

INCIDENT INVESTIGATION TRACKING
SYSTEM BASED ON PROCESS SAFETY
MANAGEMENT

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Bachelor of Occupational Safety & Health with
Honours

UNIVERSITI MALAYSIA PAHANG

INCIDENT INVESTIGATION TRACKING SYSTEM BASED ON PROCESS
SAFETY MANAGEMENT

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Proposal submitted in fulfillment of the requirements
for the award of the degree of
Bachelor of Occupational Safety & Health with Honours

Faculty of Engineering Technology
UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2018



SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis/project and in my opinion, this thesis/project is adequate in terms of scope and quality for the award of the degree of Bachelor of Occupational Safety and Health with Honours.

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ACKNOWLEDGEMENTS

I am thankful to anyone who have assisted me directly and indirectly in many ways in order to make this Final Year Project successful.

First of all, I would like to record my deep appreciation and sincere thanks to my supervisor Dr Hanida Abdul Aziz for her critical comments and suggestions, as well as her precious time; Faculty of Engineering Technology that gave me a chance for developing this Final Year Project; and all my course-mates for your friendship and intellectual discourse we have had for the whole duration of the course.

Next, I would like to dedicate this small piece of work to my father, my mother and my sister for their wholehearted support, encouragement and understanding.

Lastly, I want to express my appreciation to two factories at Gebeng, Kuantan, Pahang that willing to accept me for carrying out the system validation at their companies and providing useful information for my Final Year Project improvements.

ABSTRACT

Incident investigation is a method to determine root cause of the incident and propose corrective actions to prevent recurrence. It is one of the element under Process Safety Management (PSM) OSHA 29 CFR 1910.119 (m) regulation. Although this regulation established in 1992, some catastrophic process safety accidents still occurred. This is because there are some problems that caused the failure of the implementation of this regulation. People failed to record and document the underlying causes had cause this element failed. Besides that, the proposed corrective actions did not implement properly in most of the cases to prevent recurrence. Furthermore, people unable to learn the lessons from the past incident cases as the incident investigation reports are difficult to be accessed. Even though the incident reports are able to access, the information in the report may incorrect as the organisation may alter the information in order to protect its privacy. Some information are missed out as there is no proper tool to aid this complex incident investigation procedures. Thus, this study is about the development of a full incident investigation tracking system to ease the implementation of PSM program. An improved framework is developed by arranging the requirements during an incident investigation and organising the incident investigation steps accordingly. Then, the framework is loaded into Microsoft Access to form an incident investigation tracking system. After the tracking system is completed, it is verified with two case studies. If there are lack of the required information in the case studies, the tracking system will prohibit the user to proceed to the following steps as this is the gap in the incident investigation report.

ABSTRAK

Siasatan kes kejadian ialah kaedah untuk menentukan punca kejadian dan tindakan pembetulan untuk mencegah kejadian yang sama berulang. Ia merupakan salah satu unsur dalam Undang-undang Pengurusan Keselamatan Proses (PSM) OSHA 29 CFR 1910.119 (m). Walaupun undang-undang ini digubalkan pada 1992, beberapa bencana keselamatan proses masih berlaku. Hal ini adalah disebabkan beberapa masalah telah menggagalkan pelaksanaan undang-undang ini. Kegagalan merekod dan mendokumenkan punca-punca kejadian telah menyebabkan unsur ini gagal. Selain itu, tindakan pembetulan yang tidak dilaksanakan dengan betul telah gagal mengelakkan kes kejadian berulang. Tambahan pula, laporan sisatan yang tidak dapat dibaca oleh pihak awam telah mencegah pihak awam belajar pengajaran daripada kes-kes kejadian tersebut. Walaupun pihak awam dapat mengakseskan laporan kes kejadian, maklumat tersebut mungkin telah berubah untuk melindungi kesulitan organisasi tersebut. Sesetengah maklumat yang hilang dalam laporan kes kejadian akibat kekurangan alat yang sesuai untuk menyiasat kejadian. Oleh itu, kajian ini adalah untuk mencipta satu sistem pengesanan penyiasatan kes kejadian untuk memudahkan pelaksanaan program PSM. Rangka kerja yang ditambahbaik telah menyatakan keperluan asas semasa menyiasat kes kejadian dan menyusunkan langkah penyiasatan kejadian dengan sewajarnya. Kemudian, rangka kerja itu ditransformasikan kepada satu sistem pengesanan dengan menggunakan Akses Microsoft. Selepas sistem pengesanan siap dibuat, ia disahkan dengan dua buah kajian kes. Sebarang kekurangan maklumat dalam kajian kes, sistem pengesanan akan melarang pengguna meneruskan ke langkah yang berikutnya kerana ia merupakan jurang dalam laporan kes kejadian itu.

