WORKSAFE
NEW ZEALAND | MAHI HAUMARU AOTEAROA

EXEMPTION RECOMMENDATION

To: Nicole Rosie, Chief Executive, WorkSafe New Zealand

From: Paul Hunt, Chief Inspector, Extractives

Date: 14 November 2019

Prepared by: Marcela Fuentes, Senior Policy Advisor, Regulatory Frameworks

Subject: **EX0056 – Request from Te Kāhui Whakamana Rua Tekau mā Iwa - Pike River Recovery Agency for an exemption from Regulation 170(4)(a) of the Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016**

Amended 20 November 2019

Recommendations

I recommend that you:

a. **note** that Regulation 170(4)(a) of the *Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016* require a mine operator to ensure that at least one of the escapeways at an underground coal mining operation is designated as the primary escapeway, and is an intake airway or a combination of adjacent intake airways;

b. **note** that Te Kāhui Whakamana Rua Tekau mā Iwa -Pike River Recovery Agency has applied for an exemption from this requirement in relation to its underground coal mine near Ararua (Pike River mine)on the West Coast of the South Island;

c. **note** that WorkSafe has the power to grant exemptions under section 220 of the Health and Safety at Work Act 2015 (the Act). Under section 220(3) of the Act WorkSafe may grant the exemption on any terms and conditions that you think fit;

d. **note** that I have followed the principles of WorkSafe's Exemptions Policy and ensured our recommendations are proportionate to the situation for which the exemption is sought;

e. **note** that while the circumstances of Pike River mine are exceptional, I have followed an approach consistent with other exemption applications in my analysis of the PRRA application to reach a final conclusion. This conclusion is based on the PRRA application and supporting documents, as well as my understanding of the works and other plans;

f. **note** that my conclusion is that the PRRA exemption application meets the requirements of section 220(2) of the Act. I consider the extent of the exemption is considered sufficiently narrow in scope and not broader than reasonably necessary to address the matters that gave rise to the application;

g. **note** that I consider that overall, PRRA's plans and controls will ensure that workers and other persons (during re-entry or escape) are given the highest level of protection against harm to health, safety and welfare, as is reasonably practicable;

h. **agree** to grant the exemption subject to the terms and conditions in recommendation (i);

Agreed / Not agreed

i. **agree** that the exemption be granted subject to the following terms and conditions:

- the exemption applies only in respect of re-entry and recovery of the drift up to the phenolic plug; and
- the phenolic plug must be in place and effective throughout all the recovery process; and
- if there is a change that could have a significant impact on how the PRRA can safeguard the health and safety of workers and others, PRRA must:

  a) respond in accordance with the critical controls included in its principal control plans, principal hazard management plans, and associated standard operating procedures and trigger action response plans; and

  b) inform WorkSafe immediately of any significant change.

Agreed / Not agreed

Signature endorsing the recommendations	Paul Hunt, Chief Inspector, Extractives WorkSafe New Zealand
Date	20/11/19
Signature of the decision-maker	Nicole Rosie, Chief Executive, WorkSafe New Zealand
Date	

Glossary of Terms

Term	Meaning
CABA	Compressed Air Breathing Apparatus
Change-over station	Short duration refuge, in which miners may exchange self-rescuer units during evacuation of a mine
Drift	An inclined access from the surface to the coal seam that passes through rock strata. The Pike River mine drift is approximately 2.3km long rising 1m in 9m through metasedimentary gneiss rock and terminates at the known roof fall at the start of the mine workings. The drift is also referred to as the tunnel
ERZ0	Explosion Risk Zone. All parts of an underground coal mining operation where the general body concentration of methane (CH_4) is or is likely to be (or become) greater than 1.25% CH_4
ERZ1	All parts of an underground coal mining operation where the general body concentration of CH_4 is or is likely to be greater than 0.25% but no more than 1.25% and: i. a development heading, ii. a goaf area, iii. a place where adequate standards of ventilation in relation to methane cannot be assured, taking into account abnormal circumstances, iv. a place on the return side of the above, unless classified as an ERZ0
Inbye	The direction towards the interior of the mine or tunnel from any reference point
Intake	Any underground roadway that contains intake air moving through it towards the working place
Intake air	Air that is going into the mine. Normally, fresh air
JHA	Job Hazard Assessment
Outbye	The direction away from an underground point towards the surface from any point of reference
PHMP	Principal Hazard Management Plan. A plan developed for a recognised principal hazard that has had a risk assessment applied to the hazard and contains information to mitigate the risks and manage the hazard in the operation. A PHMP is required under the Health & Safety at Work (Mining and Quarrying) Regulations 2016
Portal	Entrance to the tunnel; surface end of the drift

