Non-Routine Flaring in Upstream Oil and Gas Industry—Root Causes and Mitigations

Maryam AL Kamali

Abstract

As human activities in the oil and gas industry increase in order to improve our increasingly complicated lifestyle, the possibility of station shutdown and equipment failure increases, which in turn increases non-routine flaring. Although non-routine flaring happens in a non-continuous basis and for short periods of time, it leads to high amounts of gas flaring which impacts the environment in the long term. As a result, this thesis will deep dive into the non-routine flaring issue. We investigate the issue to identify the root causes of non-routine flaring and we propose key recommendations for minimizing the occurrence of such incidents in the future.

This study deals with non-routine flaring issues and based on literature research, we found that it is a novel subject which has not been conducted in such depth before. Therefore, data gathering and data analysis are important steps in this study. This thesis focuses on data collection and analysis of non-routine flaring incidents, in particular those that happened in six production stations located in southern Oman. These stations were chosen because they have high non-routine flaring frequency and high flared volume compared with other stations. This will help define the bad actors that contributed to the frequent failure of the involved equipment. Bad actors are identified based on the frequency of equipment failure, amount of gas flared during the incidents and the duration of incidents. Moreover, risk assessment matrix and root cause analysis were carried out to help in identifying the risk for each bad actor and the main causes behind the frequent failure. These resulted in proposing suitable solutions in order to minimize the failure occurrence in the future. In addition to that, a comparison between three years was conducted in order to know which year has much more representative data for the analysis. Finally mitigations and recommendations are suggested to minimize the frequent occurrence of such incidents.

This study found that the main three bad actors are the chiller compressor in station A, gas recovery compressor in station B, and gas injection compressor in station C. Moreover, risk assessment shows that all bad actors fall under high risk cases, which indicates the criticality of failure of these equipment. Furthermore, root cause analysis has shown that the main reasons behind the frequent failure of equipment are damage of internal parts of compressors, lack of preventive maintenance in some areas, and lack of quality of maintenance for certain rotating equipment.