CHAPTER I

INTRODUCTION

1.1 Background and statement of problem

Oil refinery manufacturing facilities consist of process plants, utility plants and systems, product storage and blending facilities, crude oil storage and receiving facilities, marine product loading facilities and road vehicle product loading facilities. These facilities are divided in various sections of operation and each section consists of many process units.

Figure 1 Process plant and storage plant in the refinery

These manufacturing facilities are extensive, technically sophisticated, integrated with substantial automation and computerized control system. The operation of these facilities requires comprehensive theoretical and practical training/experience for safe and efficient operation.

All facilities are operated round-the-clock (continuous 24 hours) in a shift cycles e.g. 8 hours and 12 hours etc.

The major challenges in refinery operation are able to detect early warning signs for impending failure of equipment, product going off grade and take necessary actions to prevent their occurrence. This includes coping with emergencies such as failure of major equipment and utilities or fire. The appropriate and immediate actions must be taken very quickly to avoid a disaster. Safety is one of major concern in the refinery in particular when equipment has to be taken out operation for maintenance or inspection.

A good communications during shift handover are essential to avoid misunderstandings that could result in hazardous situations.

The communication problems might not be cleared and concise record on the key areas of the process status that would be needed by the incoming shift operator or supervisor; no procedure and standard logbook/log sheet systems are provided. In addition, times constrain, and fatigue of the shift crew and competent of refinery operator are also among the shift handover problems.

In order to solve these problems, it is crucial to develop a general guidance of shift handover procedures, standard logbook and refinery operator competency profile. This expected that it would help improving safety issues and reduce accident/incident at oil refinery operation in Thailand.

There are quite number of the known published investigations into accidents/incidents where failure of communication at shift handover was held to have been a contributory casual factor. These were major accidents/incidents resulting in actual or potential loss of life, major property damage or environment impact. Each of accidents described failure of communication at shift handover formed part of complex combination of design and operation failure.

The followings are the cases of incident:

CASE 1

Piper Alpha was a large production platform that started production in 1976. On 6 July 1988 there was a massive leakage of gas condensate that was ignited causing an explosion that led to large oil fires. The heat ruptured the riser of a gas pipeline from another installation. This produced a further massive explosion and fireball that engulfed Piper Alpha. All this took just 22 minutes. The scale of the disaster was enormous. 167 people died, only 62 survived.

Figure 2 The major incident at Piper Alpha

It is believed that the leak came from pipe work connected to a condensate pump. A safety valve had been removed from this pipe work for overhaul and maintenance. The pump itself was undergoing maintenance work. When the pipe work from which the safety valve had been removed was pressurized at start-up, it is believed the leak occurred.

The report from http://www.ukooa.co.uk concluded that one of the many factors that contributed to Piper Alpha disaster was failure of transmission of information at shift handover. Specifically, knowledge that a pressure safety valve had been removed and replaced with blind flange was not communicated between shifts.

Costs for this lesson learnt:

The insurance placement of these value very high value and high hazard risk is extremely complex and does not just cover the damage to the facility but could effect business interruption such as:

Loss of Profit

- Third party liability
- Pollution and cleaning and debris removal.

Approximate breakdown cost:

• Physical Damage	680
• Cost of Well control	34
• Drilling Expenses	87
• Damage to Pipelines, Removal, Re-routing	30
• Wreck Removal	100
• Seepage and Pollution	4
• Business Interruption	275
• Bodily Injury and Fatalities	160

TOTAL	1470 Million ($)

CASE 2

Thai Oil, the nation's largest oil refinery, is 49 percent owned by the Petroleum Authority of Thailand and covers about one-third have the domestic gasoline and diesel consumption.

An explosion at Thai Oil refinery happened around 23: 00 hrs on 2nd December 1999 one hour after shift changed. Four Refinery workers charged by police; 7 employees were killed and 15 were injured.