Term	Meaning
PCP	Principal Control Plan. A specific plan that is the result of a risk assessment or series of risk assessments relating to hazard mitigation within a particular system such as ventilation, electrical reticulation and mechanical processes and equipment. A PCP is required under the Health & Safety at Work (Mining and Quarrying) Regulations 2016
Refuge chamber	Safe haven where miners can wait either until the danger has passed or they station are rescued. It has guaranteed air supply and sustenance
Return	Any underground roadway that has 'contaminated' air moving through it towards the surface
Spontaneous Combustion	Coal reacts with atmospheric oxygen even at ambient temperatures and this reaction creates heat. If the heat liberated during the process is allowed to accumulate, the rate of the above reaction increases exponentially and there is a further rise in temperature. When this temperature reaches the ignition temperature of coal, the coal starts to burn and the phenomena is described as spontaneous combustion
Ventilation Control Device (VCD)	A structure used in a mine or tunnel to control the ventilation circuit and contain gases or atmospheric conditions that must be separated from the ventilated part of the mine or tunnel. Some VCDs are rated and some are temporary
Forced ventilation	A system using a fan to blow air into the mine
Exhaust ventilation	A system using a fan to suck air out of the mine
The phenolic plug	The seal (made of rapidly expanding phenolic foam material) installed in front of the rockfall to isolate the drift from the mine
Escapeway	Exit trafficable on foot
Workings	The roadways and extraction areas in the coal seam, beyond the access drifts
Fresh air	Contains not less than 19% by volume of oxygen, not more than 0.25% methane, 25 ppm of carbon monoxide, than 5000 ppm of carbon monoxide Contains no other substance at a level that is likely to cause injury or illness to a mine worker over the period that the mine worker is exposed to the substance at the mining operation
Shaft	Vertical or near-vertical tunnel from the top down

Executive Summary

1. Te Kāhui Whakamana Rua Tekau mā Iwa -Pike River Recovery Agency (PRRA) is seeking an exemption from regulation 170(4)(a) of the Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016 (the Regulations).

2. Regulation 170(4)(a) imposes a duty on a mine operator of an underground coal mining operation to ensure that there is a primary escapeway that is an intake airway.

3. Under the Regulations, existing mining operations do not require a second escapeway until 16 December 2024 under transitional provisions.

4. PRRA has requested the exemption in respect of the re-entry and recovery of the drift as far as the roof fall at the end of the drift.

5. In the Pike River mine, there is a single drift which is therefore the primary escapeway. PRRA has stated that creating a second escapeway, while technically possible, is complex and would create more risks to workers and people than adopting the proposed plan (which includes the use of forced ventilation in the drift).

6. PRRA is planning to use forced ventilation to establish a breathable environment in the drift. PRRA and the external ventilation expert engaged by WorkSafe agree that forced ventilation (as opposed to an exhaust ventilation) will be more suitable for the planned activities (i.e. removing the 170 barrier, purging of any residual gases in the drift and conducting the recovery).

7. The key concern is that, in case of an emergency situation, forced ventilation would require workers to escape in contaminated air (i.e. potential gases and fumes). The analysis shows that there is no certainty of what air conditions would be available to workers in an emergency situation. PRRA's application presents a list of all controls and additional measures that will be applied if workers need to escape in contaminated air.

8. PRRA has submitted that :

   - it is confident in its assessment of the risks associated with escaping in return air, as it is based on well-known techniques and standards[1];

   - the final controls and measures identified in the risk assessment would be equal to or better than what is required under regulation 170(4)(a) of the Regulations;

[1] PRRA used a risk assessment technique based upon NSW MDG1010 guidelines and AS/NZS ISO31000:2009, as well as FTA (fault-tree analysis), ETA (event –tree analysis) and Bowtie analysis.

- the application is not broader than is reasonably necessary, as required by section 220(2)(a) of the Act. This is because it only relates to one part of a single regulation (170(4)(a)). This regulation relates to the 'intake airway' that will apply in respect of the re-entry and recovery at Pike River mine;

- PRRA believes the exemption meets section 220(2)(b) of the Act as forced ventilation will better eliminate or minimise the risks and provide the highest level of protection from hazards and risks as is reasonably practical.

9. I note that the alternative proposed option to comply with regulation 170(4)(a) involves forced ventilation and implementing additional measures. This is to ensure adequate controls remain in order to:

- prevent a catastrophic event (i.e. an explosion);

- control any potential risks associated with the re-entry in a 'normal' situation; and

- control any potential risks associated with workers needing to escape in return air.

