

Investigation of Hand Injuries During Turnaround Based on Job Hazard Analysis

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Abstract: Work-Related Hand Injuries (WRHIs) may lead to disability, decreased productivity, and economic effects on the affected person and their families, employers, and local society. This studied aims to determine the rate of accidents involved hand injuries in service valves in the oil and gas industry. This studied had been conducted at MRCSB's Plant 1 (area 4). Three objectives have been listed, to investigate the root cause of accidents related to the work process during turnaround, to analyse hand injuries accident based on past data accidents during turnaround, and to recommend controlled measures for reducing hand injuries based on the hazard. From the comprehensive data on accidents 2019 and 2022, 141 accidents happened, and 41 cases were from hand injury accidents. A method of Job Hazard Analysis (JHA) had been applied to knew the hazard and the risk rating of each worked activity. Therefore, proper risk assessment and communication are necessary to reduce hand and finger injuries. In summary, Job Hazard Analysis was one of the controlled measures that being proposed and developed that was required for the safety and health worker to work in a safe condition.

Keywords: Hand Injury, Turnaround in Oil and Gas, Job Hazard Analysis

1. Introduction

A severe injury to the hand was referred to as a mutilating hand injury. It had been difficult or impossible to utilize the hand as a result. Employees in any job focused on the operation of the machine had the potential to expose themselves to hand-related accidents. Several factors contributed to these injuries, including a lack of attention, careless use of machinery or tools, and inadequate maintenance of workplace equipment [1].

Due to the continuous operation of all equipment in the oil and gas sector, it was challenging to execute required inspection and maintenance operations without bringing the equipment offline. During the refining process, a refinery unit undergoes a turnaround, which was a major maintenance event [2]. As a result, most refineries execute shutdowns or turnarounds every two, three, or five years. Turnarounds' main objective was to complete the activities necessary to maintained the plant running as safely, consistently, and productively as needed [3].

Furthermore, various types of activity could cause the number of hand injury accidents that increase related to mechanical worked during turnaround [4]. Most severe hand injuries commonly occurred among mechanical fitters and general workers. Mechanical work such as dismantling, valve installation, blinding, and de-blinding activities, including types of equipment such as flange, stud bolt, and operating manual lifting equipment (lever blocked and chain blocked).

2. Methodology

This methodological studied aims to made it more systematic and ensured that the progression of this study has been more organized.

2.1 Materials

Previous researched, journals, and studied were gathered to had a better knowledge of this study, which was focused on the hand and injuries hazard in oil and gas industry.

2.2 Methods

This study employs a quantitative approach to data collection. Conducting a risk assessment has been accomplished by used the JHA of mechanical work and analysed the accident data. To assess the activities and identified the tasks that most contribute to hand injury, a site visited had been conducted. This was followed by a risk ranking system based on the specified jobs.

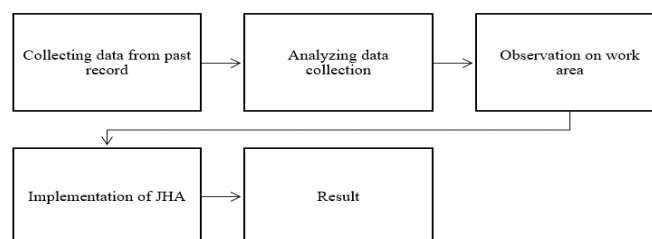


Figure 1: Flowchart of data collections

3. Results and Discussion

Each piece of information collected was subjected to an analysis known as JHA. By used data accident report, the numbers of root cause of hand injuries have been provided by the work process so

that the effectiveness of preventive measures in JHA risk assessment in identifying hazards and controls to mitigate the hazards could be determined.

