

LEVEL 4 ASSESSMENT SPECIFICATION

Student name:	RHYS BEAVIS	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 an extensive range of relevant and credible literature. Consistently accurate application of referencing.	20	15
2. Knowledge and Understanding Skills		
Excellent knowledge and understanding of the basic underlying concepts.	30	23
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 for further development.	10	7

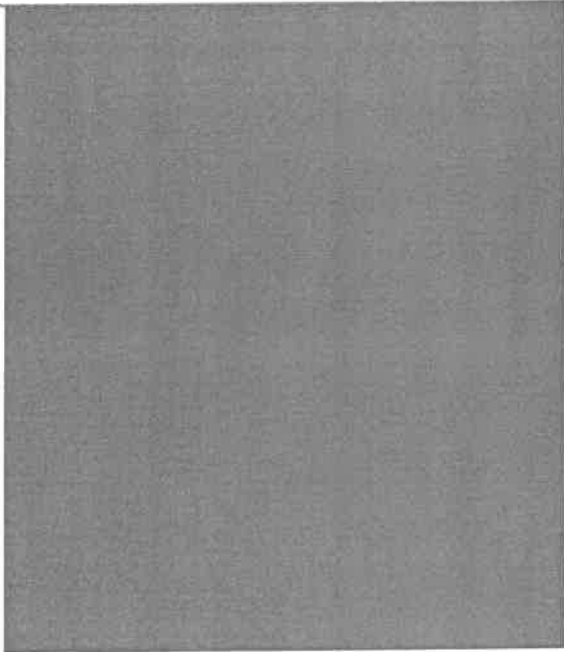
Assessment Mark (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed.)

Late Submission Penalties (tick if appropriate)

Up to 1 week late (40% Max)

Over 1 week late (0%)

75%



Process Safety Systems

Safe Systems Of Work

Rhys Beavis

Table of Contents

Task 1	3
Task 2	5
2A	5
2B	7
Bibliography	10
Table of Figures	10

Task 1

The different measures of the prevention and mitigation of major accidents within a workplace may be considered as layers of protection. These layers serve to either prevent an initiating event from developing into an incident or to mitigate the consequences of an incident if it does occur. The best way these layers can be shown is by using the swiss cheese model. In this model, you have hazards on one side and on the other side are losses. In between these hazards and losses, you have swiss cheese which show lines of defence for the hazard. These lines of defence are something that can prevent the hazard from becoming an incident. This could be things such as backup components, monitoring of equipment, damage control systems, personnel training or policies and procedures which are in place. In the cheese there are holes. Each hole represents a gap in the line of defence that allows the hazard to progress. Examples of these holes can include, a broken or faulty piece of equipment, an outdated policy or procedure or a human factor. With many lines of defence between the hazard and the loss, a hole in one line may not lead to the loss as other lines of defence may catch this. This is known as a defense in depth strategy, many layers means that there are multiple chances to prevent a small issue from turning into a major issue. (Schwartz, 2019)

This model shows how a failure cannot be traced back to a one single root cause, but that accidents and losses can result as a combination of factors. It shows that losses are a result of latent errors which are failures which are directly linked to a procedure or piece of equipment. These latent errors are triggered by errors which are linked to unsafe behaviours carried out by individuals.

