Deputy of underground coal mines

Summary of results and general comments

Written Examination

Examination Date: 2 September 2016
Number who passed: 13 out of 19
Highest mark obtained 78%
Average overall mark: 60%
Lowest overall mark: 31.5%

Coal mining practice and legislation

Question 1 (total of 20 marks)

Highest mark obtained 20/20
Average overall mark: 10.9/20
Lowest overall mark: 2.5/20

1a) Answer: (worth 10 marks)

(a) inspection of all production areas, including,

(i) inspection for the presence of flammable and toxic gas before connecting power to any plant, and

(ii) inspection, at least once every 2 hours, of each face area where coal or mineral is extracted, and

(iii) inspection, at least once every 5 hours, of all other places where persons work, and

(iv) inspection, at least once every 8 hours, of all safely accessible places in the production area,

(b) inspection of places other than production areas, including, but not limited to:

(i) inspection at least once every 8 hours of all places where persons work, and

(ii) inspection at least once every 24 hours of all roadways where persons regularly travel, and

(iii) inspection at least once every 7 days of all safely accessible places (including all safely accessible roadways, goaf edges, shafts and drifts),

(c) inspection for the presence of flammable gas prior to the supply of electric power to any underground part of the mine,

(d) inspection for the presence of flammable gas or contaminants in the general body of the air,

(e) inspection of the adequacy of the following:
(i) ventilation,
(ii) the process of making roadway dust inert,
(iii) emergency, first aid and fire-fighting equipment,

(f) inspection of the condition of the following:
   (i) ventilation control devices,
   (ii) auxiliary fans,
   (iii) surfaces over which persons may travel or vehicles may be driven,

(g) inspection of the support for the excavation,
(h) inspection of the stability of roadways in the excavation,
(i) inspection for indications of heating of coal or other material or fire,
(j) inspection for abnormal water inflow,
(k) inspection for plant malfunction,
(l) inspection of the functioning of communication and monitoring systems,
(m) inspection for excessive accumulation of mud, water, rock or coal,
(n) inspection of environmental conditions.

**Overall comment:** Inspection program is the main function of a coal mining supervisor. Each section has equal weighting, people concentrated only on inspection times and places and not the full requirement of the regulation.

1b) 
**Answer:**

(a) the supervisor of each outgoing shift provides a written report to the supervisor of the incoming shift, in relation to the state of the workings at the mine or petroleum site and plant and any other matters that relate to work health or safety, and
(b) the supervisor of the outgoing shift acknowledges in writing to the supervisor of the incoming shift the accuracy of the report and signs (or electronically signs) the acknowledgment, and
(c) the supervisor of the incoming shift communicates the content of the report to the workers on the incoming shift, and
(d) the supervisor of the incoming shift acknowledges in writing to the supervisor of the outgoing shift that the content of the report has been communicated to workers on the incoming shift and the supervisor of the incoming shift signs (or electronically signs) the acknowledgment.

**Overall comment:** It was not clear in many cases who was addressing who. The content in the legislation is in 4 parts and is quite clear.

1c) 
**Answer:**

Health Control
Electrical Control Plan
Mechanical Control Plan
Explosives Control Plan
Ventilation Control Plan
Well Integrity Control Plan

**Overall comment:** Candidates guessed some of the Principal Control Plans and others mixed them up with Principal Hazard Mining Plans. There is a clear distinction.

**Question 2 (total 20 marks)**

Highest mark obtained: 17.5/20  
Average overall mark: 14.5/20  
Lowest overall mark: 8/20

2a)  
**Answer:**

\[ \text{(worth 4 marks \(\frac{1}{2}\) mark each answer)} \]

\[ \text{i. Longwall} \]

- Working on return side of shearer / production (position of people)
- Double Chocking of LW Supports
- Automation of LW equipment not being utilized
- Water sprays not working (shearer, supports, BSL, etc.)
- Localised changes in the characteristics of the coal seam (could be due to inseam drainage and/or geology)
- Cutting roof or floor (out of seam)
- Roof fall on LW face (poor conditions)
- Dry conveyor belt outbye LW
- Not rotating personnel due to periods of high production
- Defective dust extractor (BSL)
- Inadequate face ventilation quantity
- Poor housekeeping standards – dust on walkways and maingate corner
- Methane drainage has removed inherent moisture content from coal
- Dusty roads leading to the face

\[ \text{ii. Development Panel} \]

\[ \text{(worth 4 marks \(\frac{1}{2}\) mark each answer)} \]