3.1 Data accident report based on service valve during turnaround 2022

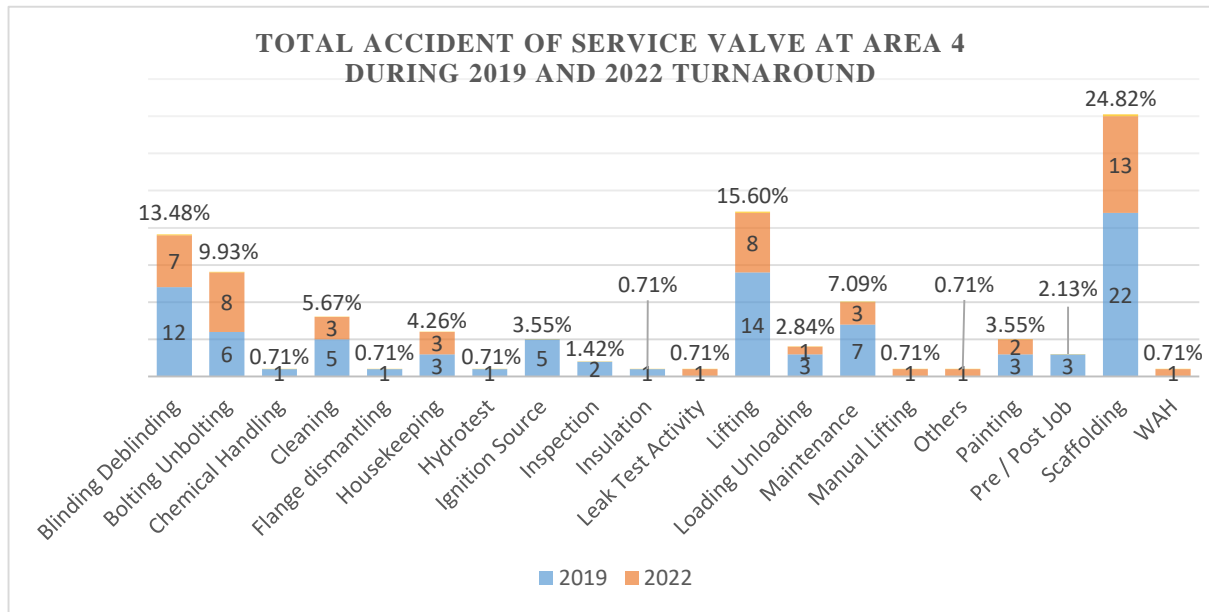


Figure 2: Total accident of service valve at area 4

The result in figure 2 provides the number of accidents dropped sharply from 89 cases (63.12%) in 2019 to 52 cases (36.88%) in 2022. Evidently, scaffolding activity had the highest number of cases in 2019 and 2022, with 22 and 13 cases, which made the total of cases are 35 (24.82%). This was followed by lifting activity with 14 cases in 2019 and 8 cases in 2022, where both years held 22 (15.60%) cases. While blinding and de-blinding activity shows 12 cases in 2019 and dropped to 7 cases in 2022, bringing the two years total to 19 cases (13.48%). Regarding bolting and unbolting activity, 6 cases occurred in 2019 and 8 cases in 2022, with both years making the total 14 cases (9.93%). Despite the high number of cases overall in 2019, several activities, such as leak test activity, manual lifting, others, and working at height (WAH), had a rise of 1 case (0.71%) in 2022. This trend of cases shows a significant drop to several activities in 2022 but a slight increase with 2 cases in bolting and unbolting activity from 2019 and 2022.

Even in three years gap of 2019 and 2022, scaffolding activity still held the highest number of cases during the turnaround. From this figure, we can conclude that scaffolding activity was the main root cause in servicing valve process.