10. I consider that:

- the exceptional circumstances of the Pike River mine (the mine set up and the limited scope of recovering only one mine drift) were never fully anticipated by the Regulations;

- in the Pike River mine, both either an exhaust or forced ventilation would still be vulnerable in an emergency situation. Neither system can guarantee that workers will escape in fresh air. However, the measures, additional controls (e.g. phenolic plug, nitrogen chamber) and emergency provisions that PRRA is proposing:

    - will provide the highest level of protection to workers and others during the normal re-entry situation;

    - will not significantly disadvantage workers and others while escaping in return air.

- the use of forced ventilation will eliminate the need to install high voltage electrical power. Electrical hazards were suspected of being one of the main causes of the Pike River mine explosion;

- the evacuation of workers and others whenever a vehicle leaves the mine during the recovery of the drift will reduce the overall risk. This control exceeds standard industry practice;

- PRRA's plans have addressed the main implications (e.g. men escaping in return air) of using forced ventilation in an emergency situation through the

installation of multiple CABA and change over stations. PRRA's management plans have used robust risk assessments[2];

- overall, PRRA has followed a reasonable process and engaged with respected mining, engineering and mine safety experts (see Appendix 4).

11. Therefore, based on the above and:

- the Extractives team's wider understanding of the works to be undertaken and the precautions to be applied by PRRA;
- the application material and associated evidence (i.e. risk assessments and plans) provided by PRRA;
- the revision of working methods and evaluation of other plans undertaken by PRRA;
- a detailed analysis of the situation and regulatory requirements.

12. I recommend you grant the exemption subject to the terms and conditions that:

- the exemption applies only in respect of re-entry and recovery of the drift up to the phenolic plug; and
- the phenolic plug must be in place and effective (having sufficient resistance and low leakage to allow the area between the fall and the plug to be positively pressurised relative to the open drift and the old mine workings to maintain a nitrogen plug)throughout all the recovery process; and
- if there is a change that could have a significant impact on how the PRRA can safeguard the health and safety of workers and others, PRRA must:
  a) respond in accordance with the critical controls included in its principal control plans, principal hazard management plans, and associated standard operating procedures and trigger action response plans; and
  b) inform WorkSafe immediately of any significant change.

Purpose

13. I have prepared this memorandum to inform your decision on the application submitted by PRRA for an exemption for its Pike River mine from compliance with regulation 170(4)(a) of the Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016 (see Appendix 1).

[2] PRRA used a risk assessment technique based upon NSW MDG1010 guidelines and AS/NZS ISO31000:2009, as well as FTA (fault-tree analysis), ETA (event –tree analysis) and Bowtie analysis.

Exemption provisions in the Health and Safety at Work Act 2015

14. Under section 220(1) of the Act, WorkSafe may exempt any person or class of persons from compliance with any provision of a Regulation made under that Act, but only if satisfied that:

- the extent of the exemption is not broader than is reasonably necessary to address the matters that gave rise to it (section 220(2)(a) of the Act); and
- the exemption is not inconsistent with the purpose of the Act (section 220(2)(b) of the Act).

15. Section 220(3) of the Act empowers WorkSafe as the regulator to grant the exemption on any terms and conditions that WorkSafe thinks fit. WorkSafe may also amend or revoke an exemption.

Background

Pike River mine

16. Underground coal mine development often involves creating long entry drifts to access the coal seam, which then connect to drifts or other roadways to establish a full ventilation circuit with multiple access options.

17. This was how Pike River mine was developed initially, and at the time of its construction it was classified as a tunnel. The same forced ventilation that is currently being proposed was permissible at that time and was used at the Pike River mine. Forced ventilation is the most common auxiliary ventilation in tunnelling operations in New Zealand.

18. The plan for recovery of the Pike River mine with a single access entry (the drift) must take into account a combination of exceptional circumstances that were not envisaged in the Regulations. These include:

- the lack of provisions for recovery of a coal mine or part of a coal mine in the Regulations;
- the sealing of the mine at the surface (including the concreting of the old shaft). PRRA's plan is only to recover the single entry 2.3 km drift. This is unusual, as recovery would normally extend further towards the other underground old mine workings.

19. PRRA now wish to recover the drift only and have proposed inserting a phenolic plug before the roof fall in the mine, to isolate the old mine workings from the recovery effort. They are also proposing to ventilate the drift with forced ventilation as occurred when the drift was originally driven.