- Water sprays not working
- Insufficient face ventilation (auxiliary fan on wrong VIV setting, rubbers not installed on vent tubes, if onboard vent ducting – build-up of fines in ducting, poor standard of vent tube installation, etc.)
- Cutting out of seam (i.e. high drivage)
- Blunt / missing picks (poor maintenance standards)
- Position of personnel on continuous miner (i.e. In advance of ventilation)
- Not rotating people during periods of high production
- Localised changes in the characteristics of the coal seam (could be due to inseam drainage and/or geology)
- If cut and flit – scrubber on continuous miner needs cleaning
- Depending on face ventilation to the miner – onboard ventilation blocked
- Methane drainage has removed inherent moisture content from coal
- Dusty roads leading to the face
2b) Answer:

i. **Longwall**

   (worth 4 marks)
   
   - Ensure maintenance inspections are complete to ensure all water sprays are operational
   - Rotation of personnel
   - Replace damaged or worn picks
   - Personnel not to operate on the return side of the shearer during production
   - Identify and control dust made external to the LW (i.e. Travel road, conveyor belt, other work tasks)
   - Cutting the correct seam horizon (not floor or roof)
   - Introduction of a wetting agent
   - Water infusion
   - Maintain adequate ventilation

ii. **Development Panel**

   (worth 4 marks)
   
   - Correct position of personnel relative to ventilation system in use
   - Ensure that all water sprays required are operational
   - Maintenance of picks on the continuous miner
   - Identify and control dust made external to the LW (i.e. Travel road, conveyor belt, and other work tasks)
   - Cutting the correct seam horizon (not stone)
   - Introduction of a wetting agent

**NB:** answers that refer to PPE will not prevent a re-occurrence.

**Overall Comment:** Reasonably well answered most candidates had good knowledge on how dust should be handled in panel and longwall operations.

2c) Answer:

(worth 4 marks)

Respirable Dust (invisible dust) – 2.5mg/m³

Respirable dust (which is only a fraction of the width of a human hair) is too small to be seen with the naked eye. When air containing dust is breathed, the larger particles are either stopped by the nose or mouth, or if they go deeper, are removed naturally by the special defences of the lungs. However, a small fraction of the dust cloud, the very small particles, can be retained in the lungs. Therefore a lack of visible dust does not mean that respirable dust is not present.

Inhalable Dust (visible dust) – 10mg/m³

Inhalable dust particles are visible, which also includes respirable dust particles. Inhalable dust (visible dust size below 100 microns) is dust that enters the body but is trapped in the nose, throat and upper respiratory tract.

**Overall Comment:** This question was reasonably well answered airborne dust is topical and mining operations are addressing the concerns candidates had good knowledge on the limits of respirable and inhalable dusts.
Questions 3 (total 20 marks)

Highest mark obtained: 16/20
Average overall mark: 11.9/20
Lowest overall mark: 7.5/20

3a) Answer: (worth 10 marks)

Patient Care
- Danger response make the place safe, safe to self and others including injured person
- Remove power from machinery (LHD), ensure other power to the site is isolated
- Contract control (surface CP) advise injury to person and ambulance requested suspected electric shock, advise control to contact undermanager
- Remove person to a place of safety
- If casualty is responsive ask what happened
- Organise for best of your first aiders to take care of patient
- Consult electric shock protocols
- Organise for transport and ensure a DEFIB is sent with injured person (if available) send most experienced first aiders with casualty
- Ensure pain relief available.

Investigation
- Contact undermanager directly advise of incident
- No road the face area and sterilise the incident scene for investigation. Ensure machinery is sterilised for investigation
- Seek approval to restart auxiliary fan to ventilate face area, ensure damaged miner cable has been pulled and tagged
- Inspect area, start fan inspect face areas for safety, ventilation etc.,
- Gather any crew and commence investigation. Any personnel observations should be recorded
- Fill out any appropriate statutory reports and if required, a damaged cable report.

Overall Comment: This question was answered satisfactorily by most candidates. Patient care is the primary concern, scene sterilisation and the investigation follows. Candidates received top marks if they identified the electric shock and put the best first aider in charge of patients care and realised a defibrillator if available may need to be used.

