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EXTERNAL INTEGRATED SUMMATIVE ASSESSMENT EXEMPLAR 1C - MEMORANDUM

STUDENT NAME & SURNAME	
ID NUMBER	
EISA REGISTRATION NUMBER	
ASSESSMENT CENTRE	
ASSESSMENT CENTRE ACCREDITATION NUMBER	
QUALIFICATION	**Chemical Plant Operator, NQF Level 4**
SAQA ID	**102156**
CREDITS	487
PAPER	**1C (there are 3 papers to be written: 1A, 1B, 1C & practical assessment)**
DATE OF EISA	DD/MM/YYYY
DURATION	**2.0 HOURS**
TOTAL MARKS	**150**

CANDIDATE INSTRUCTIONS

- Candidates must complete all questions in this EISA.
- Candidates must ensure that they use only a black pen when completing this EISA.
- Should you require additional space to complete your answer, please request additional paper from your invigilator. Ensure that you indicate your name, surname and EISA registration number at the top of the additional paper. Also ensure that the question number is clearly marked on your additional paper.

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Unit B2, Cnr Race Course & Omuramba Roads, Montague Gardens, 7441

KWAZULU-NATAL
Tel: 031 368 4040 | 087 944 4377
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ELO 4 Optimise the product quality by using sampling and analysis of the sampling results to continuously adjust operating variables.
ELO 5. Communicate effectively to assess risks and respond to emergencies, and abnormal conditions enhance safe operating conditions and report effectively.
ELO 6. Apply environmental considerations and safe disposal of waste or non-conforming product.
ELO 7. Conduct trouble shooting and participate in root cause analysis to develop recommendations to alleviate unsafe working conditions/acts as a member of a team.

Lime Slaking Plant Process Description

The following process description and diagram shows a simple lime slaking plant which is used to prepare a lime slurry that is used in a process plant for pH control.

The lime in the lime storage silo includes grit particles. In the lime slaker pre-heated water is introduced in order to form a slurry. The lime is essentially calcium oxide, and when it is mixed with water in the slaker, a chemical reaction occurs, in which calcium hydroxide and heat are produced during an exothermic reaction.

The lime slaker is provided with a water jacket around its exterior. The water jacket is adapted to receive water via any of water delivery lines.

The slurry aging tank receives lime slurry from the lime slaker via delivery line.

Initially, the ambient water delivered to the lime slaker would be at the ambient temperature. However, as soon as the exothermic reaction begins to occur in the lime slaker, the heat of hydration is captured in the lime slaker water jacket, and then begins to preheat the water passing into the lime slaker. The process continues, gradually increasing the temperature of the water delivered to the lime slaker as the reaction runs to completion, forming a slurry in the lime slaker.

The system also includes a discharge line from the slurry aging tank, which discharges to the inlet or suction side of a pump, which in turn, delivers the slurry via line, to a grit classifier. This comprises a tank with a sloped auger which conveys grit up a slope. The grit becomes separated from the liquid in the tank and discharged. The auger conveys the grit out the discharge into a dumpster.

On a daily basis, the Lime Slaking Plant Operator conducts an inspection at the beginning of the shift and records the findings on an inspection checklist. The inspection checklist is a tool used to reinforce Workplace Health and Safety (WHS) practices, help organizations comply with safety rules and regulations and operational requirements. During the walk about, The Operator notices a leak on the makeup water supply pipeline which might affect the makeup process. The operator also noticed a leakage on the transfer pump casing and heard unusual noise coming from the transfer pump. Safety signs in the area were not visible enough due to build up on the surface. Housekeeping is vital for the control of tripping Hazards. The bund wall has accumulated lime slurry spillage, and this pose a slipping risk.