3.2 Hand injuries accident report based on service valve during turnaround 2022

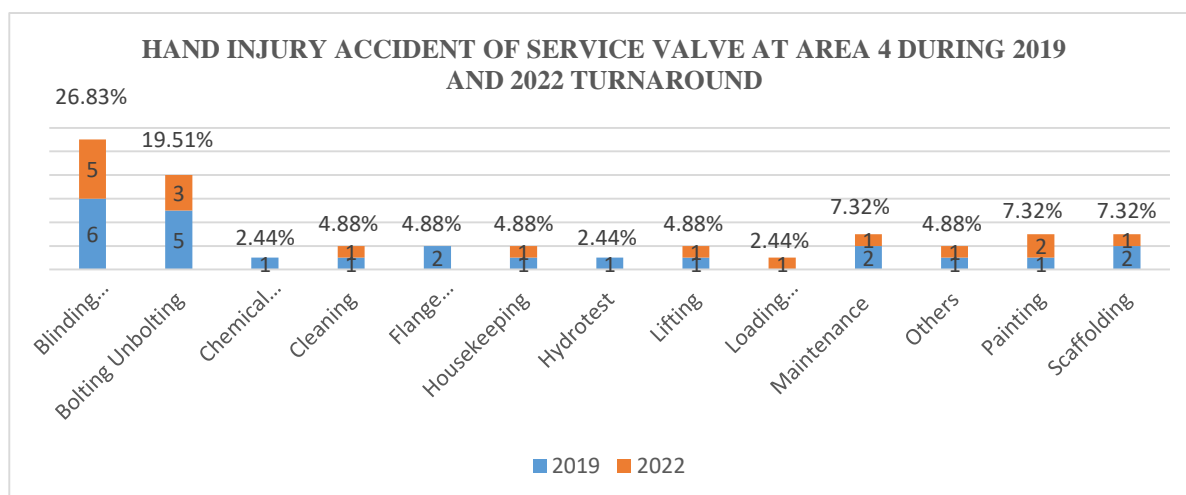


Figure 3: Total accident of service valve at area 4

The result in figure 3 provides the number of hand injury accidents for each worked activity dropped from 24 cases (58.54%) in 2019 to 17 cases (41.46%) in 2022. Evidently, blinding and de-blinding activity contributed to the highest number of a hand injury accidents in 2019 and 2022, with 6 and 5 accidents, respectively, which made the total of accidents 11 (26.83%). This was followed by bolting and unbolting activity, where both years held 8 (19.51%) accidents, with 5 accidents in 2019 and a slight decrease to 3 accidents in 2022. For loading and unloading activity, no accidents were recorded in 2019, but the accidents appeared in 2022 with 1 (2.44%) accidents. Meanwhile, in painting activity, a slight increase in 2022 than 2019 accidents, with 2 (4.88%) and 1 (2.44%) accidents were recorded, respectively.

From this figure, we could conclude that blinding and de-blinding activity was contributing the highest hand injury accident in 2019 and 2022. Even the accident dropped with only one cases, this activity was still at the top of hand injury accident during turnaround.

3.3 Control measure by using Job Hazard Analysis

Table 1 shows that hazards were identified based on the highest total of accident of servicing valve process and the highest risk rating in hand injury involve. The process involve are erection, modification and dismantle of scaffolding activity, bolting and unbolting (loose bolt and nut), and blinding and de-blinding. These worked activities were the main part on servicing valve.

Table 1: Job Hazard Analysis for servicing gate valve weight 4” at area 4

| Step No. | Description of Step/ Task | Potential Hazards | Initial Risk Rating | Control Measures | Final risk rating |
|----------|--|-------------------------|---------------------|--|-------------------|
| 1 | Erection, modification and dismantle of scaffolding activity | Working at height (WAH) | High | Erector must wear full body harness with double lanyard and ensure its secure properly The area must be barricade and allocated the warning signage Ensure all workers attend WAH training | Medium |
| 2 | Bolting and unbolting (loose bolt and nut) | Hand injury | High | Make sure wear proper PPE (semi leather glove) and beware of pinch point To use Hydraulic Torque Wrench (HTW) machine | Medium |
| 3 | Blinding and de-blinding | Leak and spill or | High | to reconfirm the location with Operation and witness blinding and de-blinding activity and follow LOTO system | Medium |

| | | | |
|---------------|------|--|--------|
| valve passing | | Ensure supervisor to install blind tagging and fill-up JIT form | |
| | | Supervisor to reconfirm the valve condition with operation | |
| | | Ensure workers to wear half mask respirator (N6009) during blinding activities | |
| | | Provide running water and spillage drum or tray during blinding and de-blinding activity | |
| Hand injury | High | Make sure wear proper PPE (semi leather glove) and beware of pinch point | Medium |
| | | To use hydraulic flange spreader | |
| | | Use correct tools and ensure the tools are in a good condition | |

4. Conclusion

This researched had produced information about the contributing factor towards hand injury in the service valve process. Comprehensive data on accidents in servicing valves during turnaround, specifically hand-related injury accidents, had been collected. Finally, the trend of hand-related injury accidents for 2019 and 2022 had been obtained. This researched had succeeded in achieving all three of its objectives. According to the first objective, there were twenty worked activities of the root cause was identified in the service valve process during turnaround. In the following objective, hand injuries had been analysed, where blinding and de-blinding activity contribute most in hand injuries accident, with 6 cases in 2019 and 5 in 2022. The third goal had also been accomplished by using JHA. According to this researched, three worked activities, the erection of scaffolding, bolting and unbolting, and blinding and de-blinding, had a high-risk rating. Therefore, eliminating the hands-on activity or implementing engineering controls should be prioritised to reduce employee exposure to avoidable hazards. In the hierarchy of controls, protective gloves should be regarded as a final mitigation option [5]. A similar studied might been carried out at different unit in processing plant, develop different data collection methods, and gathered for hand injury data on hot work activities.

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