

LEVEL 4 ASSESSMENT SPECIFICATION

Student name:	SHAUN DALLING	Student ID number:	
Programme:	HNC Process Operations Engineering		
Module:	Process Safety Systems		
Module code:	PCPO4006	Contribution to Overall Module Assessment (%):	50%
Lecturer:	Yan Mills	Internal Verifier:	L. Rutherford
Assignment Title:	Process Safety Management	Word count (or equivalent):	2000
Submission deadline:	17/02/2022	Return date of provisional marks & written feedback:	10/03/2022
Submission method:	All written assessments, where practical and possible, must be submitted via Turnitin unless otherwise instructed by the Lecturer. (Please DO NOT put this assessment specification into Turnitin or it will match many similarities with other students' submissions.) Alternative submission method (if applicable): Late submission of the assessment will result in a late penalty mark. Penalties for late submission: Up to one week late, maximum mark of 40%. Over one week late, 0%. Only the Extenuating Circumstances Panel may approve a change to submission dates.		
Academic honesty / referencing:	Academic honesty is required. In the main body of your submission you must give credit to authors on whose research and ideas your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have used, cited or quoted in order to complete this assessment.		

Module Learning Outcomes (from module syllabus)

- Explain the elements required to ensure the safe operation of an industrial process.
- Explain the strategies and procedures required to ensure an industrial process meets legal and regulatory requirements, and how safe systems of work are established.

STUDENT FEEDBACK FORM

Generic Assessment Criteria	Marks available	Marks awarded
1. Engagement with Literature Skills		
Engagement with an extensive range of relevant and credible literature. Consistently accurate application of referencing.	15	11
2. Knowledge and Understanding Skills		
Excellent knowledge and understanding of the basic underlying concepts and principles of the subject.	35	27
3. Cognitive and Intellectual Skills		
Excellent evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data accurately and with some insight. Excellent ability to devise arguments using evidence and make appropriate and valid judgements	30	22
4. Practical Application Skills		
An advanced application of a range of taught, basic methods, materials, tools and/or techniques. The context of the application is well considered, and insightful.	10	8
5. Transferable Skills for Life and Professional Practice		
Work is coherent, very fluent and is presented professionally. Can work effectively independently and/or as part of a team, with an excellent contribution to group activities. Demonstrates excellent skills for employment requiring the exercise of some personal responsibility with an appetite for further development.	10	7

Assessment Mark (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed.)	Late Submission Penalties (tick if appropriate)		75%
	Up to 1 week late (40% Max)		
	Over 1 week late (0%)		

Process Safety Management

Assignment 1

Lecturer: Yan Mills

Word Count:

2030

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Introduction

This assignment will focus on how the process controls that are put in place maintain safe operation for employees and equipment including management systems and the principles behind them, a safety control system on the crude unit and the process implications and safety measurements that are commonplace on the refinery and units.

Process safety management system

TASK 1

When designing a process safety management system, a common approach is to use the four-pillar system. This system uses the pillars of:

- Committing to process safety
- Understanding Hazards and Risk
- Manage Risk
- Learning from experience

These pillars have separate parts that make up the full system and is shown in the graphic below:

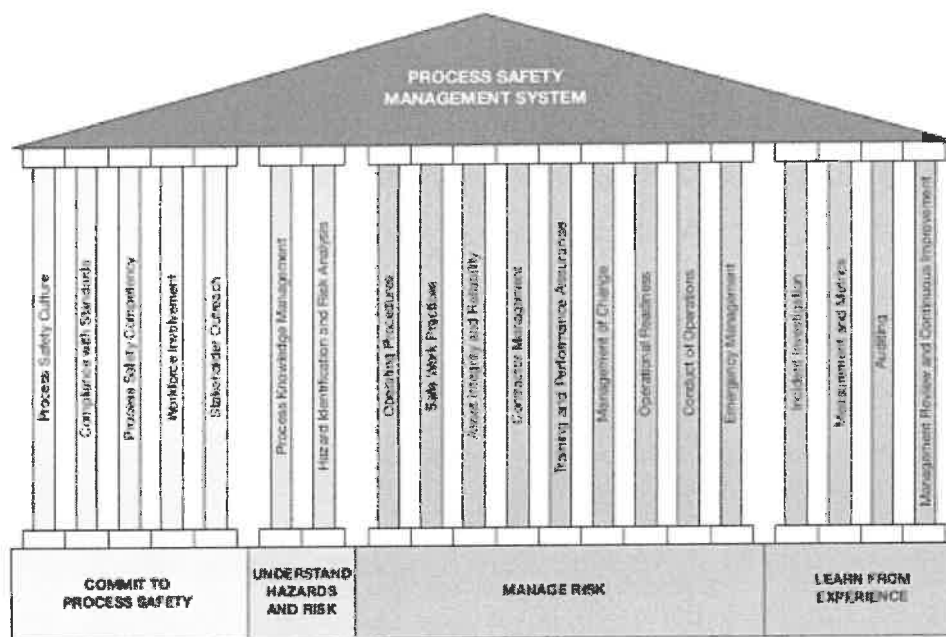


Figure 1 - Four pillar system (AIChE, n.d.)

Under the committing to process safety pillar there are multiple subheadings. Process Safety Culture is about instilling the importance of process safety and the part employees play in process safety. This allows all employees whether operations or maintenance to improve the safety for everyone working within the refinery. It also allows all employees to identify issues that may affect safety and to notify the relevant people without worry of consequences. This must apply to all personnel on the refinery from maintenance to upper management. By involving all levels of the refinery, it allows safety issues to be identified and rectified quickly and efficiently to

remove the risk of injury to personnel or damage to the equipment, therefore increasing reliability and the refinery's public image. The involvement of the refinery leadership team also allows the workforce to support the system as they can see that it is being followed from the top down and not just being imposed on them. This in turn will increase the compliance with regulations and safety requirements as the workforce will be committed to doing the work correctly for their own safety and for all the other personnel working on the refinery even when they are not being overseen.

The next pillar of the system is to understand the hazards and risks. This is a vital task in the preparation, control and performing of the tasks. When a potential loss of containment is identified it is important for the relevant personnel to inspect the issue and plan a maintenance task to rectify this issue. This could involve operations inputting a work order to start the process dependant on the severity. This could then be inspected by the relevant planning department as well as any process engineers and operations planners. This is to allow the required parts/equipment to be assigned to the task and for an isolation and preparation pack to be built. In the planning process the actual process taking place in the affected area will be inspected for any hazards or risks associated with it such as potential H₂S within the product or whether there are any chemicals within the line that will pose a danger to personnel. By identifying the hazards within the process and the maintenance task required to fix the issue an operations pack can be built for safe isolation and preparation. This could involve nitrogen purging the system to blowdown to remove any hydrocarbons or water washing to remove chemicals. Once prepared and the maintenance task is to be carried out a permit identifying any risks is given to the maintenance personnel for them to read through and accept. A personnel risk assessment is then carried out at the worksite by maintenance before starting work. With the safety culture already identified if the maintenance personnel are unhappy with the system being worked on, they can use their stop work authority and explain the issues they have found so further planning and preparation can be carried out.

The next pillar of managing risk is used to set a standard across the refinery of how work should be carried out to maintain safety of all involved. This may be in the

production of procedures for carrying out work or by identification of the safe working practices that should be worked at. Procedures for carrying out work are based on risk assessments of the process and equipment and give a step-by-step method for the preparation or maintenance of equipment. This way of controlling work makes sure that all tasks that are the same are carried out in the safest way possible. This may highlight extra precautions such as the use of breathing apparatus if venting of equipment is required. Warnings of hazards at certain points in a task are also highlighted so the person carrying out the work is aware of any possible dangers. To carry out maintenance and procedures it is imperative that all personnel are trained in the task they are carrying out. If the person/s are not fully trained in that task they have the stop work authority to allow them not to carry out the work until they are sufficiently trained.

Another part to managing risk is the Management of Change procedure.

Management of Change is described as 'a systematic approach to dealing with organizational change, typically in industrial facilities and operations. The goal of this approach is to safeguard workers from potential harm during the crucial period of transition.' (Paoletta, 2020). Management of Change is required if a task is required to deviate from the procedure/risk assessment and will require management to sign that the work being carried out remains safe and any extra precautions are in place to avoid any incidents.

The last pillar is about learning from experience. This is a vital part of the system as it allows potential near misses and accidents to shape safety systems to avoid that incident happening again. When incidents happen, they are investigated, and the underlying issues are highlighted and shared throughout the industry. This allows all members of the industry to review and audit their procedures and to implement extra safety precautions on certain tasks. An example of this was during a leak under insulation on the Chevron Richmond refinery (Chevron Richmond Refinery Fire Animation, 2013) where a leak was made worse by trying to control the leak with a fire hose aimed at the pipework. This made the incident worse as it further damaged the pipework. By sharing of this information, it allowed all other refineries to update their emergency procedures on finding a leak under insulation or on pipework to avoid aiming water jets at the pipework leaking. It was deemed safer to try and keep

a water blanket around the affected pipework to avoid the leak spreading or causing damage to surrounding equipment until the leak can be isolated.