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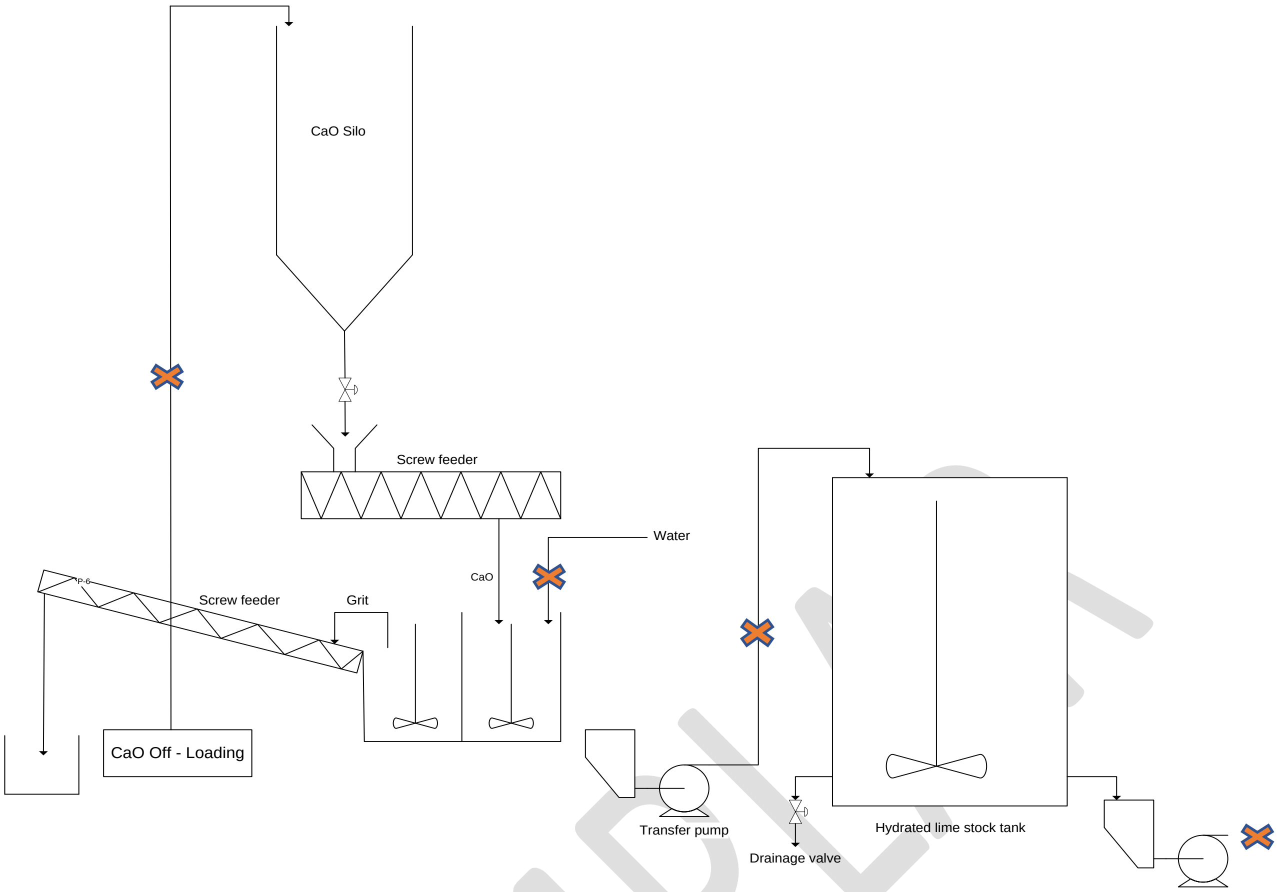

Question 1.

1.1.1 Ensure all raw materials used are within specifications. /10

1.1.1.1 Using the information and process diagram provided above, identify three possible sampling points by making a mark on the process flow diagram and complete the table below: /6

Sampling Point	Possible sampling method	Analysis Required
1. Offloaded CaO	• Manual sampling	• Quality – Concentration • Particle size
2. Makeup Water	• Manual sampling/Automtic sample	• Water quality
3. Lime to aging tank/ stock tank	• Manual sampling	• SG • Strength
4. Lime slurry to the process plant	• Manual sampling	• SG • Strength

1.1.1.2 Explain the effects of incorrect sampling and analysis on the process in terms of up and downstream requirements. /4

Accurate information is required for pH control purposes:

- Incorrect information could lead to poor control of pH in the process plant.
- Long delays or inaccurate information will result in poor efficiencies downstream.
- Predicting behaviour of the downstream processes and correcting parameter will be difficult.