The re-entry operation and recovery process

20. The key steps that PRRA is planning to undertake are set out in Appendix 5. In summary, the proposed steps are:

- purging the drift with nitrogen;
- Recover drift to the 170m seal mark;
- purging the nitrogen with fresh air using forced ventilation;
- installing the phenolic plug back 19m from base of existing roof fall; [3]
- removing the temporary 170m barrier inbye the portal[4];
- undertaking recovery up to the phenolic plug and nitrogen chamber;
- Install VCD1 at location 200m from the phenolic plug (or other suitable location);
- pausing, reviewing, testing and adjusting to consider next steps;
- removing the phenolic plug and continuing the recovery of the drift as far as the roof fall at the end of the drift;
- exiting and sealing the drift.

Appendix 5 - Refer to fig 4 Flowchart Phases of Entry and Exit

Regulation 170

21. In 2012, after the Pike River mine tragedy, the Royal Commission made a number of recommendations for new regulations for mining operations which included specific requirements regarding:

- a second intake/entrance (escapeway) in underground coal mines that need to be free of smoke and gas so workers can escape in fresh air;
- all areas underground that need to be adequately ventilated before any mine worker enters the mine5.

22. The mining regulations that existed before the Pike River mine tragedy were replaced by the new Health and Safety in Employment (Mining Operations and Quarrying Operations) Regulations 2013 which reflected these requirements[6]. These have now in turn been superseded by the 2016 Regulations.

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[3] The fall is located 2.3km from the portal.

[4] Note that the drift is currently recovered to 170 m using forced ventilation

[5] Royal Commission Report, Volume 2, Part 2, *Proposals for reform*: https://pikeriver.royalcommission.govt.nz/Volume-Two---Contents---Part-2. The most relevant information is in two key chapters: Chapter 26 (pp -316) *The regulatory Framework*; and Chapter 33 *Improving emergency equipment and facilities*

[6] The Health and Safety in Employment (Mining Operations and Quarrying Operations) Regulations 2013 were replaced by the Regulations following the passage of the Act, but the content of relevant provisions was not changed.

23. However, in recognition of the increased compliance costs and the practicality of immediately complying with the Regulations, the former Government provided a transitional period (until 2024) under regulation 170(1) for existing underground coal mines to have two escapeways.

24. Under regulation 170(4)(a), an underground coal mine must have at least one escapeway that is an intake airway. Because the Pike River mine has only one escapeway, that escapeway is required to be an intake airway.

Application of regulation 170(4)(a) to Pike River mine

25. PRRA and WorkSafe have proceeded on the basis that the Pike River mine is a 'mining operation' under the Regulations. This is because:

a. the Pike River mine has never been 'abandoned' in terms of the definition in the Regulations[7]; and

b. treating the Pike River mine as a 'mining operation' ensures compliance with the Regulations for mines of that status.

26. Sec 9(2)(h)

27. PRRA subsequently consulted with WorkSafe and we advised that in our view the requirements of regulation 170(4)(a) did apply. We also advised that for a mine with a single escapeway, the single escapeway must be designated the primary escapeway.

28. Sec 9(2)(h). PRRA later applied for an exemption from regulation 170(4)(a).

PRRA's exemption application and submission of other documents

29. On 13 September 2019, PRRA made a formal exemption request, seeking exemption from the requirements of regulation 170(4)(a) in respect of the re-entry and recovery of the drift as far as the roof fall at the end of the drift.

[7] Under the Regulations 'abandoned' means that the whole or part of the mining operation has been closed or sealed and the activities described in the Act are no longer carried out

30. PRRA's application focuses on the re-entry and recovery, as well as the benefits of using forced ventilation over exhaust ventilation. PRRA's analysis of the criteria under section 220(2)(b) of the Act is related to the ventilation system in conjunction with a number of other control measures. They consider that forced ventilation during the re-entry will provide the highest level of protection from hazards and risks as is reasonably practicable.

31. PRRA's application emphasises an overall risk reduction strategy to prevent an emergency occurring and provides a summary of what it considers to be suitable emergency provisions for the current situation.

32. PRRA has provided WorkSafe with risk assessments and plans (including a risk assessment for escape in return air) supporting its exemption request.

33. The PRRA risk assessment for escape in return air assesses the existing hazards (which could cause an emergency) and recommends additional control measures to ensure that the use of forced ventilation will provide an equivalent level of safety to that provided by an exhaust ventilation.