Process Control Measures *Task 2.*

Process control measures are the most important controls when operating an oil refinery. When the units are operating process control makes sure that all the variables stay within the set limits to reach the desired product or outcome. Within the crude unit there are multiple different process control loops to maintain safe and efficient operation. The first major control system is the backpressure controller on the flash drum. As the crude enters the unit it is heated to around 140°C before entering the flash drum for the light hydrocarbons to flash off from the desalted crude. A backpressure controller is used to maintain a constant backpressure of around 8-9kg/cm². This is required as if the pressure was to drop the crude could potentially flash off within the pipes causing major damage as the crude separates. To avoid this incident happening the control operator monitors the pressure and will adjust the control valve or bypass to maintain the pressure. If the pressure becomes too low the unit will have to be shutdown to avoid any incident. The DCS controller will aid in completing this automatically with each shutdown step brought up on the panel. Another main control loop present to ensure no incidents occur involves the instrumentation on the main distillation column. Instruments are present to monitor the levels, temperatures, and pressure within the column to avoid any dangerous occurrences within the column. The levels controller controlling the bottoms level will make sure that there is a sufficient level within to avoid overboiling the column with the stripping steam which in turn will affect the pressure. If a low level or high level appears the stripping steam valves will trip shut to avoid damaging the system or causing an incident. The pressure monitoring will allow makeup gas to be vented if the pressure rises to high or added if the pressure starts to drop by a split range controller. This allows the pressure to be controlled to avoid venting off hydrocarbons by the PSV's.

Process Safety Measures

TASK 3

Process safety is the most important aspect in Pembroke Refinery. This is to ensure that all employees working on the refinery get to go home safely at the end of working hours. To ensure that the level of safety required is maintained there are certain standards that must be kept. The most evident one is the permit to work system. The permit to work system is a system that allows operators to control which maintenance work is carried out. To allow a permit to be issued it is first up to operations to prepare the equipment by isolating the equipment from all energy sources whether this is electrical or process. Dependent on the task being carried out the equipment may need to be depressured and purged of hydrocarbon vapors. Once this has been completed and the relevant documentation signed for confirmation the permit can be issued. The maintenance personnel will report to operations to accept the permit where the operations staff can highlight any extra precautions or issues with the equipment. Certain tasks will also require a gas test to make sure the area is safe to carry out the work and this will be carried out by operations prior to the permit being issued.

A standard across the refinery is the use of PPE dependent on the area being worked in. There are three main areas on the refinery that require different levels of PPE. The first is the green zone where suitable long sleeve clothing should be worn and suitable footwear. The next zone is the amber zone which requires the use of overalls, or a two-piece fire retardant set of clothes. Safety boots, hard hat and safety glasses must also be worn. However, there is an exception when travelling to the point of work and home every day. The last zone is the red zone which requires all the previous PPE as well as hearing protection, H2S monitor and any specialist PPE (such as alky suits).

Another safety measure prevalent at the refinery is around the use of breathing apparatus. If hydrocarbon vapors are likely to be present and the potential for H2S or other dangerous gases breathing apparatus must be worn. It is also part of the rules around using breathing apparatus that a standby person is used upwind of the task being carried out with a working radio. This is so if anything was to happen to the person in breathing apparatus, they can call for help before donning there breathing apparatus to ensure their own safety. It is also part of the training that is given that

checks of the breathing apparatus are carried out to confirm that there is enough air to last the task and that there are no leaks around the mask that could allow any vapors in.

Conclusion

Through looking at the control measures, management and safety measures enforced on the refinery it is evident that to ensure everyone's safety that all personnel must follow the rules. It also shows that with everyone following the same safety culture that any potentially dangerous tasks will be stopped by anyone who witnesses it to ensure the safety of those around them. By applying the management system, it allows any relevant training to be given without fear of disciplinary action as the backing of the upper management allows personnel to request the training before being expected to carry out a task. By having this management system, the safety of the refinery and all its personnel is kept to the highest standard possible allowing the refinery to run at its most efficient level.

References

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