Question 2

2.1.1. Assess, record and report process, equipment, and operating environment for risks. /30

In a Chemical Plant, there are several hazards and risks associated with the process, equipment, and operating environments. These hazards and risks must be managed for the safety of the employees and the environment.

The HIRA procedure for risk management (involving hazard identification, risk assessment and control) is a practical guide for helping make all workplaces safer for employees. Hazards identification and risk assessment must be carried out every time a change is made or when work is performed. A formal one must be carried out on a regular basis.

2.1.1.1. What is Risk management? /2

- Risk management is the process of making and carrying out decisions that will minimize the adverse effects of risk on an organization.

2.1.1.2. Give three reasons why risks are managed. /3

- Saving resources: people, income, property, assets, time
- Protecting public image
- Protecting people from harm
- Preventing/reducing legal liability
- Protecting the environment

2.1.1.3. Give 5 steps to Risk Management. /5

1. Identify the hazards/ risk .
2. Decide who might be harmed and how.
3. Evaluate the risks and decide on precaution - assess the risk.
4. Record your findings and implement them.
5. Review your assessment and update if necessary (document)

2.1.1.4. Using the information and Lime slaking process flow diagram provided, complete a daily inspection checklist for this plant. The inspection checklist is used as one of the risk management tools. /10

What to check for:	Good	Bad	Comment/Action Required
1. CaO Silo level	x		
2. Condition of Silo discharge valve	x		
3. CaO Screw feed	x		
4. Water supply valve	x		

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5. Water supply pipes		x	There is a hole on the pipe body. The pipe must be replaced
6. Slaker Agitator condition	x		
7. Transfer pump condition		x	Pump casing is leaking due to loose liner. This is cause friction between the impeller and the liners. Liners must be repaired
8. Grit classifier condition	x		
9. Stock tank agitator condition	x		
10. Stock tank level	x		
11. Bund wall		x	Spillage accumulation due to leaking casing. Stop the leak and clean the spillage from the band wall.
12. Fire extinguishers	x		
13. Condition of safety signs		x	Clean safety /symbolic signs
14. Condition of lights	x		
15. Safety devices e.g. E-stops.	x		

2.1.1.5. Using the information and Lime slaking process flow diagram provided, identify5 Hazards and Risks associated with the Lime make-up. /10

Hazard	Risk
Moving Machinery	• Limbs can be caught in • Loose clothing caught in • Burn wounds can be caused by contact with hot machinery or equipment
Harmful dust	• Respiratory illness or Lung disease • Suffocation
Faulty safety devices	• Personal injury • Death/Fatalities
Noise	• Hearing loss
Poor illumination	• Poor visibility • Slipping • Tripping • Falling
High temperatures /Heat	• Burns
Slippery conditions/Spillage	• Slipping • Falling • Personal injury

2.1.2. *Take corrective actions to identified risks. /30*

2.1.2.1. For each of the identified Hazards above, determine the risk rating by using the risk matrix below and indicate the control actions required. /10

			Likelihood Score				
Risk Consequece/Impact Score	Likelihood ➡		1	2	3	4	5
	Risk consequence /impact ⬇		Rare	Unlikely	Possible	Likely	Almost Certain
	5	Catastrophic	5 Moderate	10 High	15 Severe	20 Severe	25 Severe
	4	Major	4 Moderate	8 High	12 High	16 Severe	20 Severe
	3	Moderate	3 Low	6 Moderate	9 High	12 High	15 Severe
	2	Minor	2 Low	4 Moderate	6 Moderate	8 High	10 High
	1	Negligible	1 Low	2 Low	3 Low	4 Moderate	5 Moderate

