

Minerals Council South Africa


SUBJECT:

CHAMBER OF MINES OF SOUTH AFRICA –
CERTIFICATE IN MINE ENVIRONMENTAL CONTROL

PAPER 4 – RISK MANAGEMENT. INFORMATION
MANAGEMENT, FIRES & EXPLOSIONS, GASES AND
STATISTICS

SUBJECT CODE: COMMEC4

EXAMINATION DATE: 9 MAY 2025

TIME: 14:00 – 17:00

EXAMINER:

Thulile S Zamisa

MODERATOR:

Ramokone A Rabaji

TOTAL MARKS: [100]

PASS MARK: 60%

NUMBER OF PAGES 5 (including this page)

Examination Instructions:

All candidates are advised to read the below instructions/requirements and adhere to them. Not adhering to them could lead to the loss of marks.

This examination question paper consists of **5** pages

1. Answer all **4** questions in *English*.
2. Put your identification number on the outside cover of each book used, and on any graph paper or other loose sheets handed in.
NB: Your name must NOT appear on any answer book or loose sheets.
3. Show all calculations **and check calculations on which your answers are based**.
4. Hand-held electronic calculators may be used for calculations only.
5. Write in ink on the **right-hand page** only – the left hand page will not be marked.
6. Illustrate your answers by means of sketches or diagrams wherever possible.
7. Answers must be given to an accuracy which is typical of practical conditions.
NB: Ensure that the correct units of measure (SI unit) are recorded as marks will be deducted from answers if the incorrect unit is used (even if the calculated value is correct).
8. In answering the questions, full advantage should be taken of your practical experience as well as data given.
9. Please note that you are not allowed to contact your examiner or moderator regarding this examination.
10. This is **NOT** an open book examination but the approved formula hand out may be used.
11. Cell phones are **NOT** allowed in the examination room
12. You are encouraged to make use of the CoMCert Tip-off Hotline whenever you witness or suspect any wrongdoing related to the CoMCert Examinations on landline 0800 118 998 or alternatively you can use email COMCert@tip-offs.com. This tip-off hotline and tip-off email is managed anonymously and confidentially through an independent service provider.

QUESTION 1.

- 1.1. A LHD (Load hauler dumper) operates in a haulage and emits $0,3\text{m}^3/\text{s}$ of exhaust gas containing 2500ppm carbon monoxide. The cross-sectional area of the haulage is $14,8\text{m}^2$ and the ventilation quantity is $12,8\text{m}^3/\text{s}$.

Calculate the percentage of carbon monoxide content in the air immediately on the return side of the locomotive when:

- a) When the LHD is standing still (3)
 - b) The LHD is travelling at $1,5\text{km/h}$ in the same direction as the ventilation (4)
 - c) The LHD is travelling at 7km/h in the opposite direction to the ventilation (4)
 - d) When the LHD travels at the same speed as the airflow and in the same direction as the airflow (4)
- 1.2. You are requested by the engineering department on your mine to calculate the maximum nitrogen dioxide emissions from the exhaust of a vehicle driven by a 95kW compression ignition diesel engine. The purpose is to ensure that the time weighted average exposure over an 8-hour shift (TWA), for NO_2 is not exceeded, when operated in uncontaminated intake air. The quantity of air used by the machine and released via the exhaust is $0.3\text{m}^3/\text{s}$. Assume a clean airflow rate of $0.2\text{m}^3/\text{s}$ per kW of engine power.
- a) The required clean airflow rate for the operation of the engine. (1)
 - b) Determine the maximum NO_2 concentration allowed at the exhaust of the engine in this airstream. (3)
- 1.3. Describe six means on how adequate ventilation can be maintained to prevent flammable gas accumulation (6)

[25]

QUESTION 2.

- 2.1. The 2024 annual noise measurements for drilling operators HEG with 120 employees indicate a mean of 104dBA and the 90th percentile is 106dBA for personal measurements. The employees use one type of drill which emits noise ranging from 105.0dBA to 106.4dBA.