34. In summary, PRRA submits that:

a. the single entry drift and the use of forced ventilation means that the primary escapeway is a return airway rather than the 'intake airway' as required by the Regulations;

b. it undertook risk assessments to choose the preferred approach (forced ventilation) and identified controls to mitigate the risks associated with escaping in return air to provide a similar level of protection to workers;

c. the final controls identified in the risk assessment and additional measures would be equal to or better than what is required under regulation 170(4)(a) of the Regulations.

35. A summary of the supporting documents provided by the PRRA, and WorkSafe's assessment of those documents, is set out in Appendix 2.

Analysis – alignment with exemption provisions in the Act

Statutory criteria exemption

36. Under section 220(2) of the Act, WorkSafe can only grant an exemption if satisfied that:

- the extent of the exemption is not broader than is reasonably necessary to address the matters that gave rise to it (section 220(2)(a) of the Act), and
- the exemption is not inconsistent with the purpose of section 220(2)(b) of the Act.

37. I note that the alternative proposed option to comply with regulation 170(4)(a) involves forced ventilation and implementing additional measures. This is to ensure adequate controls remain to:

- prevent a catastrophic event (i.e. an explosion);
- control any potential risks associated with the re-entry in a 'normal' situation; and
- control any potential risks associated with workers needing to escape in return air.

38. PRRA is seeking an exemption only from regulation 170(4)(a) that applies to the method of ventilating the escapeway. Accordingly, I believe the exemption sought is not broader than reasonably necessary to address the matters that give rise to it, and thus meets the requirement of section 220(2)(a) of the Act.

39. I have considered the safety of the arrangements proposed by PRRA in their totality, and overall I believe the arrangements are consistent with the purpose of the Act.

40. I believe the mitigations and controls proposed will provide the highest level of protection to workers and other persons, as is reasonably practicable. On this basis, I consider that the exemption is not inconsistent with the purpose of the Act, and therefore meets the requirement of section 220(2)(b) of the Act.

41. I reached this conclusion based on analysis, assessment of documents, understanding of PRRA's working methods and evaluation of other plans, and the following considerations:

- the exceptional circumstances of the Pike River mine (mine set up and limited scope of the only mine drift) were never fully anticipated by the Regulations;
- PRRA's plans have addressed the main implications (e.g. men escaping in return air) of using forced ventilation in an emergency situation through the installation of multiple CABA and change over stations. PRRA's management plans have used robust risk assessments;
- PRRA has also (where possible) prescribed conservative worker deployment processes to further reduce the likelihood, exposure and effects of an emergency involving a fire in the drift to the workers and other people;
- the execution plan and management plans which were provided to support the submission have been developed using robust risk assessment and has involved credible industry and subject matter experts (mining, engineering and safety) (see Appendix 4);
- other than meeting the requirements in regulation 170(4)(a), the escape provisions that PRRA plan to implement, meet or exceed industry practice (see our comments in Appendix 2).

Other relevant considerations- why this exemption is necessary

Is an escapeway in fresh air possible at Pike River mine?

42. The ability for workers to escape in fresh air from a mine is usually achieved by the primary ventilation configuration of the mine. This would typically involve creating two separate escapeways, with at least one escapeway being an intake airway. The second escapeway is normally established prior to the commencement of production. In this case, there is no plan to fully recover the mine (drift and old mine workings).

43. In a normal mining situation, the costs associated with providing an escapeway in fresh air are not disproportionate to the benefits that would be gained in an emergency.

44. However, the Pike River mine recovery operation is not a 'normal' mining situation. Pike River mine is not a fully developed mine and the objective at this stage is to undertake work to recover only the 2.3 km stone drift (which will be sealed from old mine workings with a phenolic plug.)

45. Due to the exceptional situation of Pike River mine, the creation of a second escapeway is still possible but will be more complex and expensive, and available only for a short period of the planned project.

46. Therefore the only other option to ensure workers and others have an intake airway is by installing a ventilation system.

47. In non-technical terms, the two main options for single entry mine ventilation are:

- to either suck air (i.e. exhaust ventilation) from the working place through a duct, or
- to blow air (i.e. forced ventilation) into the working place through the duct.

48. To comply with regulation 170(4)(a) using ventilation in the single entry mine at Pike River can only be achieved using exhaust ventilation.

However, would compliance with regulation 170(4)(a) guarantee escape in fresh air?

49. If an emergency event did occur in the drift there is no certainty that workers would be able to escape in fresh air with either forced or exhaust ventilation. Consequently, the benefits gained by complying with regulation 170(4)(a) are less certain and less robust, and may not outweigh the other risks[8] and costs associated with an exhausting set up.

50. Maintaining fresh air in the drift with a single ventilation system in an emergency is dependent on the resilience of the duct set-up and the nature and location of the emergency.