Hazard	Risk	Risk Rating	Control Action
Moving Machinery	• Limbs can be caught in • Loose clothing caught in • Burn wounds can be caused by contact with hot machinery or equipment	• Impact = 4 • Likelihood = 3 • Rating = 12	• Isolation and Lockout. • Do not wear loose clothing. • Proper machine guarding should be in place. • Warning signs must be in place. • Wear PPE
Harmful dust	• Respiratory illness or Lung disease • Suffocation	• Impact = 3 • Likelihood = 3 • Rating =9	• Wear dust musk or a respirator.
Faulty safety devices	• Personal injury • Death/Fatalities	• Impact = 4 • Likelihood = 3 • Rating = 12	• Regular testing of safety devices. • Regular inspections. • Report defective safety equipment. • Follow the lockout procedure. • Wear PPE
Noise	• Hearing loss	• Impact = 3 • Likelihood = 5 • Rating = 15	• Wear hearing protection. • Report excessive noise
Poor illumination	• Poor visibility • Slipping • Tripping • Falling	• Impact = 2 • Likelihood = 2 • Rating =4	• Defective lighting must be reported for immediate repair. • Avoid wetting lights when hosing.

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High temperatures /Heat	• Burns • Heat exhaustion	• Impact = 2 • Likelihood = 2 • Rating =4	• Ensure good ventilation. • Always drink enough water •
Slippery conditions/Spillage	• Slipping • Falling • Personal injury	• Impact = 2 • Likelihood = 2 • Rating =4	• Visually examine working and travelling areas for spillage • Warn all persons of the condition. • Spillage must be cleaned as soon as possible, and the cause identified and rectified • Notify the persons responsible for the area

The Lime stock tank has build-up that must be washed. For this task to be started, a risk assessment must be conducted. List 5 main activities/task steps that are required to complete the task. For each Identified task step, Indicate the hazard, risk, initial risk rating, control measures and residual risk rating.

2.1.2.2. Complete the risk assessment using the risk assessment matrix used in 2.1.2.1 for performing this task. /20

Activity/ Task Steps	Hazard	Associated Risk	Initial Risk Rating	Control Measure	Residual Risk Rating
1. Stop the agitator	Moving machinery	Burn wounds can be caused by contact with hot machinery or equipment	Impact = 4 Likelihood = 3 Rating = 12	Isolate and Lockout	Impact = 3 Likelihood = 2 Rating = 6
2. Isolate and lock the agitator	Electrical energy	Agitator starting while cleaning the tank.	Impact = 4 Likelihood = 3 Rating = 12	Isolation must be tested before cleaning starts.	Impact = 3 Likelihood = 2 Rating = 6
3. Connect the high-pressure hose to water supply	Hand tool (hose)	Hand injury/Cuts. Slipping/tripping	Impact = 3 Likelihood = 2 Rating = 6	Wear correct PPE (gloves and safety shoes)	Impact = 2 Likelihood = 1 Rating = 2
4. Open the tank drain valve	Slurry splashes (discharge at high pressure)	Slippery surfaces - Slip and fall	Impact = 3 Likelihood = 3 Rating = 9	Wear correct PPE. Ensure the spillage pump is running.	Impact = 3 Likelihood = 1 Rating = 3

5. Wash the build-up	High Pressure water. (Splashes)	Eye injuries Slip and Fall	Impact = 4 Likelihood = 3 Rating = 12	Wear Correct PPE. Take a firm position to prevent slipping	Impact = 2 Likelihood = 2 Rating = 6

2.1.3. *Respond to emergencies as per emergency procedures. /30*

The following are examples of potential environmental emergencies associated with Chemical Plants.

