in process industry to generate steam for various purposes. Since boiler works under high pressure and temperature, hazards associated with boiler is almost as significant as its importance in the industry. This research aims to determine contributory and sub-contributory factors of a boiler incidents and the linearity and non-linearity of the factors by combining Fault Tree and Event Tree Analysis. This will give complete overview regarding the boiler incidents in process industry since the two methods are related and their combination will enhanced the effectiveness of both methods.

1.2 Research Background

Boiler is simply defined as any closed vessel used to generate steam. It produces steam from the combustion process of the fuel source such as oil or gas. The chemical energy produced from the combustion is converted into heat which is then transferred to the contained water which increases the pressure and eventually converting the liquid form into steam (Stranks, 1996).

The application of the boiler will vary depending on the plant. Among the main application of boiler in industry are for supplying power to electric generating equipment, blowers and pumps; to power the plant's heating and air conditioning units for both workers comfort and to keep equipment at proper operating temperatures. In some cases, it is also involved in the sterilization process or in achieving required processing temperature.

The safety concern regarding industrial boiler are often triggered by boiler overheating due to loss of feed water to the steam boiler (Amina Lyria, 2016) and also the failure of pressure