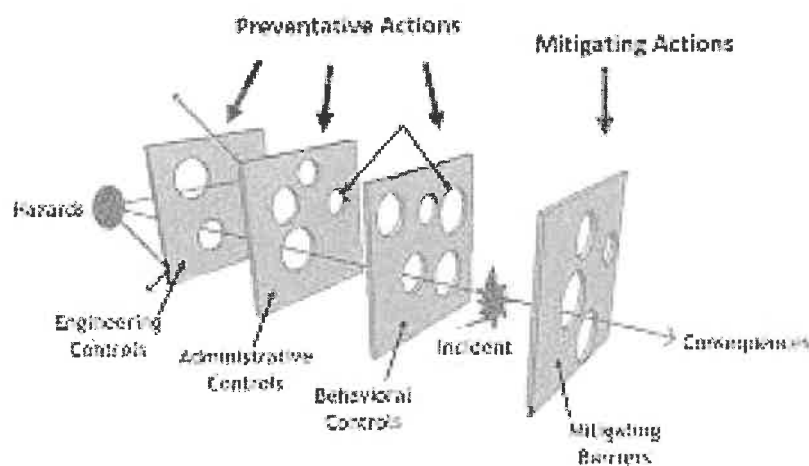


Figure 1: Swiss cheese model

In terms of human factors, there are several things which can lead to process safety failure. Everyone can make small errors no matter if they are fully trained and how motivated they are. In the refinery environment, a small human error can lead to a failure which can be severe. There are various types of human errors that contribute to process failures or the potential to failure. Some errors are slips or lapses, these may be actions that were not as planned or any unintended actions. These lapses often occur during a task which is familiar and can include pressing the wrong button or reading the wrong gauge. The errors commonly occur during procedures where the person carrying it out does not concentrate on what they are doing. These lapses cannot be eliminated by extra training, but perhaps improved design on the equipment will help to decrease the likelihood of the errors occurring. (Human factors/ergonomics – Managing human failures, n.d.)

Other mistakes can be errors of judgment where the intended actions are wrong, this is where a person may do the wrong thing but believes it to be the right thing. These types of mistakes tend to occur in situations when a person is unsure of the correct way of completing a task either because it is new or because they have had the proper training. In these circumstances, they fall back to what they know previously from similar situations, and these may not be correct. To combat these, a good understanding of the training based on good procedures is essential to avoiding these mistakes. A main human error is when violations occur. These are intentional actions of a person who deliberately does not carry out the procedure correctly. They usually result from an intention to get the job done as efficiently as possible or often occur where the equipment or task being carried out has been poorly designed or maintained. (Human factors/ergonomics – Managing human failures, n.d.)

Task 2

2A

There are multiple safe working practices that are applicable to the refinery. One of the key things implemented are the seven life saving rules. Work with a valid work permit when required, these work permits confirm that the work can be carried out, that the work can be carried out safely and confirm that all parties, operations and maintenance, are in agreement that the work can be carried out safely. Verify energy isolation before beginning work. This is so energy isolations are confirmed in terms of locks, tags, valves, or circuit breakers. This is so that there is no stored energy or other dangers remain whilst the work gets carried out.



Figure 2: seven life saving rules

The main purpose of confirmation is to confirm that it is safe to start work. The third rule is obtain authorization before entering a confined space. This rule entails that there is a work permit valid, gas testing has been carried out, confirmation that the access is always being controlled. Next rule is to obtain authorization before overriding or bypassing a safety system. This is where the correct personnel need to confirm that overriding the safety system is possible and that it can be carried out. Another key life saving rule is to use specified life saving equipment. This rule includes the general safety equipment such as the generic PPE that is required to be worn. There are 3 main PPE zones on site, these are the green zone, the amber zone and the red zone. The red zone is the highest zone where the requirement is fire retardant

overalls, hard hat, safety boots, safety gloves, H2S monitor and hearing protection. The other two zones have lesser requirements for the level of PPE. Other safety equipment included in this are breathing apparatus when required, fall protection equipment and electrical safety gear. The sixth rule is to protect yourself against a fall when working at heights. This includes ensuring that the environment is safe and includes scaffolding and handrails. If there are unprotected heights, then fall protection equipment is required. Also, in this is that authorization is required to work at heights, be aware of what equipment is required and confirm that it is safe to start work. The final life saving rule is to only smoke in designated areas, this is to ensure that no sources that can ignite are present in the working environment. (Valero, 2022)

Inside the RED ZONE, full PPE Fire retardant overalls / hard hat / safety glasses / hearing protection / H ₂ S monitor / safety boots
AMBER ZONE, site PPE – outside the Red Zone Long sleeves, covered legs and covered suitable footwear Hard hat and safety glasses (except for transit to / from work area)
Inside the GREEN ZONE, LPSA Wear suitable clothing and footwear, subject to your LPSA