1. **Fires**
2. **Spillage of potentially contaminated water (Surface Pipelines)**
3. **Chemical spillages**

2.1.3.1. Draw up procedures that must be followed when responding to the emergencies indicated above. /15

Fire Procedure : (10 Marks)
All fires are to be reported to the Control Room
- On discovering the fire , inform the control room who will raise the alarm
- Close all doors and windows on leaving building
- Everybody immediately evacuate the area / building
- A roll call will be taken
- Assess the extent of the fire and try to extinguish the fire
- If the fire is contained log an incident
- The fire will be investigated and a report will be made out
- If the fire is uncontrollable, phone control room and state your name and exact location and extent of the fire
- Control room will call the 911 medical Team, fire master, fire brigade, Plant manager, Senior SHE Specialist, SectionEngineering Manager and inform protection services of the fire and its location.
- Protection services must accompany the fire brigade to the scene of the fire.
- The local fire brigade will take over and extinguish the fire If the fire is contained an Incident will be logged and the fire will be investigated

Spillage of potentially contaminated water (Surface Pipelines): (5 Marks)
- The person detecting the emergency should call the emergency number (xxxx)
- Notify the nearest most senior official
- Notify the Safety, Occupational Hygiene and Environmental Sections
- Mobilise possible equipment that can be used to remedy the situation.

Chemical spillages Procedure : (5 Marks)

- Assess the site for your own safety;
- Report the incident and ask for assistance;
- Stop the source (leak, close bund valve, etc.);
- Use oil / chemical spill kit to clean up spillages on impermeable surface;
- Spillages on bare soil should be treated by removing the contaminated soil and sending it to the hazardous waste transfer facility;
- Log the incident on the available system
- Return to workplace after area has been declared safe.

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The purpose of an Electrocution Emergency procedure is to ensure speedy corrective action when a person has been electrocuted and to prevent further electrical shock.

2.1.3.2. What are the general precautionary measures and requirements that one must remember when attending a person who is electrocuted? /5

- DO NOT touch a person that is in contact with live conductors with bare hands prior to the removal of the live conductor that caused the electrical shock.
- Separate a live conductor from the person by using a non-conductive material such as manilla rope, wood, etc.
- All persons engaged in electrical work must be conversant with the correct methods of releasing persons in contact with live conductors, in artificial respiration, in treatment of electrical shock and in fire extinguishing procedures.
- The location of the nearest telephone and the telephone number of the nearest place where help can be summoned in case of an emergency must be known; or phone emergency number.
- The location of the nearest first aid equipment must be known.
- Notice boards shall be displayed at suitable places within Substations.
- Be familiar with the Electrocution Emergency Procedure.

2.1.3.3. What is an Emergency? /1

An emergency is a situation that poses an immediate risk to health, life, property, or environment.

2.1.3.4. Why is it important to have an emergency plan? /2

An emergency plan specifies procedures for handling sudden or unexpected situations. A definite plan to deal with major emergencies is an important element of OH&S programs.

2.1.3.5. What is the overall objective of an emergency plan? /3

The objective is to be prepared to:

- Prevent fatalities and injuries.
- Reduce damage to buildings, stock, and equipment.
- Protect the environment and the community.
- Accelerate the resumption of normal operations.

2.1.3.6. What are the elements of an emergency plan? /4

The emergency plan includes the following elements:

- All possible emergencies, consequences, required actions, written procedures, and the resources available.
- Detailed lists of emergency response personnel including their cell phone numbers, alternate contact details, and their duties and responsibilities.
- Floor plans.
- Large scale maps showing evacuation routes and service conduits (such as gas and water lines).

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2.1.4. Identify abnormal conditions, correct conditions, and implement preventative actions. /30

Fire Evacuation Drills are conducted four time a year in the Chemical Plant. The first drill is scheduled early in the first semester (March) , the second drill is scheduled late in the first semester (June) , the third drill is conducted early in the second semester (September) and the last drill is conducted late in the second semester (December) . Evacuation is mandatory for all Employees during all fire alarm activations. When the fire alarm sounds, you must leave the plant immediately. **Never** assume that the alarm is false or that the system is being tested.