3b) Answer: (worth 5 marks)

WHS (Mines and Petroleum Sites) Regulation 2014
- Clause 179 (b) fire underground - release of heat and light
  - As set out under WHS (Mines and Petroleum Sites) Act 2013 Clause 14 Notifiable incident and Clause 15 Duty to notify notifiable incidents
- Clause 179 (c) electric shock (other than a shock from extra low voltage)
  - As set out under WHS (Mines and Petroleum Sites) Act 2013 Clause 14 Notifiable incident and Clause 15 Duty to notify notifiable incidents
- Clause 128 5 (h) Electric arc in hazardous zone that leaves visible evidence on an electric cable
  - Notification no later than 7 days after becoming aware of the incident or 48 hours after becoming aware that the incident resulted in an illness or injury
  - Notification to an Industry safety and health representative
Overall Comment: The briefing session identified that there was poor knowledge of what constitutes a Clause 128 (5) High Potential Incident and Clause 179 Dangerous Incidents. From previous examinations, the question was not answered well and candidates confused Clause 128 and 179 events.

3c) Answer: (worth 5 marks)

- Elimination - Elimination of machinery coming in contact with live cable, eliminate need for machine to back into C/T, eliminate the possibility of a machine being able to contact a cable.
- Substitution – Change to how materials are delivered to face area using different method or machinery.
- Isolation – Cable standards isolate cable from machinery to avoid contact.
- Engineering – Review design of machine contact with aim to proximity detection alarms.
- Administrative controls - Review of procedures for delivering materials to face based on risk to machine and operators, retraining of machine operators.
- PPE – No value in preventing this incident.

Overall Comment: Most candidates answered this question reasonably well.

Question 4 (total 20 marks)

Highest mark obtained: 15/20
Average overall mark: 9.9/20
Lowest overall mark: 2/20

4a) Answer: (worth 5 marks)

- Stress corrosion of bolts
- Rib degradation causing the width of the roadway to increase over time
- Inadequate primary support initially
- The critical controls around strata failure are not adequate (i.e. Frequency of inspection, standard of inspection, poor reporting and/or actioning of strata movement/change in conditions)
- Abutment load changes (i.e. Goaf on both sides of old main headings)
- Development of creep
- Original pillar dimension were not adequate
- Presence of geological structures
- Moisture in roof strata leading to degradation of supports
- Natural or induced seismic activity
- High vertical or horizontal stresses

Overall Comment: Identification of strata failure is one of the primary functions of a coalmining supervisor most candidates answered this section poorly.

4b) Answer: (worth 5 marks)

WHS (Mines and Petroleum Sites) Regulation 2014

- Clause 128 Duty to notify regulator of certain incidents
  - High potential incident - 5 (d) a failure of ground support where persons could have potentially been present (where person could have potentially been exposed to a danger incident)
- Clause 179 Dangerous incidents - An incident that exposes a worker or any other person to a serious risk to a person’s health or safety emanating from an immediate or imminent exposure (Person in vicinity)
○ Clause (a) (xvi) a failure of ground, or slope stability control measures

**Overall Comment:** The briefing session identified that there was poor knowledge of what constitutes a Clause 128 High Potential Incident and Clause 179 Dangerous Incidents from previous examinations. The question was not answered well and candidates confused Clause 128 and 179 events as with question 3 b.

4c) **Answer:**

(1) The following matters must be considered in developing the control measures to manage the risks of ground or strata failure:

(a) the local geological structure,

(b) the local hydrogeological environment, including surface and ground water,

(c) the means by which water may enter the mine, and the procedures for removing water from the mine and the effect that those procedures have on rock stability over time,

(d) the geotechnical characteristics of the rocks and soil, including the effects of time, oxidation and water on rock support and stability,

(e) the timing of installation of ground and strata support for the mine, taking into account the geotechnical conditions and behaviour of the rocks and soil,

(f) the collection, analysis and interpretation of relevant geotechnical data, including the monitoring of openings and excavations,

(g) any natural or induced seismic activity,

(h) the equipment and procedures used to record, interpret and analyse data from the monitoring of seismic activity,

(i) the location and loadings from existing or proposed mine infrastructure such as waste dumps, tailings storage, haul roads and mine facilities,

(j) any previously excavated or abandoned workings,

(k) the proposed and existing mining operations, including the nature and number of excavations, the number and size of permanent or temporary voids or openings, backfilling of mined areas and stopes, abutments, periodic weighting and windblast or airblast,

(l) the proposed blasting activities (including the design, control and monitoring of each blast),

(m) the design, layout, operation, construction and maintenance of any dump, stockpile or emplacement area at the mine, including any open cut dumps or stockpiles,

(n) the filling requirements for mined areas and the material to be used as fill,

(o) the stability of any slopes,

(p) the size and geometry of the mine’s openings,

(q) the use of appropriate equipment and procedures for scaling,

(r) the design, installation and quality of rock support and reinforcement,

(s) the need to monitor areas at or around the mine where control measures are in place for the principal hazard of ground or strata failure,

(t) in the case of an underground mine—the stope and pillar dimensions,

(u) in the case of an underground coal mine—the strata support requirements for the mine and the pillar strength and stability required to provide that support and the probability of instability of any pillar taking into account the pillar’s role,
(v) in the case of highwall mining, pillar and highwall support, the interaction of persons and plant.