[8] The PRRA risk rating comparison demonstrates that exhaust ventilation posed greater risks to safety (e.g. high voltage, noise emission, increased underground transport, catastrophic failure of the vent line)

51. Any significant roof fall would likely affect the supply of air, regardless of whether exhaust or forced ventilation was used and the ventilation set up would be of little consequence.

52. It is also likely that any ducting associated with either ventilation system would be affected in a severe fire situation.

53. In an exhaust ventilation set-up, fire would still pollute portions of the fresh air escapeway dependent on the location of the fire. In fact, a fire on a vehicle close to the mine entry, would affect the majority of the roadway in an exhausting system.

54. In summary, any ventilation system chosen for Pike River (forced or exhaust) will be considered a lower level control than the more robust escape set up of the multiple escapeways of a fully set up mine envisaged by the Regulations.

Advantages of using Forcing Ventilation

55. By implementing the 27 additional controls identified in the exemption request for escaping in return air[9] and the other controls included in the principal hazard management plans, principal control plans, trigger action response plans, and standard operating procedures, PRRA will provide an equal level of safety to workers that would be achieved by using exhausting ventilation and being compliant with regulation 170(4)(a). PRRA proposes that, as well as providing a breathable environment, forced ventilation will better manage the other risks arising from the re-entry.

56. I agree that using forced ventilation is appropriate and will provide an overall safer working environment for workers and other people by reducing or eliminating some risks (e.g. explosive or noxious gas mixture, ignition sources).

57. I consider that the advantages of using forced ventilation include that:

- it provides a greater ability to scour any remnant gases in the drift as the recovery proceeds, as it can be more easily directed into cavities and stubs
- it eliminates the requirement to reticulate high voltage underground to support an auxiliary ventilation system, therefore reducing hazards in the workplace.

Summary

58. Therefore, forced ventilation provides a higher level of safety for the re-entry operation overall, if the PPRA implements the controls referred to in paragraph 55.

[9] See pages 5-7 of the Application for Exemption from Regulation 170(4)(a) of the Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016, dated 13 September 2019.

Recommendation

59. I recommend granting the exemption subject to terms and conditions, as described below:

Terms and conditions	Rationale
• the exemption applies only in respect of re-entry and recovery of the drift up to the phenolic plug[10] • the phenolic plug must be in place and effective throughout the recovery process	There is no detailed plan available for work beyond the phenolic plug or for its removal o the likelihood and consequence of an emergency event such as inundation or spontaneous combustion is likely to increase if the phenolic plug or is not in place o therefore the exemption is conditional on the continued maintenance of the phenolic plug is appropriate and does not apply for any work to remove it or proceed beyond it o PRRA may submit a plan at a later date to extend or change the exemption conditions to enable work to remove or proceed beyond the phenolic plug
• if there is a change that could have a significant impact on how the PRRA can safeguard the health and safety of workers and others, PRRA must: a) respond in accordance with the critical controls included in its principal control plans, principal hazard management plans, and associated standard operating procedures and trigger action response plans; and b) inform WorkSafe immediately of any significant change.	The exemption request or supporting management plans could not anticipate on every change that may occur at the mine. The documentation reviewed included TARPs[11] and other change management provisions. The exemption is conditional on PRRA responding immediately to any changes as per its plans, and informing Worksafe of any significant change that could be considered relevant to the health and safety of workers working in the mine or to any other people.

[11] Trigger Action Response Plan

Next steps

60. If you agree to grant this exemption, I will prepare a letter notifying PRRA of the outcome of the application and the Exemption Document.

Consultation

61. This memorandum has been prepared in consultation with:

Team	Description
Legal Group	Provides effective legal services and advice to WorkSafe
Marketing and Communications	Delivers high-quality internal and external communications
Operational Policy	Decides how WorkSafe operates, and should operate, to be the regulator WorkSafe wants to be
Regulatory Frameworks	Ensures legislative tools are fit for purpose, works closely with MBIE's policy team for the regulatory reform programme, and represents WorkSafe's interests on external regulatory frameworks which could impact WorkSafe

Appendix 1: Legislative Provisions exemption is sought from

Health and Safety at Work (Mining Operations and Quarrying Operations) Regulations 2016

170(4)(a) Escapeway designated as the primary escapeway and is an intake airway

(4) The mine operator must ensure that at least 1 of the escapeways at the underground coal mining operation is designated as the primary escapeway and is—

(a) an intake airway or a combination of adjacent intake airways; and

(b) separated, as far as is reasonably practicable, from all other roadways by a separation stopping that is anti-static, fire-resistant, and of substantial construction that will ensure there is minimal leakage through the stopping;

and

(c) as far as practicable, free from hazards associated with fire; and

(d) trafficable by a vehicle; and

(e) fitted with fire-fighting equipment located on, or near, any equipment installed in the escapeway.