The four operators of night shift were monitoring the oil tank control room and their supervisors during blending gasoline product. In doing this many components from the component storage tanks were transferred into this tank by the previous shift. However, one component left a valve (some said allegedly) on one storage tank wide open when it was being filled, causing it to overflow.

The gasoline was spilled over the tank causing cloud of vapor emission around the vicinity area. And a car engine started by employees when they were trying to leave the area when they noticed the overflow ignited it.

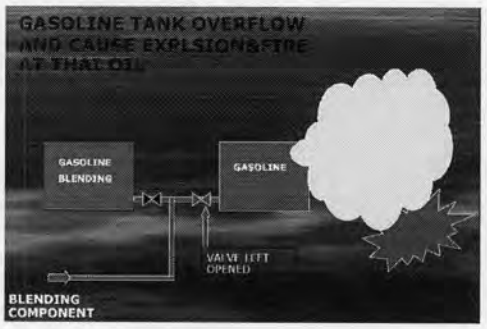

Figure 3: Diagram of incident root cause

Figure 4: Damage and impact round the area.

An explosion caused damage on the fire fighting trucks and its facilities, many houses of villagers living near by the refinery. The fire had spread from the first storage container to three others. Strong winds were fanning the flames higher than the surrounding treetops. It took more than three days to extinguish the fire completely.

The damage from the fire and explosion estimates between 850 million and 1 billion baht (between US$23 million and US$27 million). The whole refinery has to be shut down for about 2 months.

Thai Oil and Royal and Dutch Shell Group have worked together to improve control systems at the refinery in four or five key areas in the aftermath of the fire. On February 4, 2000 - 11:21 AM a company official has returned to 100 percent capacity (Full capacity is 220,000 barrels a day).

The report states that many countermeasures were recommended to prevent reoccurrence e.g. hazop study (hazardous operation study), installation of valve position indicator, procedure/instructions, Shift handover procedure was also included.

Source of Information :(www.chemsafety.gov/circ/post)

1.2 Statement of the problem:

The problem could be seen from the case study in the background statement therefore the summary of the problem in Oil refinery it would be concluded.

Summary of problems on shift handover can be listed as follows:

1. No standard procedure is provided.
2. No standard logbook/log sheet is provided.
3. Communication problem
4. Time constrain during shift handover.
5. No auditing during shift handover.

Moreover, it can be continued to investigate the root cause of the accident in some cases other than previous examples. The Implementation of this method requires consideration of possibility of whether operators are surely able to follow the procedure or not because environmental living and working condition apply to their works as well.

1.3 Objectives of the Thesis:

The objective of research is to develop further on shift handover system in oil refinery. In order to avoid the risk that causes such a fatal accident during the plant operation.

1.4 Scope of the research:

The research would include only on the shift handover problems of the oil refinery in Thailand.

1. The research would involve in how to maintain the effective shift handover system and how to implement the system of shift handover into practical operation?
2. Set up the system of protection to all individual to control all Hazard energy and chemical from equipment in the oil refinery.
3. Develop the refinery operator competency model.

1.5 Expected Benefits:

1. Provide communication skills for their shift worker.
2. Provide work instruction procedure, which specifies manners to conduct an effective shift handover.
3. Avoid or control the risk that might occur during the plant operation.
4. To ensure that all individuals on the process plant and other refinery facilities are protected from accidental or unexpected activation of mechanical and/or electrical equipment during maintenance, repairing, cleaning, servicing, or adjusting of prime movers, machinery, or equipment.

Apart from this the research results would also provide information on strategy to improve their shift handover for the best practice in oil refinery operation.

1.6 Rational interest in these topic

Regarding the Major accident at Thai Oil refinery, upon the occurrence, the author was a child. He witnessed the incident, which was devastatingly disastrous, on site with his father who was an employee there. The accident motivates him to pursue his studies on how to prevent the accident caused by failure in communication during shift handover. This research shall address approaches and suggestions throughout the oil refinery in Thailand in order to preclude accident from miscommunication during shift handover and develop a standard work instruction.