**Overall Comments:** This was poorly answered. Most candidates referred to support plans and types of support however the requirements are based on pillar strength and size and the geological and hydrogeological environment. Candidates who studied the legislation received good marks.

4d)

**Answer:**

**(worth 5 marks)**

**Primary support**

- Initial support place on the advance after an opening has been created, based on geotechnical advice and written up as support rules giving the minimum support requirements to adequately support the opening, the support rules are tabled under the ground or strata failure MP – the support acts by binding the strata into a solid beam.

- Assists in maintaining integrity of the roof varies in density and there is a range of support measures.

**Secondary Support**

- Secondary support is follow up support put in place after the initial opening has been developed. It may be placed as a longer term support, or to reinforce minimum support that has been set. The support may also be placed to counteract the effects of any longwall abutment zones or goaf areas, to maintain the life of the roadway in the mine and can be made up of long cables and trusses or passive support such as cans, chocks, fibre cribs, link and locks, prop-setters, steels, roc-props and also includes strata binders.

**Passive support**

- Support is not active that is binding strata it allows for the area to weight on the supports e.g. cans, chocks, fibre cribs, link and locks, prop-setters, steels, roc-props and also includes strata binders.

**Overall Comment:** Candidates had a reasonably good grasp between primary and secondary support. Some candidates struggled with what constitutes passive support.

**Question 5 (total 20 marks)**

Highest mark obtained 17.5/20
Average overall mark: 12.8/20
Lowest overall mark: 4/20

5a)

**Answer:**

**(worth 8 marks)**

Ventilate the attached plan – show intake and return airways, stoppings, coffin seals, regulators, overcasts, doors and seals.

**Overall Comments:** Most candidates ventilated the plan satisfactorily.
5b)  
**Answer:** (worth 4 marks)  
Quantities at points A to O

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**Overall Comments:** some quantities given were excessive and in others intakes did not match return air overall reasonably well answered.

5c)  
**Answer:** (worth 4 marks)  
Displayed on plan

**Overall Comments:** monitoring stations reasonably well placed by candidates.

5d)  
**Answer:** (worth 4 marks)  
Displayed on plan

**Note:** error on plan, scale should be 1:5000 not 1:50. Some candidates corrected the error themselves, others did not. Those that did not were not penalised in the marking.
Quantities at F, G, H vary on how roadways are ventilated.

1. Intake = $20 \text{M}^3/\text{s} - 40 \text{M}^3/\text{s}$
2. Returns = $20 \text{M}^3/\text{s} - 40 \text{M}^3/\text{s}$

$O = B + C$ Minus any longwall face quantity

Eg: $B = 30 \text{M}^3/\text{s}$ $C = 60 \text{M}^3/\text{s}$; Total = $90 \text{M}^3/\text{s}$

Longwall Face Quantity say $30 \text{M}^3/\text{s}$ = then

$90 \text{M}^3/\text{s} - 30 \text{M}^3/\text{s} = 60 \text{M}^3/\text{s}$ @ 0

Scale 1:5000

LMN = Minimum $1 \text{M}^3/\text{s}$
However $3 \text{M}^3/\text{s} - 10 \text{M}^3/\text{s}$ for each
Oral Examination

Date: 2 November 2016
Number of candidates: 39
Number deemed competent: 26

General comments

The outcome from the deputies oral exams are the best in many years. Two thirds of the candidates were successful in their oral exam and is reflective of the amount of work put into the oral process. Eight candidates were successful on their first attempt whilst thirteen candidates were successful on their second attempt and five on their third and final oral exam.

Comments from examiners include people working in an outbye role or capacity not having face time and unsuccessful in their first attempt have revisited the working face areas of the mine and gathered more experience to pass the exam.

Ventilation and emergency scenarios are vital in coal mining and it appears the candidates who were not successful lacked knowledge in these areas. It is evident from the second attempts that these areas have been addressed.

The written exam was largely legislation based and candidates’ knowledge of the new legislation is relatively good and was demonstrated effectively throughout the oral process.

More information

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Acknowledgments

The Deputy Examination Panel

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (May 2017). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the NSW Department of Planning and Environment or the user’s independent advisor.

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