Schedule 1:

Existing mining operations

2. Transitional provision for escapeways in underground coal mining operation.

Until 16 December 2024, nothing in regulation 170(1) applies to an existing mining operation that is an underground coal mining operation.

Appendix 2 – WorkSafe's assessment of PRRA's supporting evidence

PRRA Risk Assessments (RA) and plans

1. PRRA submitted the following documents:
    - Pike River mine drift re-entry exhausting and forcing ventilation risk management plan
    - Escape in return air risk assessment
    - Mine entry and exit strategy risk assessment report
    - Pike River mine re-entry ventilation and gas management plan
    - Pike river mine entry and execution plan
    - Emergency management principal control plan
    - Single entry principal hazard management plan
    - Pike river mine – drift re-entry geotechnical assessment report

PRRA Risk Assessments (RA)

2. PRRA submits that after following a "robust risk assessment process" they consider that creating a second escapeway (which would allow one escapeway in fresh air), presents a higher risk to workers (due to the hazards associated with creating one)
3. The RA process was conducted at a high level between the three options identified (a) small tunnel, b) large diameter bore hole, c) single entry recovery only- existing roadway). The first two options would have created an alternate escapeway.
4. Option a) and b) were discounted. The only option that was then fully risk assessed was c), the single entry option.
5. I consider that the high level RA adequately identified that, creation of a second escapeway would have introduced additional risks, and it was appropriate to discount option a) and b).
6. The additional risks were related to those of actual mining or drilling in arduous and difficult to access environmental conditions, plus the significant amount of helicopter flights that would have been involved. I believe that these risks could have been potentially managed and work been undertaken using best industry practice. Therefore, the options a) and b) can still be considered as a practical step.
7. But a significant consideration was the fact that the second escapeway could not actually be achieved until the drift had been fully recovered to the point where either a large diameter borehole or a short incline drift was intercepted, at approximately the 2km point. This meant that for a large proportion of the project the second escapeway option would not actually be in place.
8. Therefore, I agree with the PRRA decision that creating a second escapeway was not a practical step. This is because additional risks were introduced to the project that would have little benefit to the health and safety of workers and others until late in the project.

9. If the scope of project were to change the options for a second escapeway should be reassessed at that time

Forcing Ventilation

10. The PRRA provided 9 reasons (listed a-i in pages 2 and 3 of their submission) why they considered forced ventilation preferable to exhaust ventilation. I make the following observations in relation to these reasons.

PRRA submission Advantages of using forced ventilation	I made the following observations
a. Based on the risk assessment undertaken by the Agency, forced ventilation provides a safer and more robust ventilation method, and better manages the risks than the exhausting ventilation method	In conjunction with advice from a WorkSafe contracted ventilation expert, we agree that the forced ventilation method proposed by the PRRA, in the context of the 2.3km single entry drift at Pike River, provides ventilation advantages to manage explosive, toxic and irrespirable atmospheres and better manages the risks
b. Uncontaminated air is delivered directly to the working locations	I agree with this statement
c. Forced ventilation eliminates the need to install high voltage electrical power underground. In contrast, the alternative of using exhaust ventilation requires an overlap ventilation system, which requires high voltage electrical power underground, and the associated electrical risks with this system are (i) electrocution; (ii) ignition; and (iii) a complex ventilation system	I agree with this statement. The elimination of electricity of high voltage from the underground working is a significant risk reduction
d. The absence of development activities and a limited negligible methane make from seam gas leaves diesel equipment as the main source of contamination, making the conditions more suitable for forced ventilation	I agree with this statement
e. Forced ventilation provides a positive pressure, dispersing and diluting any gases at the discharge point. It also provides good scouring to force and dilute any remnant gases or diesel particulates, and scours any hard to move gas layering	I agree with this statement. The more dynamic aspect of forced ventilation would allow easier purging of residual gases in the recovery of the drift
f. Forced ventilation was employed during the original drift development	I agree with this statement

with an installed capacity sufficient for re-entry	
g. Forced ventilation is an established practice for ventilating long, single-entry tunnels in New Zealand and other countries	I agree with this statement
h. The installation of a phenolic ventilation plug will keep the mine workings positively pressured with nitrogen, stop the ingress of oxygen over the fall and restrict the leakage of an irrespirable atmosphere into the drift	I agree with this statement. The phenolic plug is a critical element of the Pike River recovery plan
i. The installation of the phenolic ventilation plug will create a physical separation barrier between the mine workings and the drift, thereby establishing a single entry tunnel situation, which is not dissimilar to any other tunnelling operation currently in New Zealand.	I agree that the installation of the phenolic plug segregates the drift from the coal mine workings and effectively results in only a single entry drift being accessible. Note that Pike River is still a mine under the Act