Figure 3: PPE zones on the refinery

Another policy that the refinery has is the stop work authority. This policy gives anyone the ability to stop any work they see that may be dangerous or unsafe. This policy is supported by the Pembroke refinery leadership team. In this policy, you can stop work which can potentially cause harm to a person, damage to equipment or does not comply with any policies or procedures that are in place. You can do this once you have assessed, analysed and acted and then stopped the work taken place. Within the policy, it can be summarised by three statements, these are: -

- Do it safely or not at all
- There is always time to do it right
- Complete every task the right way every time

A safety initiative which has been rolled out to all workers at the refinery is the work safe home safe scheme. This is focused on reducing injuries and improving our personal safety performance through a variety of aspects. These include positive recognition of correct safe behaviours, clarifying expectations of safety to workers, working together to modify behaviours of those who break site rules, looking after the safety of yourself and your colleagues and positive recognition of the safety awareness programme. (Valero, 2022)

A good example of where multiple safe working practices can be seen is in the removal of PSVs for maintenance. This involves multiple life saving rules being implemented. A few of these are obtain authorization when bypassing a safety system and LOTO. The first part includes operations ensuring that the spare PSV is available, then ensuring they can isolate and de-pressure the one required safely. As apart of this, there is a procedure required to be followed to allow the safe de-pressure of the system and removal of the PSV. After the removal there are two forms to be completed for records, these are the authorization form and also the movement form.



Title: LOTO: GEN/F/003 - Authorisation to Operate a Flare or PSV Isolation Valve			
PP-PEM-FRM-0049	Rev 2.1	Issued: 29 04 2018	Page 1 of 2

1. Form - Authorisation to Operate a Flare or PSV Isolation Valve

Step	ITEM	DESCRIPTION
1	Plant Number & Unit name	TOP OF REACTOR SKID (EX 14-F-III)
2	Valve identification and / or associated equipment number	14-PSV 1632
3	Exact location	TOP OF REACTOR SKID (EX 14-F-III).
4	Reason for valve movement? Confirm Valves are blank locked in position.	REMOVE FOR TEST + REPLACE PSV BACK IN STBY POSITION
5	Description of alternative protection device or Procedure No.	14-PSV-1632.
6	Atmospheric PSV / TSV?	Y / ~~N~~
7	BA Requirement	Y / ~~N~~
8	PPE requirement	Mandatory site wear. Extra PPE requirement ~~Y~~ / N Alky PPE - Class A, B, C, D.
9	LOTO to be fitted	Y / ~~N~~
10	Benzene present?	~~Y~~ / N
11	H ₂ S present?	~~Y~~ / N
12	Oxide Regs?	~~Y~~ / N
13	HF Alkylation?	~~Y~~ / N
14	PSV / TSV Quick Turnaround?	~~Y~~ / N
15	PSV movement logbook to be updated	Y / ~~N~~
16	Notes:	
17	Valve movement authorised	Print M. WATKINSON Sign
18	Conditions accepted	Print M. WATKINSON Sign
19	Date & Time	Date 21/07/20 Time 15:20
20	Work complete	Print M. WATKINSON Sign
21	Date & Time	Date 21/07/20 Time 15:10

Figure 4: Authorisation to operate PSV form

2B

A permit to work system has two main purposes, one is to prevent the unauthorised execution of any work and the second is to ensure that all work which is carried out is performed in a safe and controlled manner. The main reason behind using a permit to work system is that under the Health and Safety at Work Act 1974, employers are legally obliged to provide and maintain systems that are safe without risks to health. The HSE also states that where work is identified as being a high-risk task, strict controls are required. The work must be carried against agreed safety procedures, a permit to work system falls into this category. The permit itself is a documented procedure that authorises certain people to carry out work within a specified time frame. On there it will provide precautions which are required by workers to carry out the work safely. One of the main things about a permit is that requires declarations from people authorising the work and those who are carrying out the work.

