

LEVEL 4 ASSESSMENT SPECIFICATION

Student name:	JACK HARRIS	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:	Safe Systems of Work	Word count (or equivalent):	2000
Submission deadline:	05/05/2022	Return date of provisional marks & written feedback:	26/05/2022
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 a wide range of literature, including sources retrieved independently. Selection of relevant and credible sources. Generally sound referencing.	20	13
2. Knowledge and Understanding Skills		
Competent knowledge of the basic underlying concepts and principles	30	20
3. Cognitive and Intellectual Skills		
Sound evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data accurately. Ability to devise arguments using evidence to make mostly appropriate and valid judgements.	30	21
4. Practical Application Skills		
A very good application of a range of basic methods, materials, tools and/or techniques. Very good consideration of the context of the application.	10	6
5. Transferable Skills for Life and Professional Practice		
Work is accurate, coherent, fluent, well-structured and organised. Can work effectively independently and/or as part of a team, with very good contribution to group activities. Demonstrates very good skills for employment requiring the exercise of some personal responsibility, with just occasional minor weakness	10	6

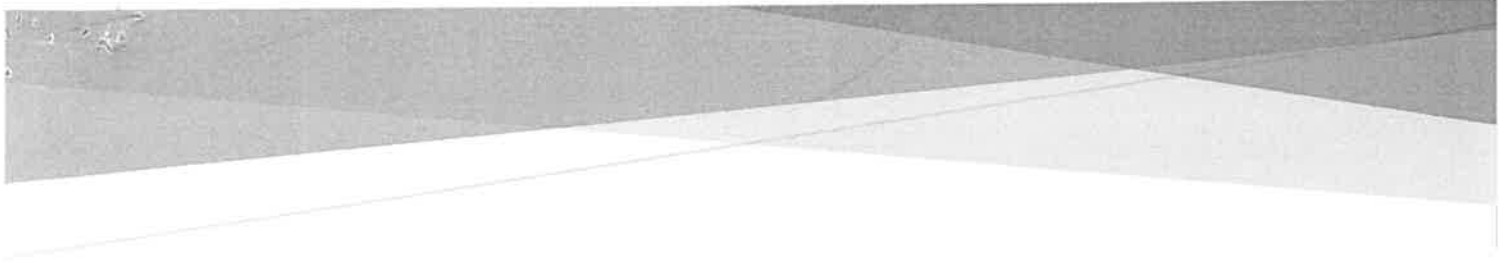
Assessment Mark (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed.)

Late Submission Penalties (tick if appropriate)

Up to 1 week late (40% Max)

Over 1 week late (0%)

64%



PROCESS SAFETY SYSTEMS

Safe Systems of Work

Jack Harries

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Task 1

There are many reasons how process safety failure can occur in a workplace. All companies will have precautions in place to ensure that the risk of this happening is very small, however, it is always possible. Layers of protection failure and human error are two common reasons for process safety failure. Typical examples of process safety incidents include rapid overpressure events in process plant arising from dust, gas or vapour explosions, detonation or deflagration of highly energetic materials, rapid decomposition of thermally unstable substances or mixtures and runaway exothermic chemical processes.

Layers of protection is a method that is used for safety in a workplace to evaluate high consequence scenarios and is also commonly known as the 'Swiss Cheese Model'. The Swiss cheese model is often employed in representing process safety. The individual slices represent different defences or barriers, and the holes represent the potential for a barrier to fail. If the holes should align, all barriers will fail and the hazard consequence will be realised. Shown below is a diagram of how the swiss cheese model works.

