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**TITLE:**

Dynamic Process Safety Assessment By  
Mapping Aloha Simulation into Bow-Tie Analysis:  
Application to Distillation Column in  
Production Of Methanol Route 1

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## ABSTRACT

The increasing use and distribution of chemicals are causing serious chemical accidents such as fires, explosions, and leaks during manufacturing and handling. Regarding the reports on the past accident investigation, an accident starts with loss of containment of hazardous substance resulting in fire, explosion, or vapor cloud explosion. The study's goals are to analyse the safety hazard and risks posed during the preliminary design stage and to propose an appropriate risk mitigation strategy for reducing the identified hazard and measured risk using Basic Over Web Tactical Imagery (BOW-TIE) analysis and Areal Location of Hazardous Atmospheres (ALOHA) software. In this study, the BOWTIE analysis method and the ALOHA software are integrated to improve the present safety assessment methods and their application to the design and design of chemical processes. This is due to existing methods having limitations, such as unable to predict the threat zone and the inability to predict the risk assessment. BOW-TIE analysis is incapable to predict the clear consequences of the threat zone and is unable to predict visually. However, using ALOHA software may estimate the threat zone's distance to visualize the damage range of the hazard consequences. ALOHA is needed to overview the accident possibilities that may occur in that location. In this study, Production of Methanol Route 1 in Distillation column shows that the worst threat zone that releases Methanol. The red zone is around 1.1 kilometres (AEGL-3) and the range of the orange zone is around 1.8 kilometres (AEGL-2) and the yellow zone is 3.1 kilometres (AEGL-1). As the result, this study was carried out to enhance and combine ALOHA software and BOW-TIE analysis in order to create a more comprehensive assessment towards hazard and risk consequences and also cover a research gap by developing an integration method.

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# CHAPTER ONE

## BACKGROUND

### 1.1 Introduction

Process safety is an essential aspect of the chemical industry and plays a critical role in ensuring the safe and efficient operation of processes. The production of methanol via distillation columns is a critical process in the chemical industry. Using heat and pressure, methanol is separated from a mixture of other chemicals. Because of the hazardous nature of the chemicals used in this process, it is critical to ensure the operation's safety during the preliminary design stage.

The Bow-Tie Analysis and ALOHA Software is a widely used methods for risk assessment in the chemical industry. One limitation of using ALOHA alone is that it does not provide a complete understanding of the system because it only focuses on the potential consequences of a chemical release. But when used together with bow tie analysis, these two methods can give a more complete picture of the possible risks and hazards, as well as the controls that can be put in place to reduce these risks. Bow-Tie Analysis approach involves mapping the components of a process and its associated hazards into a visual representation of the relationship between threats, events, and consequences.

In this study, the BOWTIE analysis method and the ALOHA software are integrated to improve the present safety assessment methods and their application to the design and design of chemical processes. The study aims to analyse the threat zones of a distillation column in production of methanol based on different sources and scenarios. Thus, the mapping of the Aloha Simulation into a Bow-Tie Analysis can provide a visual representation of the process safety and enables a better understanding of the relationships between the various components.