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State	Finished
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Time taken	9 hours 52 mins
Marks	93.50/141.00
Grade	66.31 out of 100.00

Question 1

Complete

Mark 8.00 out of 8.00

Chapter 1.1: The Engineer's Survival Guide

(8 marks total for all correct responses; 2 marks for each correct response in order; 1 mark for each correct response but not in the correct order; no penalty for each incorrect response or no response)

List the key points for the Engineer's Survival Guide, in order, below:

1. Understand company values

2. Understand your program

3. When you make decisions, put safety ahead of any other objective

4. Pay attention to failures in safety systems and take action

Question 2

Complete

Mark 2.25 out of 3.00

Recall the Piper Alpha Case Study, where the Day Engineer submitted a PTW for maintenance on Pump A, along with the subsequent decisions and actions of the Night Engineer and the Supervisor (who assumed that Pump A was safe to start).

We will begin by considering **the situation**. Listed below are several potential descriptors of the **situation**. Select the **FOUR** descriptors which best describe **the situation** from the Piper Alpha Case Study. (3 marks for the correct responses; no penalty for incorrect response; 0 marks for no response.)

Select all that apply:

☒ Pump A's pressure relief valve was replaced with a temporary metal plate. [cross out](#)

☒ The handover meeting between the Day and Night Shift did not discuss the PTW for Pump A. [cross out](#)

☐ No response. [cross out](#)

☐ The Day Engineer signed off on the PTW for Pump A [cross out](#)

☒ Both the Night Engineer and Supervisor decided to put Pump A back online. [cross out](#)

☒ The Off-shore Installations Manager at Claymore, the other off-shore rig, continued to pump oil into the distribution system. [cross out](#)

Question 3

Complete

Mark 2.00 out of 3.00

Concerning the situation as described in the previous question, what was **the issue** with the situation? Listed below are several potential **issues**. Select **THREE** responses to fully describe all potential **issues** with the situation. (3 marks for correct responses, no penalty for each incorrect response; no penalty for no response.)

Select all that apply:

☐ The Night Engineer and Supervisor were rushing to put Pump A back online. [cross out](#)

☐ No response [cross out](#)

☒ The Day Engineer did not communicate with the Night Engineer that Pump A was not safe to start. [cross out](#)

☒ The Day Engineer mismanaged the PTW associated with Pump A. [cross out](#)

☒ The Off-shore Installations Manager at Claymore resisted shutting down despite the urgent requests by his assistant. [cross out](#)

☐ The PTW system on Piper Alpha was working, but was not regularly audited. [cross out](#)

Question 4

Complete
Mark 2.00 out of 3.00

What **management actions** should have been taken to resolve the **issues** with this **situation**? Listed below are several potential **actions**. Select the THREE responses which best describe the appropriate **management actions**. (3 marks for the correct responses; no penalty for the incorrect response; no penalty for no response.)

Select all that apply:

- ☒ The Claymore Offshore Installations Manager should have Initiated the shut down of oil flow from Claymore to Piper Alpha. [cross out](#)
- ☒ Ensured that the PTWs were properly managed and reviewed. [cross out](#)
- ☐ Confirmed the integrity of Pump A and piping system. [cross out](#)
- ☐ No response. [cross out](#)
- ☒ Ensured the day and night engineers met during shift change. [cross out](#)

Question 5

Complete
Mark 0.00 out of 1.00

Piper Alpha management did not recognize the misfiling and loss of PTWs as a risk to the operation and did nothing to rectify the issue.

With which Engineer’s Survival Guide Key Point is this management failure best aligned? (1 mark for the correct answer, 0 marks for incorrect answer or no answer).

Select one:

- ☐ Key Point #1 [cross out](#)
- ☐ Key Point #2 [cross out](#)
- ☒ Key Point #3 [cross out](#)
- ☐ Key Point #4 [cross out](#)

Question 6

Complete
Mark 0.00 out of 1.00

Recall The Night Engineer, who was overseeing the job to put Pump A back online. He was focused solely on maintaining productivity and preventing a rig shut down.

With which Engineer's Survival Guide Key Point is this management failure best aligned? (1 mark for the correct answer, 0 marks for incorrect answer or no answer).

Select one:

- ☐ Key Point #2 [cross out](#)
- ☐ Key Point #3 [cross out](#)
- ☒ Key Point #1 [cross out](#)
- ☐ Key Point #4 [cross out](#)

Question 7

Complete
Mark 1.00 out of 1.00

What would the outcome have been if the management actions (as described above) had been implemented?

TRUE or FALSE: There still would have been a gas release.
(1 mark for the correct answer, 0 marks for incorrect answer or no answer).

Select one:

- ☐ True
- ☒ False

Question 8

Complete
Mark 1.00 out of 1.00

What would the outcome have been if the management actions (as described above) had been implemented?

TRUE or FALSE: There would not have been a fire and explosion.
(1 mark for the correct answer, 0 marks for incorrect answer or no answer).

Select one:

- ☒ True
- ☐ False

Question 9

Complete

Mark 1.00 out of 1.00

What would the outcome have been if the management actions (as described above) had been implemented?

TRUE or FALSE: The rig would not have been destroyed.

(1 mark for the correct answer, 0 marks for incorrect answer or no answer).

Select one:

- ☒ True
- ☐ False

Question 10

Complete

Mark 0.00 out of 1.00

What would the outcome have been if the management actions (as described above) had been implemented?

TRUE or FALSE: The incident would not have happened.

(1 mark for the correct answer, 0 marks for incorrect answer or no answer).

Select one:

- ☐ True
- ☒ False

Question 11

Complete

Mark 3.00 out of 3.00

PEAP. What is PEAP? Why PEAP?