In the system, there are three main members of personnel, these are the permit issuer, permit approver and the permit acceptor. The issuer is a competent and trained individual who has been authorised by the company to complete, review and issue permits for their assigned area. The approver is trained and tested individual and authorised by the company to review, sign, and approve relevant sections of the permit. Finally, the acceptor is someone who has knowledge of the requirements of the permit process, they are also responsible for ensuring that all requirements and conditions of the issued work permit are met and maintained throughout the conduction of the work. On a permit there are a few things which can be identified such as the hazard rating for the work being completed and the type of work being conducted. On the refinery, we use a computer-based permit system called RAP. The hazard ratings for permits are low, medium, high, or high high. On the permit issued these are indicated by permit level. Level 1 is low, level 2 is medium, and level 3 is high or high high. The types of work being carried out are classified into the following categories, confined space entry, hot work, breaking containment, electrical work and general cold work. These types of work are identified on the permit by colour coding. Confined space is green, hot work is red, breaking containment is yellow, electrical work is blue and general cold work is white.

The way in which the permit to work system helps against high-risk activities are that there are multiple steps involved in the process which involve multiple personnel who are required to accept and sign off on it. As all of these personnel are trained and authorised by the company this means that there are multiple layers of protection in the process and a different point of view as others may identify hazards or risks which another person in the process may not recognise. (Valero, 2020)




Permit to Work
Permit No: 193132-2
Permit Level: 3

Location	Offgas	Job No	Job	Tag No
		20172180	REPLACE PRESSURE TRANSMITTER	08-PT-0389
		278267	REPLACE TRANSMITTER MOUNTING BRACKET, RE-GLAND FULLY CALIBRATE & LOOP PRESSURE CONTROLLER ON ONE TOX SWELL OUTLET	
Company Name: VALERO				

ELECTRICAL ISOLATION: - Not required - BURNHAM, PAUL 02/03/2020 14:51

MULTIPLE ELECTRICAL ISOLATION: - Not required - BURNHAM, PAUL 02/03/2020 14:51

GENERAL ISOLATION - Acceptance will be required to include own general isolation

DEPENDENT TASKS - No Results

DEPENDENCIES - No Results

Gas Result(s) - Not required

PERSONAL PROTECTION INFORMATION

 Fire retardant overalls	 PVC gloves	 General Purpose Drive - EN388 cut level 3 & Impact P
 Ear muffs/plugs	 S1 Safety boots	 Self-contained BA
 Personal gas monitor	 Personal H2S Monitor	 Safety harness
 Safety glasses		

Figure 5: Example of a permit to work

Various examples of different permits which can be given out for the types of work are for confined space are inspection maintenance inside a tank. On this occasion is where an inspection team are required to enter a tank to complete the tasks given. There will also be a someone on the entrance of the tank who controls who enters the tank during the duration of the job. An example of hot work can be where a piece of pipe is required to be replaced by maintenance. For this job, they would need to cut out the existing pipe and then weld the new piece in place. An example of breaking containment is when a PSV is required to be removed for stat inspection. This is where the lines to be de-pressured by venting them off to allow the safe removal of the PSV. In certain instances, they can be in hazardous service so wearing of breathing apparatus may also be required. An example where an electrical permit may be required is when a PM is required to be carried out on a 3.3kv circuit breaker. This will require them to isolate and remove the breaker to allow the PM to be carried out.

Bibliography

Schwartz, B., 2019. The Swiss cheese model: Designing to reduce catastrophic losses » Engineering for Humans. [online] Engineering for Humans. Available at: <<https://www.engineeringforhumans.com/systems-engineering/the-swiss-cheese-model-designing-to-reduce-catastrophic-losses/>> [Accessed 5 May 2022].

Hse.gov.uk. n.d. Human factors/ergonomics – Managing human failures. [online] Available at: <<https://www.hse.gov.uk/humanfactors/topics/humanfail.htm?msckid=912df10dc0bc11ecb2d14c444334d73b>> [Accessed 20 April 2022].

Valero, 2022. Safety, Health and Environment notes. 9th ed.

Valero, 2020. Permit to work system.

Table of Figures

Figure 1: Swiss cheese model	3
Figure 2: seven life saving rules	5
Figure 3: PPE zones on the refinery.....	6
Figure 4: Authorisation to operate PSV form	7
Figure 5: Example of a permit to work.....	9