2.1.4.1. What is the purpose of an Emergency drill? /5

- The purpose of conducting an emergency evacuation training drill is to assist personnel to know their roles and responsibilities in an emergency situation in accordance with the workplace plans and procedures, and to test the workforce response to an emergency.
- Workplace emergency response plan and procedure familiarisation
- Identify required roles of workplace personnel
- Discuss outcomes of simulated evacuation
- Critique of evacuation drill against outcomes,
- Suggested improvements to the plan and procedures

2.1.4.2. Why is it important to have a fire alarm system? /2

- Fire Alarm System provides you with an early warning of an emergency situation. Even if your area is clear of any smoke or odor, do not disregard the alarm, as there could be an incident on a section away from your area.

2.1.4.3. What is an Incident report? /2

- An incident report is a tool that documents any event that may or may not have caused injuries to a person or damage to a company asset. It is used to capture injuries and accidents, near misses, property and equipment damage, health and safety issues, security breaches and misconducts in the worksite.

2.1.4.4. What are the general rules regarding reporting of incidents/accidents? /2

- Employees are required by law to report all near misses and incidents to their supervisor, health and safety representative or any authority managing them.
- All incidents must be reported before the end of the working shift of the particular day the incident occurred.
- All personal injuries must be reported immediately to the supervisor.
- All incidents reported the next day will not be taken into consideration.
- All accidents not reported on the same day and or the intention was to defeat the ends of an investigation, the necessary disciplinary action should be imposed by the Supervisor on that employee involved in the act.

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2.1.4.5. When Does an Incident Report Need to Be Completed? /2

- Create an incident report **as soon as your employees are safe**, which includes seeking medical attention and implementing an immediate corrective action to prevent further danger or damage.

Incident Description

Secondary containment is used on plant as a second line of defence for preventing, controlling or mitigating major hazards events. Bunds are generally used around storage tanks or drum storage areas where flammable or toxic liquids are held. Alternative measures may be earth dikes (usually for very large tanks), sumps and interceptors. Bunds are also sometimes used within plant buildings for reactors and other process vessels. For materials that are normally gases at ambient conditions, bunds are used where flash fractions are sufficiently low to merit them.

Bunds should be sized to hold 110% of the maximum capacity of the largest tank or drum. This will allow some latitude for the addition of foam during response to the emergency. Bund spillages or seepage must be reported immediately.

On the 15th of October 2020 at 11h00, the spillage pump located in Lime slaking sections of a chemical processing plant was faulty and this resulted in the bund wall overflowing. The spillage further buried the spillage pump causing more damage to the impeller blades and shaft. This is regarded as an environmental emergency. An incident report must be generated and submitted to the SHEQ department.

2.1.4.6. Using the incident description above, Complete the incident report form below. /17

DATE:				**TIME:**	
DEPARTMENT / CONTRACTOR COMPANY:				**SECTION:**	
REPORTING PERSON'S NAME AND SURNAME					
TYPE OF INCIDENT/ACCIDENT	**Safety**			**Occ. Hygiene.**	
A PERSONAL INJURY					
Name:		**Coy No.:**		**Occupation:**	
Nature of Injury:					
Witness:			**Estimated Time Loss:**		
B DAMAGE TO EQUIPMENT / PRODUCTION LOSS					
Type of Equipment damaged:					
Nature of Damage / Loss:					
C DESCRIPTION OF INCIDENT / ACCIDENT					
D WHY DID THE INCIDENT OCCUR?					

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1.	
2.	
3.	
4.	

E IMMEDIATE CORRECTIVE ACTIONS		
	DUE DATE	DATE COMPLETED
Reporting Person		

SIGNATURE:

DATE: ____________________ ____________________

2.1.5. Respond to process alarms and emergency alarms appropriately. /20

The Lime slaking plant indicates the following Alarms.