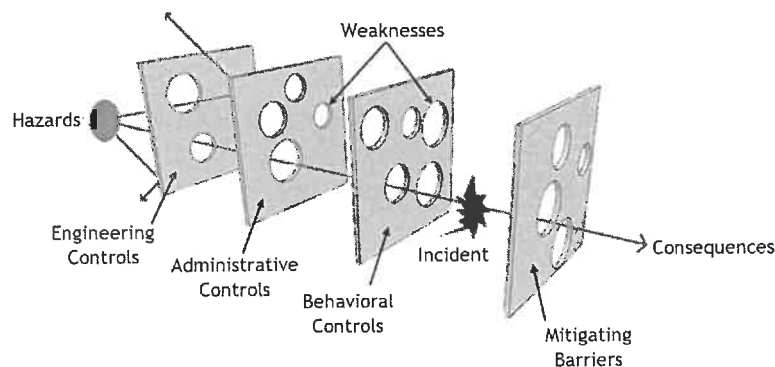


Figure 1: Swiss Cheese Model

As you can see there are numerous barriers which do have slight weaknesses. For an incident to occur, there must be vulnerability in each layer of protection, represented by holes in the slices of cheese. The size and number of holes in the cheese represent the relative lack of reliability of that layer. This model highlights the importance of having these protection layers in place so that major incidents don't occur. The different barrier controls are;

- Engineering Controls
- Administrative Controls
- Behavioural Controls
- Mitigating Barriers. (Roberts, 2020)

Obviously if all of these controls fail then there will be serious consequences. 'Engineering controls' are preventative actions which are engineered and designed into a process system. A perfect example of this would be a Pressure Safety Valve (PSV) on a vessel. If the system overpressures due to a process upset, the PSV is in place to make the process is safe again by relieving the system of the pressure.

'Administrative controls' are managerial actions taken to ensure everyone involved in the process possesses the same knowledge of the established safety procedures. An example of administrative controls would be Management of Change (MOC) procedures. Before making any changes to a process or procedure, employees must identify, read, review, and approve that they understand any modifications that have been made to ensure all changes are implemented safely. Also, a permit to work is another key barrier for the safety of the workforce. (Wiki, n.d.)

'Behavioural Controls' are actioning any individual can take to prevent an incident from happening. This barrier has a long list of actions that can be taken however a couple of examples could be; wearing the correct personal protective equipment (PPE) and ensuring it is suitable; using the correct tools for the task and ensuring that the tools have no defects and safe to use; or following the correct procedures carefully to take the correct steps.

Unfortunately, even with protective barriers in place, incidents still happen in a workplace. The 'Mitigating Barriers' are actions which lessen the severity and/or impact of an incident. For example, having an emergency response plan in place; wearing the correct PPE or RPE; or even the installation of a fire suppression system.

Disasters that have happened within the petrochemical industry in the past would have been down to these barriers failing. After each incident, further barriers will get created to ensure that major incidents do not happen again.

Task 2

Safe Working Practices

Workplace safety has become one of the main priorities for organizations across the world. As safe workplaces are also productive ones, employers are trying to find new ways to keep their remote, frontline, and in-office employees safe and healthy. Safe working practices are set in place by a workplace for employees to focus on specific things and ensure their own safety is maintained. (HSE, n.d.)

One of the largest safe working practices used on Pembroke refinery is the LPSA (Loss prevention self-Assessment). The LPSA is in place for every employee to complete before any task they carry out. This could be as simple as taking a generic sample of product, to carrying out a pump swap.

The LPSA Form is a structured document for hazard identification and risk assessment. It includes the following sections:

- Header Information:** Fields for Name (print), Date, Unit/Location, Time, and Job Description.
- JHA Checklist:** A section for JHA Checklist description, JHA Checklist used (Yes/No), and whether the JHA Checklist is a high consequence activity (Yes/No).
- Hazard Wheel:** A circular tool with 'See It!' in the center. The wheel is divided into eight segments representing different hazard types: Mechanical, Electrical, Pressure, Temperature, Chemical, Biological, Radiation, and Noise. Each segment contains a corresponding icon.
- Task Assessment:** A section titled 'Task as recorded that apply' with a 'Task as' checkbox.
- Risk Assessment:** A section titled 'Assess the risk - What hazards have you identified?' with three numbered lines for identification.
- Risk Reduction:** A section titled 'What have you done to reduce the risk?' with three numbered lines for documentation.
- Final Check:** A section titled 'Have you done a dummy run to identify pinch points?' with Yes/No checkboxes.