(3 marks total for all correct responses; 0 marks for each incorrect response or no response)

What is the Second "P" in PEAP? (1 mark)

Productivity

Which of the following is the best explanation of what this "P" represents? (2 marks)

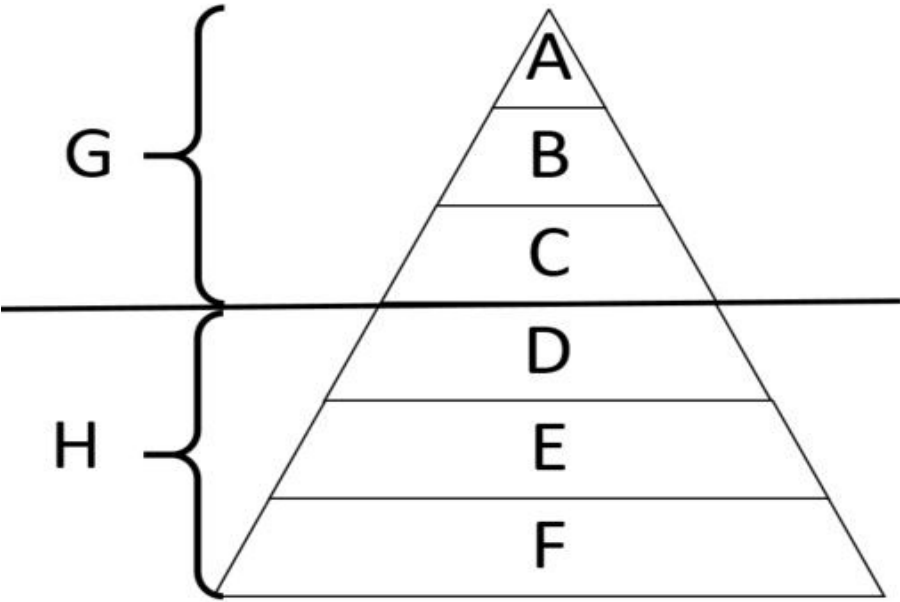
The level at which a company produces or operates or provides a service

Question 12

Complete

Mark 8.00 out of 8.00

One important relationship for managing safety and risk management is depicted by the "Incident Pyramid".



Using the pyramid shown, properly match the classification of each level to the letter shown. (Marks earned for correct selections. No penalty for incorrect selections or no response.)

- A: Major Injuries
- B: Minor Injuries
- C: Property Damage Incidents
- D: Near Miss (Close Call) Incidents
- E: Substandard Conditions / Practices
- F: Safety Culture
- G: Reactive
- H: Proactive

Information

Consider that you work at **First Rate Propane Distribution Company** where **you are the Supervisor** of Loader Operators, Pipefitters, and Truck Drivers. First Rate Propane Distribution Company has a **first-rate risk management program** and has not had any loss incidents in decades (i.e. it is NOT like Sunrise Propane at all).

Respond to the next series of questions.

Question 13

Complete
Mark 3.00 out of 3.00

In its simplest terms, how would you define "safety culture" for your workers?
(3 marks for the correct response; no penalty for an incorrect response; 0 marks for no response)

Select one:

- ☐ What our managers tell us to do [cross out](#)
- ☐ Where we go to work every day [cross out](#)
- ☐ No response. [cross out](#)
- ☐ We wear our PPE whenever we want to. [cross out](#)
- ☒ How we do work around here [cross out](#)

Question 14

Complete
Mark 3.00 out of 3.00

At First Rate Propane, give one specific example that demonstrates what you, the leader, can do to influence or shape the safety culture of your workers.

(3 marks for the correct response; 1.5 marks for partially correct response; no penalty for an incorrect response; 0 marks for no response)

Select one:

- ☐ Leadership / management proactively addresses at-risk behaviours. [cross out](#)
- ☐ Leadership / management builds competencies in themselves, becoming experts in risk management by conducting planned inspections and proactively addressing substandard workplace conditions and/or substandard work practices. [cross out](#)
- ☐ Leadership / management proactively addresses unacceptable workplace conditions. [cross out](#)
- ☐ Health and safety team leads the workplace planned inspections. [cross out](#)
- ☐ The best approach to building a positive safety culture is to have the safety officer coach workers on correct and safe work practices. [cross out](#)
- ☐ No response. [cross out](#)
- ☒ Leadership / management builds commitment in their workers by conducting planned inspections and proactively addressing substandard workplace conditions and/or substandard work practices. [cross out](#)

Question 15

Complete
Mark 3.00 out of 3.00

In general terms, which of these statements best reflects the implementation of the risk management program at the team level in this organization, First Rate Propane?

Select the best option (there are two correct responses, and two incorrect responses)
(3 marks for correct response; no penalty for incorrect response; 0 marks for no response)

Select one:

- ☐ The manager interacts with the trades-worker / conducts a planned inspection on the trades-worker to check for deficiencies / defects / substandard work practices and/or work conditions and when found, intervenes and initiates action to correct the trades-workers. [cross out](#)
- ☐ The manager conducts a planned inspection to summarize the number of sub-standard practices and sub-standard conditions in the workplace, and files a report with senior management. The manager follows up with this by implementing PDCA. [cross out](#)
- ☐ The manager conducts an internal audit of the documentation for the risk management system and the manager requests the members of the team conduct a team level self-assessment (i.e. ITP Metrics). [cross out](#)
- ☐ No response. [cross out](#)
- ☒ The manager interacts with the trades-worker / conducts a planned inspection on the trades-worker to check for compliant / acceptable work practices and/or compliant / acceptable work conditions. and provides positive feedback / re-enforce acceptable work practices / commends the workers. [cross out](#)

Question 16

Complete

Mark 2.00 out of 3.00

Thinking about your workers at First Rate Propane Distribution Company and where you are the leader, describe what you would do for a planned inspection for the workers (select best response)

(3 marks for correct response; partial marks for partially correct response; no penalty for incorrect response or no response)

Select one:

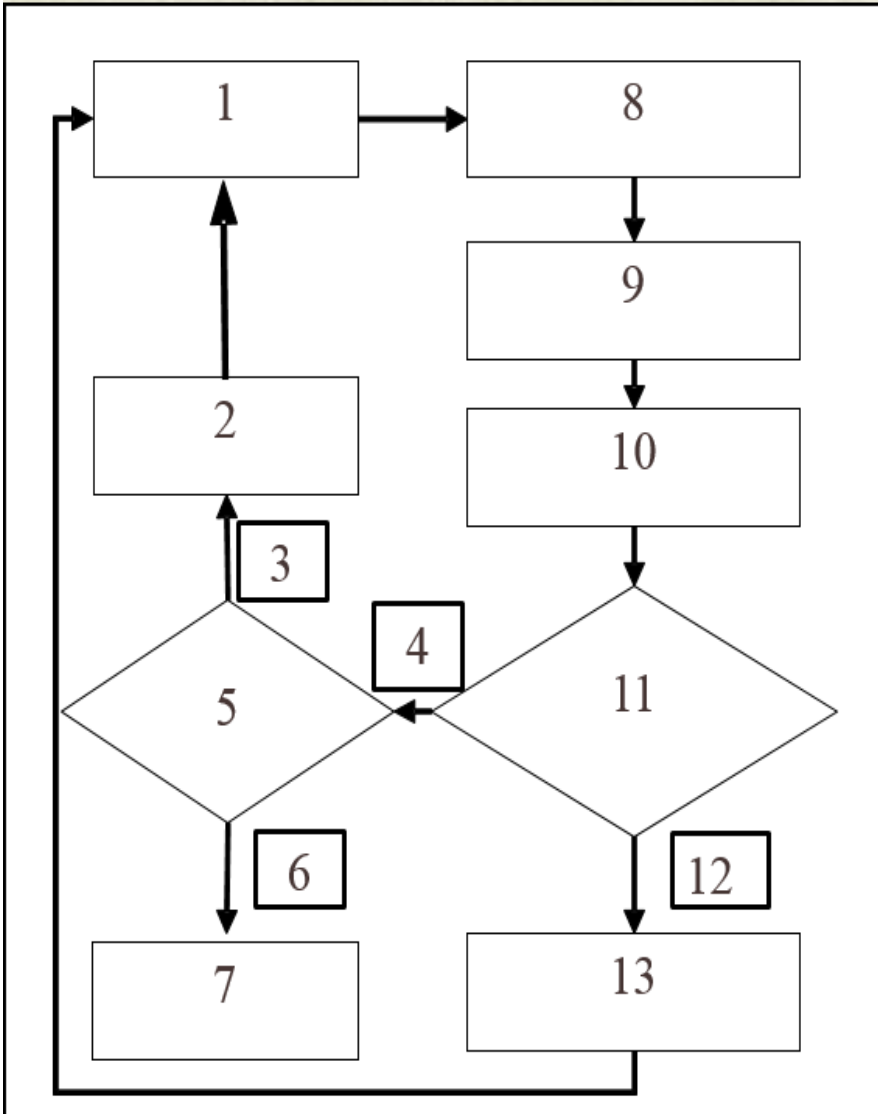
- ☐ No response. [cross out](#)
- ☐ I would observe the pipefitter doing her/his job. I would check or inspect that the pipefitter has identified the hazards and has applied appropriate control measures. If done correctly, I would commend the worker. If not, I would coach the worker to correct the sub-standard condition / sub-standard practice. [cross out](#)
- ☐ I would set up a master-planned inspection schedule and notify the pipefitters when the inspections would be taking place. [cross out](#)
- ☒ I would check or inspect that the pipefitter installs the pipe fittings correctly. If it were done correctly, I would commend the worker. If not, I would coach the worker to correct the sub-standard condition / sub-standard practice. [cross out](#)
- ☐ I would observe the pipefitter doing her/his job. If it were done correctly, I would commend the worker. If not done correctly, I would write up a disciplinary note to correct the sub-standard condition / sub-standard practice and train the worker by giving them a copy of the note. [cross out](#)

Question 17

Complete
Mark 13.00 out of 13.00

Chapter 3.2: The Risk Management Work Process

(13 marks total for all correct responses; 1 mark for each correct response; 0 marks for each incorrect response or no response)



The Risk Management Process can be described in a simple diagram (flow chart). For the image given, match the number with the appropriate phrase:

1)

Continue to monitor and manage the residual risk

2) Reduce the risks

3) Yes

4) No

5) Can the risks be reduced?

6) No

7) Discontinue the activity

8) Do planned reviews

9) Identify hazards

10) Analyze for risks

11) Are the risks acceptable?

12) Yes

13) Manage the residual risk

Question 18

Complete

Mark 5.00 out of 5.00

Chapter 5.2: The Fundamental Approach to Control All Risks

(5 marks for the correct response; 1 or 3 marks for a partially correct response; no penalty for no response or an incorrect response)

The fundamental approach to control all risks (recall the risk reduction order of effectiveness or hierarchy of controls) as required by Alberta OH&S Code Part 2 is one of these choices:

Select one:

- ☒ Eliminate the hazard, apply engineering controls, apply administrative controls and work practices, provide PPE, or any combination of these. [cross out](#)
- ☐ Provide PPE, eliminate the hazard, apply administrative controls, apply engineering controls and work practices. [cross out](#)
- ☐ Eliminate the hazard, apply engineering controls and work practices, apply administrative controls, provide PPE, or any combination of these. [cross out](#)
- ☐ Eliminate the hazard, apply engineering controls, apply administrative controls and work practices, provide PPE. [cross out](#)
- ☐ Control the two factors - likelihood and consequence - of all risks pertaining to activities. [cross out](#)
- ☐ No response. [cross out](#)

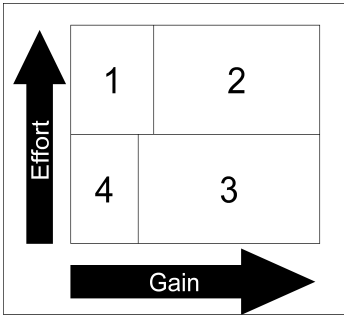
Question 19

Complete

Mark 1.00 out of 3.00

Chapter 4.6: Tools and Process for How to Prioritize Actions

(3 marks total for all correct responses; 1 mark for each correct response; 0 marks for each incorrect response or no response)



Which quadrant would be best represented by the phrase "Nice to Do"?