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LIST OF ABBREVIATIONS

PSM	Process Safety Management
OSHA	Occupational Safety and Health Administration
DOSH	Department of Occupational Safety and Health
OSHA 1994	Occupational Safety and Health Act 1994
UKM	Universiti Kebangsaan Malaysia
USM	Universiti Sains Malaysia
SOCSSO	Social Security Organisation
CFR	Code of Federal Regulations
CCPS	Center for Chemical Process Safety
SDS	Safety Data Sheets
P&IDs	Piping and Instrument Diagrams
JSA	Job Safety Analysis
SCADA	Supervisory Control and Data Acquisition
DCS	Distributed Control Systems
EPA	Environmental Protection Agency
RBPS	Risk Based Process Safety
COMAH	Control of Major Accident Hazards Regulations
OSH	Occupational Safety and Health
NADDOPOD	Occupational Safety and Health (Notification of Accident, Dangerous Occurrence, Occupational Poisoning and Occupational Disease) Regulations 2004
FTA	Fault Tree Analysis
ETA	Event Tree Analysis
RCA	Root Cause Analysis
DG	Director General
PDCA	Plan-do-check-act
ID	Identification
CSB	US Chemical Safety and Hazard Investigation Board

CHAPTER 1

INTRODUCTION

This chapter provides a detailed description on the background of study, problem statements, research objectives, research questions, significance of study, scope of study, conceptual framework and definition of variables.

1.1 Background of Study

Process Safety Management (PSM) is a regulatory standard that issued by U.S. Occupational Safety and Health Administration (OSHA) at 1992 due to the happening of various major industrial disasters like Bhopal disaster 1984, Phillips disaster 1989, BASF plant explosion 1990, and Sterlington explosion 1991. PSM applies to any company that store, process and manage highly hazardous chemicals. A list of highly hazardous chemicals and their threshold amounts are regulated under PSM (Bloch, 2016; Occupational Safety and Health Administration, 2000). Since these disasters gave a serious impact on human and environment, therefore the goals of PSM are to prevent catastrophic accidents from happening or minimize consequences if the accidents happened.

A lot of countries have implemented PSM related regulations. These countries are United States of America, European Union, Japan, Singapore, United Kingdom, Canada, Australia, India, and Korea. According to Kwon (2006), number of fatalities has been decreased, and productivity as well as product quality has increased after implemented PSM in Korea. Therefore, Malaysia should encourage the implementation of PSM program to prevent major accident from happening.

PSM established 14 elements to ensure its effectiveness including process safety information, process hazard analysis, operating procedures, employee participation, training, contractors, pre-start up safety review, mechanical integrity, hot work permit,

management of change, incident investigation, emergency planning and response, compliance audits, and trade secrets (Occupational Safety and Health Administration, 2000).

Incident investigation is one of the element under OSHA 29 CFR 1910.119 (m) regulations. Based on the regulation, any incidents that will cause or probably will cause the releasing of highly hazardous chemical catastrophically in the workplace, employers should carry out the investigation within 48 hours. This investigation should carry out by a team which consist of at least one person is familiar with the process involved. Then, a report that includes date of incident, date of investigation began, description of the incident, factors that contributed to the incident, and recommendations on corrective actions should be generated. The corrective actions that have carried out will also need to be documented. Review the report with the affected personnel and the report shall keep for five years are stated in Occupational Safety and Health Administration (1992).

Incident investigation is important in determining the root cause for preventing similar catastrophic accidents to happen again. This is because when this type of accident happened, it cost several billions of financial loss, pollution to the environment, and a number of deaths. So incident investigation is important to improve the quality of working environment. According to Mihailidou et al. (2012), a major industrial accident is defined by the criteria of 25 deaths or more; or 125 injured or more; or 10000 evacuated or more. These mean that a major industrial accident will influence a large number of lives which are valuable to the productivity of an industry as well as to the families. Hence, a proper incident investigation tracking system should establish to prevent the hazards that arise through an inadequate process safety design of the chemical plant. Since PSM is focused on the prevention of the catastrophic chemical process accidents, the incident investigation tracking system should develop according to PSM for compliance.

However, based on multiple causation theory, it is difficult to determine the root cause as there will be several factors that can cause an accident to happen. These factors can be grouped into two categories which are behavioural factor and environmental factor. Behavioural factor is related to the attitude and knowledge of a worker. According to Heinrich's Domino Theory, 88% of the accidents are caused by unsafe act. These unsafe act maybe due to the negligence of the workers, incompetent of the workers and

weak health status of the workers. Environmental factor which is the unsafe condition contributes 10% to the accidents. It may be due to the broken of the equipment or hazardous work environment. However, there are still have 2% of accidents that are unavoidable (Verma et al., 2014; Raouf, 2011; Sutton, 2010; Awal & Hasegawa, 2017).

Based on HSE (2004) and Lutchman et al. (2012), incident investigation should be carried out by trained and knowledgeable person. These persons should include management persons and workers. Three teams such as initiation team, investigation team and analysis team can be formed for incident investigation to preserve the scene of incident, collect information for the incident, determine the root cause and write a report with recommended corrective actions (OSHA, 2015; Sutton, 2010). The members of these teams should be familiar with the process involved and have some investigative skills like interviewing, data collection, evaluating and analysing the data.

Since incident investigation process is so complicated, an effective delivered method like a systematic system is needed to ensure the incident investigation procedure and data management are complied with the PSM regulation. Hence, this study is about the development of a full incident investigation system that ease the implementation of PSM program. Besides that, statistics based on the accident data through the case studies will be generated to keep track on the trend of the accidents happened in the company. This can ensure the corrective actions that implemented in that company is effective.

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