Figure 2: LPSA Form

The image above is what all employees at Pembroke refinery have to complete. It starts by stating your name, date, time, location of the task, what the task is and whether the task carries a high consequence. The wheel in the middle of the form is what Valero call the 'HIT Tool' (Hazard identification Tool). As you can see the wheel is split into different hazard types that you can tick off;

- Mechanical
- Electrical
- Pressure
- Temperature
- Chemical
- Biological
- Radiation

- Sound
- Gravity
- Motion

Moving on from the HIT tool, employees are encouraged to step back from the area and have a look at any hazards they could come across when completing a task. For each hazard that an employee identifies, they are expected to have a control in place in order to eliminate the risk; therefore, resulting in a safer working environment. LPSA forms are to be handed to your supervisors for signatures before every task. This is for them to analyse your safety and to make any improvements or to offer and advise.

The next system that Valero refinery implement are the 'Life saving rules'. These 7 very important rules are put in place by the safety department to ensure everyone leaves to go home at the end of the day safely. The 7 lifesaving rules are;

1. Work with a valid Permit to work.
 - *Ensure a valid permit to work has been collected before task begins; ensure you abide by all precaution's stated on permit; ensure each worker carrying out the job signs the back of the permit to acknowledge they have read and understand the job being carried out.*
2. Verify energy isolation before beginning work.
 - *The use of the 'Lock out tag out' system (LOTO), ensures that no permit to work can be issued to any personnel unless there has been a confirmation of energy isolation before start of task.*
3. Obtain Authorization before entering a confined space.
 - *Before initial entry to a confined space, there must be a gas test and area check carried out by an operations shift team leader to ensure that it is safe for any personnel to enter. No entry permit can be issued until the gas test has been cleared.*
4. Use Specified life protection equipment.
 - *There are site standards for correct PPE which must be adhered by for any task. If any additional life protection equipment is required, the information will be found on the permit to work, and the operations team will inform the maintenance team.*
5. Protect yourself from falls when working from heights.
 - *When working from heights ensure you have a secure safety harness attached and there are always 3 points of contact.*
6. Smoke in designated areas only.
 - *Smoking is a fire risk, therefore there are designated areas away from process for smoking to take place safely.*
7. Obtain authorization before bypassing a safety system.
 - *Before bypassing a safety system, for example a PSV, you must gain permission from your supervisor that it is safe to do so. This is normally cleared if there is a spare in place.*

These seven rules have been selected because they apply to situations and processes that have a high likelihood of life safety impact, are relatively common to

most people working in the refining industry and demand the highest attention to detail and personal accountability each and every time. People's lives and well-being depend on how well each employee executes the processes associated with these rules and how seriously we take our responsibilities relative to them. These rules apply to everyone in the refinery.

Permit to Work Systems

Where proposed work is identified as having a high risk, strict controls are required. The work must be carried out against previously agreed safety procedures, a 'permit-to-work' system. The permit-to-work is a documented procedure that authorises certain people to carry out specific work within a specified time frame. It sets out the precautions required to complete the work safely, based on a risk assessment. It describes what work will be done and how it will be done; the latter can be detailed in a 'method statement'. The permit-to-work requires declarations from the people authorising the work and carrying out the work. Where necessary it requires a declaration from those involved in shift handover procedures or extensions to the work. Finally, before equipment or machinery is put back into service, it will require a declaration from the permit originator that it is ready for normal use.

Permit To Work

Permit No: 10095959-1-1
(Work Order 200905161)
Permit Level: 3 Page 1 of 3

Location: Live-REFINING - BLACK OILS CDU
Job: REPLACE FAN BELT
Task: 1-EAM-103A CHECK BELTS CORRECTLY LOCATED ON PULLEYS AND RETENSION
Tag No: 1-EAM-103A

ELECTRICAL ISOLATION - in place

Is No	Tag No	Description	Circuit Ref	Status
75930	1-EAM-103A	1-EAM-103A CHECK BELTS CORRECTLY LOCATED ON PULLEYS AND RETENSION	1-EAM-103A	Isolated

Equipment locked in isolated position
Equipment proved not to start
De-energise Motor: Stop button

GENERAL ISOLATION - not required

GAS TEST - OK - (Gas No: 262300)
TAG No: 1-EAM-103A
Taken: 25/09/2009 08:13:59

Oxygen	21
Explosive	0
Vol 100mm (PPM)	N/A
COSHH TEST DATE	25/09/2009 08:14:01

Fire and Safety Observer - 100% With Radio

Name: _____ Signature: _____

PERSONAL PROTECTION INFORMATION

Fire retardant overalls Industrial gloves Ear muffs/plugs
Safety boots Personal H2S Monitor Safety helmet
Safety glasses

PERMIT MESSAGE

Got Risk? What action are YOU taking?