1

In many projects, the outcome of some actions has been described as a "Waste of Money, Brains, and Time". In the image shown, this would be best represented by quadrant 4.

Which quadrant would be best represented by the phrase "Significant Effort for Significant Gain"? 2

Question 20

Complete

Mark 6.00 out of 6.00

A company wants to train their employees to improve their "near miss reporting program". The **training program** will cost \$20,000 one-time (in the first year) to develop, and will require an on-going cost of 1 hour training per year of employee time for 50 employees at \$100 per hour, in the first year and in each year thereafter. The cost to implement the "near miss reporting program" is negligible.

Serious injury incidents currently cost the company \$500,000 per year in medical costs and lost-time costs. The "near miss reporting program" is expected to **reduce the cost of serious injuries** (i.e. a savings) by 50% in the first year.

Note that a savings-to-cost ratio of more than 2 to 1 is considered highly beneficial.

Enter numerals only; not commas, no decimal points, no dollar signs.

What is the spending on the **training program** in the second year? \$ 5000

What is the **potential reduction in injury costs** in the first year? \$ 250000

In the first year, what is the savings-to-cost ratio? " 10 to 1"

(2 marks for each correct response, 0 marks for incorrect response or no response.)

Question **21**

Complete

Mark 0.00 out of
2.00

In which quadrant would this case fall? (2 marks for the correct response, 0 marks for incorrect response or no response.)

Select one:

- ☐ Low-hanging fruit. [cross out](#)
- ☐ Nice to do. [cross out](#)
- ☒ Wasted or underutilized resources. [cross out](#)
- ☐ Significant effort for significant gain. [cross out](#)

Question 22

Complete

Mark 0.00 out of 8.00

Chapter 4.2: Cause & Effect Model and Chapter 4.5: Linking Latent Causes to Recommendations

An excerpt of the Detailed Cause and Effect Model is shown below:

Basic Causes		Latent Causes			
Type		System Elements	P	S	C
Engineering & Design Factors:		1) Management Leadership, Commitment and Accountability.			
inadequate technical design		2) Risk Assessment and Management of Risks.			
inadequate ergonomic design		3) Community Awareness and Emergency Preparedness.			
inadequate assessment of loss exposures		4) Management of Change.			
inadequate standards, specifications and/or design criteria		5) Incident Reporting, Investigation, Analysis and Actions.			
inadequate monitoring of construction		6) Program Evaluation and Continuous Improvement.			
inadequate assessment of operational readiness		7) Design, Construction and Start-up.			
inadequate monitoring of initial operation		8) Operations and Maintenance.			
inadequate evaluation of change		9) Employee Competency and Training.			
inadequate documentation of change		10) Contractor Competency and Integration.			
Job Factors:		11) Operations and Facilities Information and Documentation.			
Inadequate maintenance		P = inadequate program S = inadequate standards C = inadequate compliance			
Inadequate work standards / job procedures					
Error-inducing conditions					
Organizational factors					
Incompatible goals					
Inadequate training					
Inadequate communication					
Personal Factors:					
Inadequate physical / physiological state / capability to do the work.					
Perceived inadequate mental / psychological state / capability to do the work.					
Physical or physiological stress.					
Perceived mental or psychological stress.					
Improper risk taking / improper motivation					
Lack of knowledge / lack of skill.					

The mining operation at ABC Conglomerate has many risks which must be controlled. As such, company management has implemented an extensive Risk Management System with 11 Elements.

During a third-party audit, many good things were discovered i.e. there did not appear to be any deficiencies or inadequacies in the documented programs or documented standards in the facility. Further, it was discovered that most process equipment was maintained in accordance with manufacturing-engineering specifications; however, one piece of equipment was found in a defective state, specifically the automatic locking brakes on the elevator in event of power failure; fortunately, this was found before it failed catastrophically.

After an investigation, it was found that job procedures for this equipment were exceptional but not followed by the industrial mechanic tasked with maintaining this equipment (i.e. he had not performed the safety checks on the elevator).

The industrial mechanic is fully qualified on servicing this equipment but is a relatively new employee of the mining company having come from another mining company that experienced a much poorer safety record.

In an interview with the industrial mechanic, one more detail was learned: the industrial mechanic had not yet understood the value in completing safety checks and had focused his efforts to ensure conveyors and heavy mobile equipment were always available for production, as this was the emphasis that was common at his former employer.

Summarize the investigation, by selecting the best answer to the following prompts:
(2 marks awarded for correct response, 0 marks for incorrect responses or no response)
a) Select one applicable **PERSONAL** factor:

Lack of knowledge/lack of skill about servicing the elevator automatic locking brakes

b) Select the RM System Element which best aligns with the latent cause (i.e. a weakness in a management system element) and that rationally supports the category of the basic cause in item a):