1. **Water supply flowrate low.**
2. **Stock tank level is low(<20%).**
3. **Stock tank agitator tripped.**
4. **High slaking tank level (100%)**

Your responsibility is to monitor and control the operation of the Lime slaking plant and to respond to any changes that might affect the performance of the plant.

2.1.5.1. Explain how you would deal with the above process alarms, what you would check for and adjust. /16

1. Water supply flowrate low. /4 • Check the condition of the water supply pump. • Check for leakages on the line • Check if the drain valve is completely closed • Open manual makeup water • Start the standby pump and check the flow rate. If the flow picks up then stop the main pump and continue to run with the standby pump • Further investigate the faulty pump
2. Stock tank level is low. /4 • Check if the lime slaker system is running • Check the water supply and Lime addition (Screw feeder operation) • Check if there are no leakages on the makeup tank, transfer lines or stock tank. • Check for blockages on the transfer system to the Stock tank. • Check if the transfer pump is running and start it if necessary. Monitor the stock tank level for any improvement. • Physically check if the level is correct. Level transmitter might be faulty. Clean the level transmitters regularly to prevent reoccurrence.

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3. Stock tank agitator tripped. /4 • Check if the tank level is low. Agitator will trip if it is not submerged. • Check if the flow from the slaker is consistent and that there are no leakages. • Adjust the flow setpoint if necessary. • Check the SG of the Lime slurry • Check if enough makeup water is being added to the slaker. Check is the supply water is sufficient and adjust if necessary.
4. High slaking tank level/4 • Check for build-ups in the tank. • Check if the grit classifier is operating, start it if necessary. Check if the level drops after starting the classifier. • Check for blockage on the transfer line (flow to the stock tank should be low). Flush with water to clear the line. Check if the flow rate goes high and if the Level if dropping.

2.1.5.2. An evacuation alarm for the Gas leak detection system is activated in the affected section of the Chemical Plant, what will be the process to follow when evacuating to ensure that you do not put yourself into jeopardy? /4

- Call the emergency number.
- Cease all operations immediately.
- Do not switch lights on or off.
- Evacuate as soon as possible.

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WESTERN CAPE
Tel: 021 551 1113/4 | 087 944 4377
Unit B2, Cnr Race Course & Omuramba Roads, Montague Gardens, 7441

KWAZULU-NATAL
Tel: 031 368 4040 | 087 944 4377
1 The Boulevard, Westway Office Park, Block D, Westville, Durban, 3630

PORT ELIZABETH
Tel: 041 509 6478 | 087 944 4377
Struanway Block E, New Brighton, Port Elizabeth, 6001

@CHIETA_SETA @CHIETASA @CHIETA_SA www.chieta.org.za
Anti-Fraud Line: 0800 204 489 | Toll Free Line: 0800 111 173

MARK ALLOCATION GRID (For use by the Assessor only)

QUESTION	MARK	MARKS AWARDED
1.1.1.1	6	
1.1.1.2	4	
2.1.1.1	2	
2.1.1.2	3	
2.1.1.3	5	
2.1.1.4	10	
2.1.1.5	10	
2.1.2.1	10	
2.1.2.2	20	
2.1.3.1	15	
2.1.3.2	5	
2.1.3.3	1	
2.1.3.4	2	
2.1.3.5	3	
2.1.3.6	4	
2.1.4.1	5	
2.1.4.2	2	
2.1.4.3	2	
2.1.4.4	2	
2.1.4.5	2	
2.1.4.6	17	
2.1.5.1	16	
2.1.5.2	4	
Total	**150**	

ASSESSOR DETAILS

ASSESSOR NAME & SURNAME	
REGISTRATION NUMBER	
SIGNATURE	
DATE	

MODERATOR DETAILS

MODERATOR NAME & SURNAME	
REGISTRATION NUMBER	
SIGNATURE	
DATE	

CHIETA HEAD OFFICE:
Tel: 087 944 4377 | 010 590 3081 | 011 628 7000
72 New Road, Glen Austin AH (Grand Central), Midrand, 1685

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