Issuer	Acceptor	Issued
CHESHIRE, MARTYN (CHEVRON)	HOWELLS, DEREK (CHEVRON)	08:30 24/09/2009

THIS PERMIT IS VALID UNTIL 17:00 hrs Friday, September 25, 2009

Permit To Work

Permit No: 10095959-1-1
(Work Order 200905161)
Permit Level: 3 Page 2 of 3

SELECTED ICONS AND ACTIONS

Ensure positive ID of equipment to be worked on.

Confined Space - High Hazard

approved by HOWELLS, DAN on 25/09/2009 08:19:42

The effects of heat stress must be considered if temp >35 deg c.
Means of rescue considered and plan in place.
Vessel is clean and purged
Possibility of fume release during work is minimised and controlled
Electrical isolations are made
Firework isolation (physical disconnection or slip plated) is secure.
Possibility of fume ingress from outside is minimised and controlled.
Possibility of nitrogen inert gas introduced minimised and controlled
Ventilation is adequate
Dust or fibres present can be protected against with RPE
Removal of radioactive hazards is complete.
Lighting is adequate
Means of access/egress is adequate
Take care not to walk on in-fan plenum chamber floor

Working at Height - Medium Hazard

○ Cease work if wind speed becomes excessive
Performer to check for correct scaffolding before use

Mechanical Job (simple) - Low Hazard

○ Caution: Hand tools can cause sparks
ONLY work described to be carried out
Competent standby man to be in attendance

Normal Plant Conditions - Low Hazard

○ All equipment to be identified by operations.
Note location of safety showers before commencing
Ensure area is clean and free from obstructions before starting.
Ensure positive ID of equipment to be worked on.

Hand Tools - Low Hazard

○ Ensure tools are in good condition before starting.

Additional Requirements

MTCP/CDME XCD0018
BEWARE OF PINCH POINTS

PERMIT COMMENTS

None Permit Comments

CURRENT CONDITIONS

none selected

Figure 3: Permit to Work

In figure 3 above, you can see a generic example of what a permit to work looks like. All the information that can be found on the Permit to work is there to keep the workers safe from any unnecessary hazards. (HSE, 2021)

Each permit has its own special number, usually fairly long in length, but this is used to find a permit easily in a system if there are any issues. The information at the top is there to give an in-depth description of the location of the equipment being worked on. This will eliminate the risk of anyone accidentally working on the wrong piece of equipment and potentially injuring themselves. (Agg-Net, n.d.)

Next, as mentioned previously in the life saving rules, there is the verification of energy isolation on the equipment. In this case there is both an electrical isolation and a general isolation. With the Valero 'LOTO' system, a permit will not be able to get issued unless isolations are signed for by competent personnel. This removes any possibility of the equipment starting while work is being carried out.

The gas test section is to be carried out by the operations department at the start of each shift. The gas testing is an important part of the role. No job can be carried out if there are gases present in the area. The readings gained from the gas tester must be entered into the system and they will be uploaded onto the permit to work. If there are gases present in the area, the permit will not be released to maintenance, again to ensure their safety.

As also mentioned previously in the life saving rules, the use of life protection equipment is listed on the bottom of the first page to indicate to the workers what their expected to work throughout the task.

The second page of the permit to work shows any further or additional hazards that the maintenance staff may come across when carrying out the job. It also gives a small detail of ways to mitigate these dangers if they arise. The permit is also only valid for a certain timescale. This is down to changes in process and how these changes might develop risks to the workforce. Once the permit to work has been signed out, all workers must sign on the back of it to acknowledge that they have read the permit in detail and they understand the hazards that are involved with the task. The permit to work is a major line of defence to keep the workforce safe throughout their working lives.

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