Employee Competency Training

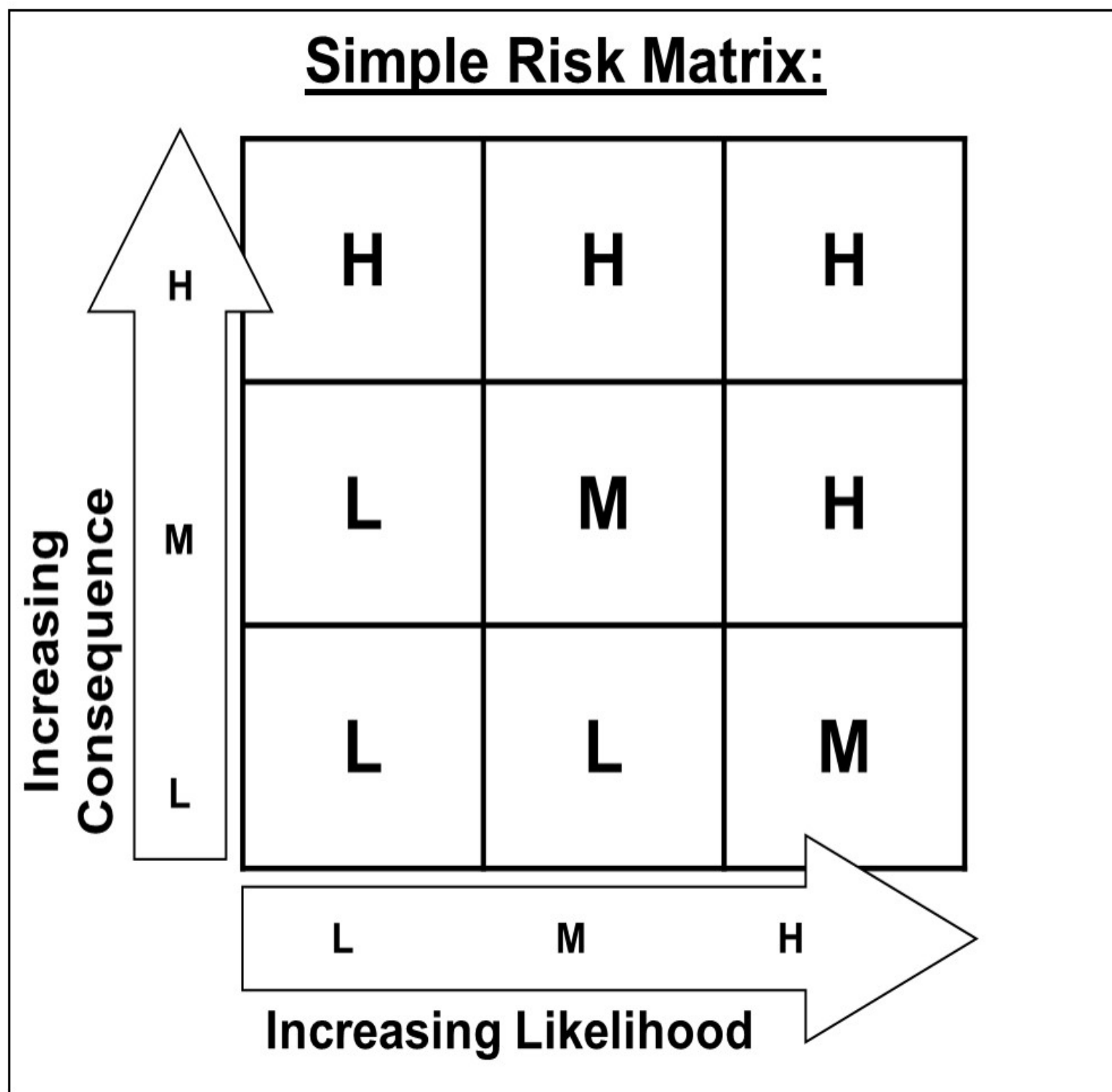
c) State your assumptions and explain your rationale for the weakness in the management system selected in item (b)

Management had failed to communicate its corporate values to its new employees

d) Characterize the latent cause (P,S,C)

Inadequate training on corporate values

The Semi-Quantitative Risk Assessment Tool demonstrates the application of the Risk Management process, and can be applied to identify and reduce risks to an activity. Use the Risk Criteria Table and the Risk Matrix shown below to answer the next three questions and complete the partially completed SQRA forms:



Ratings	Impact on PEAP	Probability
High	<u>High</u> P Disabling injury, loss of body part or fatality. E Reportable violation, toxic release. A High repair cost (Typically > \$100k). Pr Loss of function of facility for extended period, with business consequences, major quality deviation.	<u>High</u> <ul style="list-style-type: none"> Repetitive event. At least once per year Several times in the life cycle of a project. Has happened frequently in similar circumstances. Greater than 50% chance of occurring.
Medium	<u>Medium</u> P Medical Aid injury. E Non-reportable spill, non toxic release. A Moderate repair cost (typically > \$10k). Pr Short duration loss of function, serious quality deviation, medium business impact.	<u>Medium</u> <ul style="list-style-type: none"> Infrequent event. May only happen occasionally (less than once per year). Has been observed in similar circumstances. 10 to 50% chance of occurring.
Low	<u>Low</u> P First aid injury. E Minor leak, non toxic fugitive emission. A Low repair cost (typically <\$10k). Pr Brief interruption or minor quality deviation or minor cost to correct.	<u>Low</u> <ul style="list-style-type: none"> Unlikely event. Never happened to date. May happen less than once in 10 years. Has never been observed but is still felt to be a possibility Less than 10% chance of occurring.

Legend: P = People; E = Environment; A = Assets; and Pr = Production

Question 23

Complete

Mark 0.00 out of 2.00

Recall the **UCIL Bhopal Incident**. There were many deficiencies in almost every aspect of the activities in the pesticide plant. Complete the Semi-Quantitative Risk Assessment that demonstrates how you would have applied this tool to identify and reduce risks to the pesticide plant operation. (2 marks for the correct response, 0 marks for incorrect response, or no response.)

