CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

This chapter is mainly emphasizes on the general idea of this study along with the problem statements, objectives, significance of study, scope of study, and the study limitations.

1.2 BACKGROUND OF STUDY

Accident are caused by either unsafe acts or unsafe conditions or both (Rahim et al., 2008). Toole (2002) states that inadequate training is one of the causes of accidents happen, based on his studies in the USA. Tam et al., (2004) also support this statement because based on their study in China, lack of training is one of the factors of industrial accidents happen. When there are many accidents happened in a workplace, it shows that the environment of the workplace was unsafe and the employers were failing to provide adequate safety equipment and training to their employees. There are many accidents happen in process industries such as in a chemical plant that killed peoples' life.

In 2001, there are 785 deaths that are recorded in China while in 2000 about 1092 deaths because of the industrial accidents (Liu et al., 2005). Based on Figure 1.1, process hazard analysis, training and emergency response preparedness are the most contributing factors to the accidents (Zhao et al., 2014).

Case# Date	PSI	PHA	OP	Training	CM	PSSR	MI	WP	MOC	ERP	SME	D/I
Case 1 08/05/2006	1	1	1	1		1				1	Yes	22/29
Case 2 11/02/2006	Causal analysis not available										No	13/0
Case 3 03/03/2007	Causal analysis not available										Yes	4/1
Case 4 05/15/2007	Crude oil pipeline broken by criminals										No	0/0
Case 5 05/28/2007			1	1						1	No	5/80
Case 6 07/24/2007	1	1				1	1				Yes	9/1
Case 7 09/12/2007		1		1				1		1	Yes	6/3
Case 8 12/11/2007		1		1		1				1	Yes	8/5
Case 9 06/29/2008		1		1		1				1	Yes	6/29
Case 10 09/18/2008	Causal analysis not available										Yes	20/60
Case 11 08/01/2010	1				1			1			Yes	13/120
Case 12 07/13/2011		1		1						1	Yes	3/1
Case 13 07/25/2011	Causal analysis not available										No	0/0
Case 14 08/09/2011		1		1			1			1	Yes	3/2
Case 15 08/09/2011	Causal analysis not available										Yes	3/1
Case 16 02/24/2012				1					1	1	Yes	3/0
Case 17 03/13/2012		1		1			1		1	1	Yes	29/46
Case 18 03/23/2012		1	1					1		1	Yes	3/0
Case 19 09/14/2012		1	1	1		1				1	Yes	3/7
Case 20 09/14/2012		1		1			1			1	Yes	3/2
Case 21 09/14/2012		1		1						1	Yes	3/4
Case 22 04/26/2013		1				1	1	1			Yes	7/0
Case 23 05/20/2013	Illegal production										Yes	3/1
Case 24 05/20/2013	Causal analysis not available										No	3/0
Case 25 06/08/2013		1			1			1			No	4/0
Case 26 07/09/2013		1							1		Yes	1/5
Subtotal of SMEs	3	14	3	12	1	6	5	4	3	13	20	152/317

Note: PSI = process safety information; PHA = process hazard analysis; OP = operating procedure; CM = contractor management; PSSR = pre-startup safety review; MI = mechanical integrity; WP = work permit; MOC = management of change; ERP = emergency response planning; D/I = deaths/injuries.

Figure 1.1 Accident causal analysis information extracted from the MAI website

Source: (Zhao et al. 2014)

Based on Figure 1.1, Training is one of the most contributing factors to this accident. It is because the company did not know how to organize the training element, then the accidents continuously occur (Zhao et al. 2014). In 1984, the toxic gas leak and killed at least 2,000 people in Bhopal plant. Inadequate of training is one of the factors this accident happened. Based on Figure 1.2, the duration of training programme for

operators of UC plant, Bhopal has been decreased. This is because the top management was limiting the training of the workers for budget reductions (Chouhan, 2005).

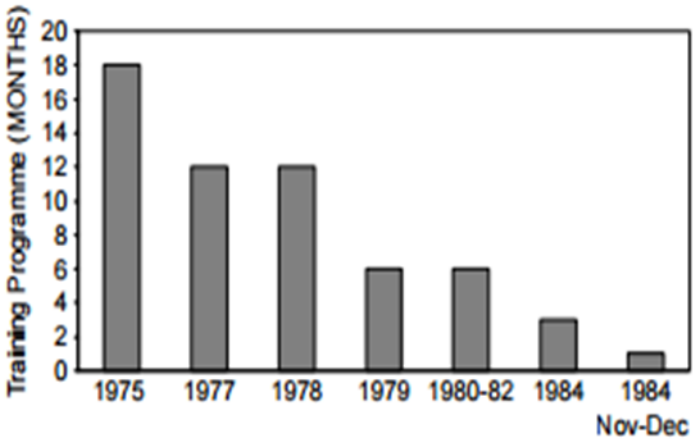

Figure 1.2 Duration of training programme for operators of UC plant, Bhopal

Sources : Chouhan, (2005)

The Texas City disaster was an industrial accident that occurred April 16, 1947, in the Port of Texas City. It was the deadliest industrial accident in U.S. history, and one of the largest non-nuclear explosions (Labib, 2014). In this case, about 15 people were killed and 180 people were injured. This is because the training department budget was cut in half since 1998 to 2004, so the trainer spent little time on actual training. On September 27, 2012, a chemical leakage accident occurred at Hube Global Co., Ltd., a chemical products manufacturer located at the 4th National Industrial Complex in Gumi City, Gyeongsangbuk Province. In this accident the hydrogen fluoride was released when the valve of the tank lorry was mistakenly opened by a worker who was injecting the gas into a facility (Lee et al., 2016). This human error factor happened due to the inadequate training of the worker.

A comprehensive reading has been done to identify the accident contributors and their root cause. The accident reports were analysed by using online database such as US Chemical Safety and Hazard Investigation Board (CSB-US) and European Major Accident Reporting System (EMARS). Based on the result in Figure 3 it shows that 53% of failures are contributed by design and technical reason and another 47% are contributed by the management related causes. From the ranking made, process hazard