UNIVERSITI TEKNOLOGI MARA

ANALYSIS OF TOTAL BURN SURFACE AREA FROM BLEVE FIREBALL IMPACT AT DYNAMIC PARAMETER CONDITION

AIMAN HAZIM BIN MOHD ZAIDI

Thesis submitted in fulfillment
of the requirements for the degree of
Bachelor of Degree Engineering Hons. Chemical

Faculty of Chemical Engineering

July 2019

ACKNOWLEDGEMENT

I would like to express my greatest gratitude to Allah S.W.T. for His willingness and consent which contribute to the success of my research paper entitled “Analysis of Total Burn Surface Area from BLEVE Fireball Impact at Dynamic Parameter Condition”. Without His guidance and Mercy, I may not have been able to finish up my research paper as a requirement of my course syllabus.

First and foremost, I would like to thank Ir. Dr. Zulkefly Ab Rashid for his support and encouragement. He kindly read my paper and offered invaluable detailed advices on grammar, organization and the theme of the paper. His guidance help me all the time in research and writing this paper.

Second, I would like to thank Dr. Sherif & Dr. Rahidawati for their valuable comments and advices during Research Project I & Poster Presentation respectively. Their discussion around my work have been an interesting experience on my flawed work.

Finally, I sincerely thank to my parents, family and friends, who provide the advice and encouragement. The product of this research paper would not be possible without all of them.

Thank you.

ABSTRACT

Feyzin disaster during 1966 in France will always leave a big mark in engineering industry as it involved many casualties. The disaster would make a perfect example of case study on impact of BLEVE fireball towards nearby occupants. The methodology to investigate BLEVE's characteristic, fireball's impact toward the effect of TBSA to human during Feyzin incident is by using BLEVE's dynamic model in the analysis. All scenarios involved during the analysis such as sphere tank design, chronology of accidents, and other relevant input is based on ARIA Feyzin incident report. The probability of occupants and the thermal dosage required for the fire personnel to get caught on fire and suffers different type of burns are determined with different distance from fireball. TBSA charts and age from JP Bull is simplified to RSM model, to determine the burn surface area on human's body. Next, 150 rescue personnel who were standing 100 to 120 meter from the centre of explosions will be investigated to determine the real possibility of mortality rate with the reported casualties. The results of the analysis found that it would take at least 32,000,000 kW/h of thermal dosage required for a victims to be inflicted with deaths. However, the model use did not have the same result as the real casualties reported. New models need to be invented to get a proper reported casualties.

Table of Contents

CHAPTER 1

INTRODUCTION

Mexico City, Mexico, 1984 – People of San Juanico were shocked when they heard an explosion at approximately, 05:35 A.M on 19 November 1984. The explosions causes a chain reaction of explosion with a 0.5 Ritcher scale maximum from nine explosion occurred. According to a journal [1] total casualties from the disaster counted were approximately 500 were killed, 7,000 were injured and 200,000 people were evacuated. Some of the fragmented cylindrical pressure blown up to 1000 meters from the centre of explosions. The vapour cloud had reached above 2 m height when it first ignited. The disaster marked as the worst disaster involving BLEVE globally.

BLEVE is a short term for Boiling Liquid Expanding Vapour Explosion is one of a major hazard which have low possibility to happen but with high consequences. Definition of BLEVE according to Robin Pitbaldo is "any sudden loss of containment of a liquid above its normal boiling point at the moment of its failure. It can be accompanied by vessel fragmentation and, if a flammable liquid is involved, fireball, flash fire, or vapour cloud explosion." Liquefied Petroleum Gas (LPG) tanks and Liquefied Natural Gas (LNG) tanks are the most popular equipment that were most certainly to BLEVE according to past accidents statistics. The accidents were always occur due to domino's effect. According to a research conducted by [2], the leading root cause of BLEVE is from a fire (36%) with mechanical damage (22%) follow close. One of the example of BLEVE disaster involving fire as the root cause is the Zarzalico Accident in Spain [3]. The truck carried Liquefied Natural Gas were involved in an accident that were cause by the driver error. Soon after the accident, fire were ignited with the co-driver trapped inside the truck and the driver couldn't do anything about it. Several hours later, the crowd heard a shrill whistle from the tank which the fire intensifies and the tank explodes.