Activity	Deviation/Concern	Likelihood	Consequence	Risk Before Control Measures	Control Measures / Safeguards	Change in Likelihood	Change in Consequence	Residual Risk After Control Measures
Large volume of MIC inventory is stored in storage tanks that are badly maintained.	Uncontrolled release of large quantity of MIC results in a large toxic gas cloud	H	H	H	?	H	L	M

Select one:

- ☐ Reduce the on-site volume of MIC to the minimum required to sustain production.
- [cross out](#)
- ☐ Undertake an inspection program to ensure that water is never allowed to enter the MIC storage tank.
- [cross out](#)
- ☒ Develop a Standard Operating Procedure for storing MIC.
- [cross out](#)
- ☐ No response.
- [cross out](#)

Question 24

Complete

Mark 6.00 out of 9.00

Complete the Semi-quantitative Risk Assessment that demonstrates how you would have applied this tool to identify the risks (before control measures) to the pesticide plant operation, given all the information that was provided about this case study loss incident in the lectures and resources. (1 mark for each correct response, 0 marks for incorrect response or no response.)

Activity	Deviation/Concern	Likelihood	Consequence	Risk Before Control Measures
Large volume of MIC inventory is stored in storage tanks	Water infiltrates into a badly maintained storage tank, reacting with MIC and causing it to vapourize, overpressure the tank, and escape to the environment.	a)	b)	c)
Slums built up around and close to the plant site over time	People do not have any warning or any time to escape, and emergency services cannot respond in a timely when an incident occurs	d)	e)	f)
Turnover in management personnel and 50% reduction of staff at the plant facility	The MIC Storage Tank and the Safety Systems (refrigeration system, scrubber tower, flare tower, water deluge systems) were disabled or degraded.	g)	h)	i)

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)

Question 25

Complete

Mark 3.00 out of 9.00

Complete the Semi-quantitative Risk Assessment that demonstrates how you would have applied this tool to reduce risks (with control measures) to the pesticide plant operation. From the numbered list below, choose the appropriate L, M, or H level for the Change in Likelihood, Change in Consequence, and Residual Risk of each activity. (1 mark for each correct response, 0 marks for incorrect response or no response.)

Activity	Deviation/Concern	Likelihood	Consequence	Risk Before Control Measures	Control Measures / Safeguards	Change in Likelihood	Change in Consequence	Residual Risk After Control Measures
Large volume of MIC inventory is stored in storage tanks	Water infiltrates into a badly maintained storage tank, reacting with MIC and causing it to vapourize, overpressure the tank, and escape to the environment.				Ensure storage tank and safety systems are inspected on a regular basis and operational at all times.	j)	k)	l)
Slums built up around and close to the plant site over time	People do not have any warning or any time to escape, and emergency services cannot respond in a timely when an incident occurs				Develop an emergency response plan for the community and emergency services that includes a warning system and evacuation plan.	m)	n)	o)
Turnover in management personnel and 50% reduction of staff at the plant facility	The MIC Storage Tank and the Safety Systems (refrigeration system, scrubber tower, flare tower, water deluge systems) were disabled or degraded.				Ensure JSA/SOP training program for the MIC Storage Tank and the Safety Systems is carried out on an ongoing basis for new staff	p)	q)	r)

j)

M

k)

M

l)

M

m)

L

n)

M

o)

M

p)

L

q)

M

r)

L

Question 26

Complete
Mark 4.00 out of 9.00

Complete the Semi-Quantitative Risk Assessment that demonstrates how you would have applied this tool to reduce risks (with control measures) to the pesticide plant operation. From the numbered list below, choose the appropriate L, M, or H level for the Change in Likelihood, Change in Consequence, and Residual Risk of each activity. Note that the safeguards / control measures are different in this question than in the previous question; the safeguard / control measure does not address both likelihood and consequence. (1 mark for each correct response, 0 marks for incorrect response or no response.)

Activity	Deviation/Concern	Likelihood	Consequence	Risk Before Control Measures	Control Measures / Safeguards	Change in Likelihood	Change in Consequence	Residual Risk After Control Measures
Large volume of MIC inventory is stored in storage tanks	Water infiltrates into a badly maintained storage tank, reacting with MIC and causing it to vapourize, overpressure the tank, and escape to the environment.				Ensure storage tank is inspected on a regular basis and operational at all times.	s)	t)	u)
Slums built up around and close to the plant site over time	People do not have any warning or any time to escape, and emergency services cannot respond in a timely when an incident occurs				Develop an emergency response plan for emergency services to provide medical services to those affected.	v)	w)	x)
Turnover in management personnel and 50% reduction of staff at the plant facility	The MIC storage tank and the safety systems (refrigeration system, scrubber tower, flare tower, water deluge systems) were disabled or degraded.				Ensure JSA/SOP training program for the Safety Systems is carried out on an ongoing basis for new staff	y)	z)	aa)

s)

t)

u)

v)

w)

x)

y)

z)

aa)

Question 27

Complete
Mark 4.00 out of 4.00

We have discussed several risk assessment tools such as FLRA, SQRA, and JSA that we can employ as leaders. Which of the following is **least characteristic** of these tools? (4 marks for correct response, part marks for partially correct response, no penalty for incorrect response)

- Select one:
- ☐

They require us to think about control measures

cross out
- ☐

They incorporate a description of the activity

cross out
- ☐

The tools are used only to find hazards associated with the activity.

cross out
- ☐

All include a description of the activity, any hazards and risks associated with that activity, and the control measures to address the hazards and risks.

cross out
- ☐

No response.

cross out
- ☐

They consider both hazard identification and risk.

cross out
- ☒

They are useful for conducting a root cause analysis.

cross out

Information

The following information pertains to the next four questions.

You work at ABC Red River Mining Company and you have recently been appointed the lead investigator for reported incidents and reported sub-standard practices and conditions. ABC Red River Mining Company is renowned for its superior risk management program. In your new role, you will be challenged with an issue and a loss incident. Address the following in your new role.

Question 28

Complete

Mark 1.00 out of 3.00

You receive a number of reports about incidents and sub-standard practices and sub-standard conditions. You are busy with managing your sector of operations; therefore, you follow up by investigating _____ .

Select the choice below that best completes the above sentence.