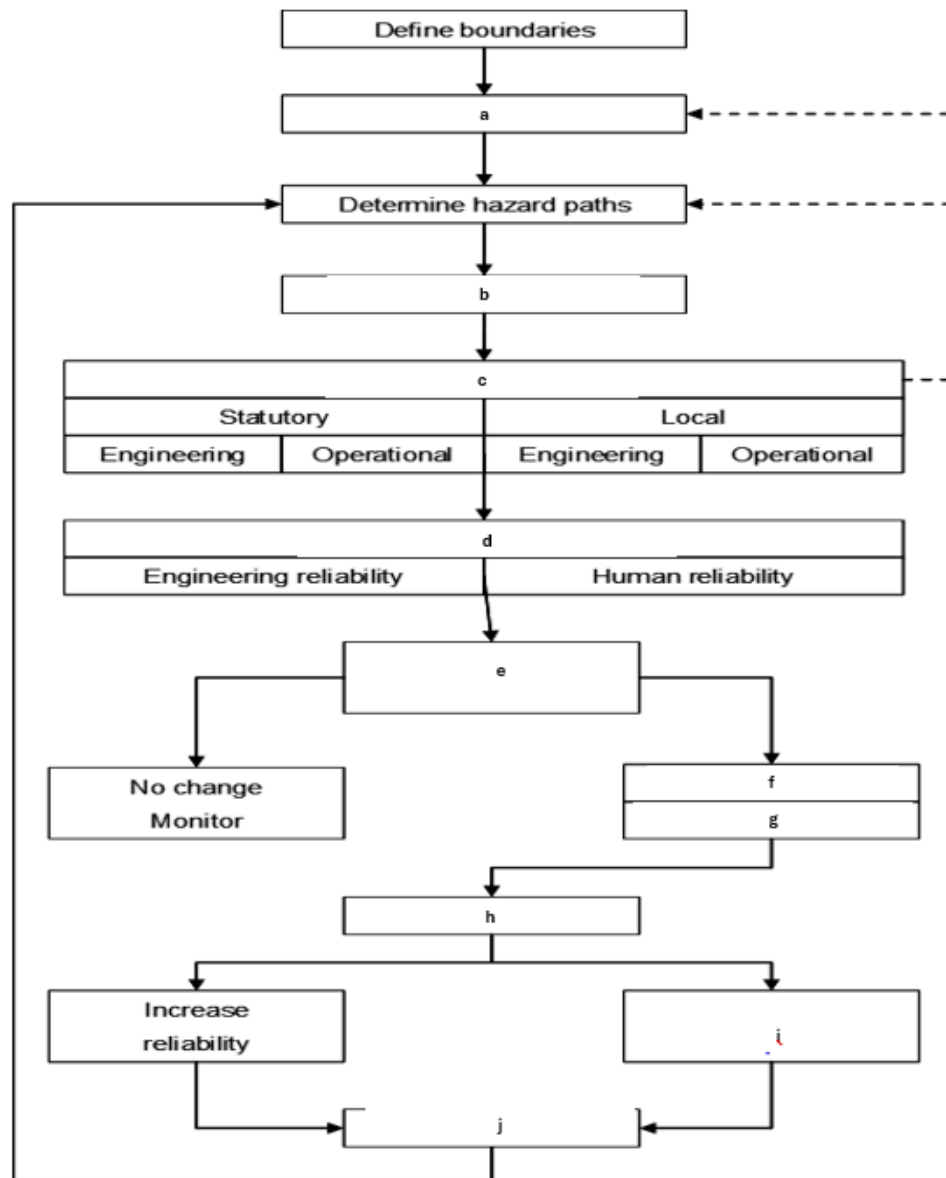
- a) What is the 2024 annual HEG Classification for these employees? Give a reason for your answer (2)
- b) How many samples must be collected in 2025 (for the year) for the HEG? Show your calculations and give reasons for your answer (4)
- c) Is medical surveillance necessary and if so, what must be the frequency of audiograms for these employees? Give a reason for your answer (2)

- d) Did the results meet the December 2024 milestones? Give a reason for your answer (2)
- e) If the information above remains the same, will they meet the 2034 milestones? Give a reason for your answer (2)
- 2.2. The following are the annual Respirable PNOC TWA dust concentration in mg/m³ from a gravimetric dust sampling program:
- | | | | | |
|------|------|------|------|------|
| 2.30 | 2.82 | 3.60 | 2.11 | 0.98 |
| 3.40 | 1.32 | 0.82 | 1.55 | 0.99 |
- a) Calculate the 90th percentile (1)
- b) Calculate the mean (1)
- c) Calculate the standard deviation (1)
- 2.3. Plot and interpret the distribution curve using the above calculation values. (5)

[20]**QUESTION 3.**

- 3.1. In the context of fire preparedness and prevention in a diesel workshop, give two examples of the elements of the hierarchy of controls stated below. (2)
- a) Elimination (2)
- b) Substitution (2)
- c) Engineering Controls (2)
- 3.2 List four things that must be depicted on an underground mine ventilation and rescue plan as required by legislation (4)
- 3.3 List and briefly explain the five actions to be taken by you as a mine official, if employees are working in a workplace with dangerous gas accumulation. (5)
- 3.4. What are the legislative aims of Risk Management for mines according to Section 11(2) of the MHSA 1996, and provide an example of Programmes to monitor risk to which employees may be exposed" as per section 11(2) (d)(ii)? (3)
- 3.5 Give short definitions of the following when used for Risk Management. (2)
- a) Tolerate
- b) Health

3.6 Complete the missing steps (a-j) on the diagram of the risk control process. (10)



[30]

QUESTION 4.

- 4.1. Give an approximate flash-point temperature of the following products and the approximate volumes of carbon monoxide (CO) and carbon dioxide (CO₂) gases produced when burning (6)
- a) Wood
 - b) High Density Polyethylene (HDPE)
 - c) Polyvinylchloride (PVC)
- 4.2. Define the following terms: (4)
- a) Pyrolysis
 - b) Smoke density
 - c) Flash ignition temperature
 - d) Self-ignition temperature
- 4.3. List and briefly explain six areas where spontaneous combustion of coal is most likely to occur. (6)
- 4.4. Briefly state the shortcomings of using fire patrol compared to electronic fire detection systems. (4)
- 4.5. Differentiate between "Explosion resistant" and "Explosion relief" (2)
- 4.6. Briefly explain the following terminology in terms of reducing the risk of coal dust explosions (3)
- a) Chain Road
 - b) Multi Road
 - c) Longwall

[25]**TOTAL MARKS 100**