(3 marks for the correct response, partial marks for partially correct response, no penalty for no response or incorrect response)

Select one:

- ☐ No Response [cross out](#)
- ☐ Selected ones because you follow the criteria for incident investigation set by the company, which includes the magnitude of the actual or potential loss and the likelihood of the incident. [cross out](#)
- ☒ All of them because we need to make sure no incident is ever repeated. This aligns with one of our key tenets as a leader in risk management. [cross out](#)
- ☐ Only those that caused large consequences. [cross out](#)
- ☐ Only those that involved losses in people; after all, the safety of people and workers is most important! This aligns with one of the Key Points of the Engineer's Survival Guide "Put Safety ahead of ..." [cross out](#)
- ☐ None of them at this time, because you need to finish your other duties associated with your sector of operations and then move towards investigating these incidents. [cross out](#)

Question 29

Complete

Mark 0.50 out of 3.00

You are called to the scene of an incident in one of the open pits at your facility. A shovel and a haul truck working adjacent to a slope have been damaged by falling debris. No injuries are reported, however operations in the area have stopped.

The order in which you collect the evidence is: _____ .

Select the choice below that best completes the above sentence.

(3 marks for the correct response, partial marks for partially correct response, no penalty for incorrect response or no response)

Select one:

- ☐ Detailed records of the scene with photographs; people interviews; JSA's; slope monitoring bulletins; FLRA's; SQRA's; broken equipment parts. [cross out](#)
- ☒ People interviews; detailed records of the scene with photographs; JSA's; slope monitoring bulletins; FLRA's; SQRA's; broken equipment parts. [cross out](#)
- ☐ People interviews; detailed records of the scene with photographs; broken equipment parts; JSA's; slope monitoring bulletins; FLRA's; SQRA's. [cross out](#)
- ☐ No Response [cross out](#)
- ☐ Detailed records of the scene with photographs; people interviews; broken equipment parts; JSA's; slope monitoring bulletins; FLRA's; SQRA's. [cross out](#)

Question 30

Complete

Mark 1.00 out of 3.00

After you have arranged to collect the evidence at the scene, you begin to think about the persons you will need on the investigation team.

Which experts would you include in your investigation team?

Select the choice below that best answers the above question.

(3 marks for the correct response, partial marks for partially correct response, no penalty for incorrect response or no response)

Select one:

- ☐ No Response [cross out](#)
- ☐ Me, the lead investigator; the general manager for the mine [cross out](#)
- ☐ ESRM expert; Shovel and haul truck operators; Slope stability expert; Mechanic; Monitoring department supervisor; Mine operations and planning employees [cross out](#)
- ☒ Slope stability expert; Mechanic; Monitoring department supervisor; Mine operations and planning employees; weather forecaster; Shovel and haul truck operators [cross out](#)
- ☐ Expert on incident models; FLRA expert; SQRA expert; JSA expert [cross out](#)
- ☐ ESRM expert; FLRA expert; SQRA expert; JSA expert; Heavy equipment mechanics [cross out](#)

Question 31

Complete

Mark 0.00 out of 4.00

Continuing in your role as the leader of the processes for incident investigations and root cause analysis, you have collected as much evidence as possible for the loss incident previously described, have established the losses and the nature of the loss incident, and have named various experts to your RCA Team. Even though you have not yet met with all of the subject matter experts who can contribute to the root cause analysis, you are now ready to convene the team to conduct the root cause analysis in a highly collaborative manner.

In the kick-off meeting for the root cause analysis, and after preliminary introductions, you present in as much detail as possible, the following "next steps" as points of discussion and collaboration: _____.

Select the choice below that best completes the above sentence.

(4 marks for the correct response, partial marks for partially correct response, no penalty for incorrect response or no response)

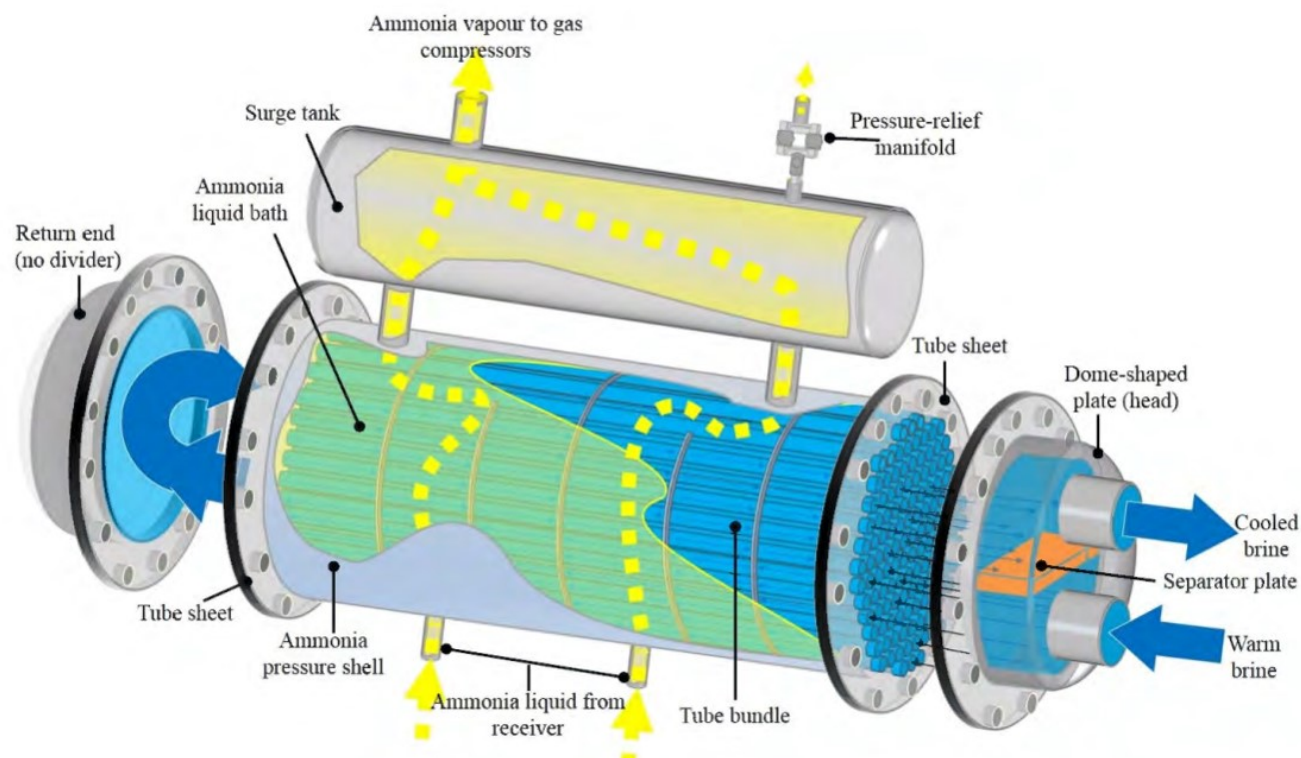
Select one:

- ☐ A detailed factual description of the impacts on PEAP, a draft "incident description", a draft "sequence of events", and a draft "abbreviated statement of the incident" that is the starting point for the root cause analysis. [cross out](#)
- ☒ A detailed factual description of the impacts on PEAP, a draft "incident description", and a draft "sequence of events". You then spend the first part of the meeting, say two hours, drafting an abbreviated statement of the incident that is the starting point for the root cause analysis. [cross out](#)
- ☐ A draft "incident description" and a draft "sequence of events". [cross out](#)
- ☐ A draft description of the impacts on PEAP, a draft "incident description", a draft "sequence of events", and a draft "abbreviated statement of the incident" that is the starting point for the root cause analysis. [cross out](#)
- ☐ No response [cross out](#)
- ☐ A finalized "incident description" and "sequence of events" because you have collected all of the evidence. [cross out](#)

The following information pertains to the next series of questions:

Background:

Recall the 2017 Fernie Ice Rink Loss Incident about an ammonia gas leak, as discussed in the lecture for Module 2-02. The ammonia leak originated from the refrigeration process used for creating ice. The refrigeration process consists of two systems, the primary circulation loop which contains ammonia, and the secondary circulation loop which contains brine. The ammonia circulates through a heat exchanger (chiller) to chill the brine. The brine circulates through pipes under the ice surface of the arena to freeze the water on the surface. The chiller consists of a number of small-diameter tubes inside a large shell that are intended to prevent the ammonia and the brine from coming into direct contact with each other. The brine circulates inside the tubes and the ammonia circulates on the outside of the tubes but inside the shell. The chiller is located in the mechanical room of the arena.



Ammonia is highly toxic, reactive, flammable, and corrosive, and is a gas at normal conditions. Brine is a highly concentrated salt-water liquid solution, and is corrosive.

The Loss Incident:

There was corrosion on one of the tubes which allowed the higher-pressure ammonia to leak through the tube and into the brine. The ammonia then flowed through the brine piping, over-pressured the brine piping components, and ruptured the brine piping system; thus, releasing ammonia gas into the mechanical room. A monitoring and alarm system was in place, and when the alarm was triggered by the release of ammonia gas, three workers responded and were overcome by ammonia gas in the mechanical room. Impact on PEAP included three fatalities (P), leak of toxic material (E), loss of refrigeration equipment (A), and rink shut down (P).

Question 32

Complete
Mark 1.50 out of 3.00

Under what classification(s) can this loss incident be listed?

(3 marks for the correct response, part marks for partially correct response, no penalty for incorrect response or no response)

Select one:

- ☐ Both Process Safety and Occupational Safety [cross out](#)
- ☐ Process Safety [cross out](#)
- ☐ No Response [cross out](#)
- ☒ Occupational Safety [cross out](#)
- ☐ Process Safety, Occupational Safety, and Impacts on PEAP. [cross out](#)
- ☐ Impacts on PEAP [cross out](#)

Question 33

Complete
Mark 2.25 out of 3.00

What was the trigger in this incident?
(3 marks for the correct response, no penalty for incorrect response or no response)

- Select one:
- ☐ Corrosion of the chiller tubes - inadequate monitoring of tube corrosion. [cross out](#)
 - ☐ No response. [cross out](#)
 - ☐ Loss of control of brine and ammonia - over-pressure and failure of the brine piping components. [cross out](#)
 - ☐ The workers entered the mechanical room without appropriate respiratory equipment. [cross out](#)
 - ☒ Loss of control of ammonia - corrosion of the tubes in the chiller. [cross out](#)
 - ☐ Loss of control of ethylene glycol refrigerant. [cross out](#)

Question 34

Complete
Mark 3.00 out of 3.00

What was the lack of safeguard pertaining to the workers' response to the ammonia gas alarms in this incident?
(3 marks for the correct response, no penalty for incorrect response or no response)

- Select one:
- ☐ The workers ignored the gas detector alarms in the mechanical room. [cross out](#)
 - ☐ The tubes inside the chiller and the brine piping system inside the mechanical room. [cross out](#)
 - ☐ Practice the emergency procedures for response to an emergency. [cross out](#)
 - ☐ No Response. [cross out](#)
 - ☒ Appropriate respiratory protection (breathing apparatus) for workers. [cross out](#)

Question 35

Complete
Mark 3.00 out of 3.00

What was the energy source in this loss incident?
(3 marks for the correct response, no penalty for incorrect response or no response)

- Select one:
- ☒ Ammonia [cross out](#)
 - ☐ Glycol [cross out](#)
 - ☐ No Response [cross out](#)
 - ☐ Brine [cross out](#)
 - ☐ Electricity [cross out](#)
 - ☐ Ice [cross out](#)