Risk Assessment - Forcing Ventilation vs Exhaust Ventilation

11. The PRRA undertook an operational risk assessment of forcing versus exhaust ventilation and addressed the following factors:
    a. occurrence of flammable and potentially explosive gas mixtures
    b. effects of barometric pressure variations on the movement of gases
    c. dynamic effects associated with the above in conjunction with ventilation control activities
    d. failure of ventilation and gas management related infrastructure
    e. irrespirable atmospheres due to oxygen depletion or use of nitrogen
    f. use of diesel equipment and treatment of exhaust emissions or fire
    g. spontaneous combustion or re-activation of heating in the area of the roof fall, or in any exposed coal material.
12. A SWOT Analysis[12] was also conducted for each ventilation option. Both the risk assessment and the SWOT analysis concluded that the forced ventilation option was the lower risk option. WorkSafe noted total risk scores were used to determine what overall risk was lower. This may have had some influence over the final decision of the preferred option chosen by the PRRA.

[12] A SWOT analysis is an strategic technique used to define Strengths, Weaknesses, Opportunities and Threats

Risk Assessment - Risks Associated with Escaping in Return Air

13. The PRRA undertook a risk assessment of the risks associated with escaping in return air in order to identify any controls that would be necessary to ensure the risks were comparable to escaping in fresh air. The PRRA has developed and provided 27 controls for escape that were considered best practice and/or exceeded regulatory requirements.

14. I make the following observations in relation to these 27 controls PRRA provided.

No.	PRRA submission	I made the following observations
1	Compressed Air Breathing Apparatus (CABA) equipment will be made available at the back of the personnel carrier, and at the work space area, for escape in the event of fire. Personnel are trained in their use. Quick re-fill system available for use in an emergency	The use of CABA in underground mining is considered to be industry standard practice and generally a risk assessment will determine if it is needed. The installation of CABA at the back of the personnel carrier and at the work space area would be additional to standard industry practice
2	Personnel carrier is to be parked facing out-bye to allow a rapid escape	This procedure has merit and would save time in an emergency
3	All personnel underground are to be trained in specific firefighting controls for single entry forced ventilation i.e. preserve life (get personnel out-bye)	Training all underground workers in firefighting would be best industry practice.
4	A dedicated person (Fire Watch) is to remain positioned immediately out-bye of an operating diesel machine whenever personnel are working in-bye the diesel machine. This person's sole responsibility is as an observer to alert in-bye personnel in the event of a fire. This person must be properly trained and duly appointed (in writing) by the Mine Manager. Additional firefighting equipment (suitable for diesel machine fires), with rapid deployment capability is to be made available for the Fire Watch	This initiative would be additional to standard industry practice But the benefits are unknown and dependent on the vigilance of the Fire watch person Due to human factors this is considered a low hierarchy control
5	A refuge chamber will be installed within 200m of the Operations zone	The use of refuge chambers in underground mining is standard practice and generally a risk assessment will determine if it is needed and where it would be located. A chamber maintained within 200m of the operations zone is standard practice in a single entry situation and good practice in an operating coal mine (regulation 173)
6	If compatible, smoke detection will be used with the installed Telemetric CO monitors	The use of smoke detectors is standard industry practice (regulation 157)

7	Fuel sources removed during drift advance e.g. belt, plant and fuel storage as encountered	I agree that this is good practice
8	Non-underground vehicles excluded from accessing area past the portal while personnel are underground	I agree that this is good practice
9	Portal area to be kept free of loose flammable material through the use of an exclusion zone for the storage of combustible material, demarcated with signage to notify workers	I agree that this is good practice (regulation 165)
10	Automatic tripping of the fan when CO levels in ducting exceed 20 ppm in the case of an external fire to prevent ingress of contaminants into the drift	I agree that is a good practice Note that there are regulatory requirement to provide fresh air to workers (refer regulation 141 – Air quality and temperature, regulation 153 – Ventilation, regulation 148 –Ventilation of work areas to be adequate before entry)
11	Installation of phenolic ventilation plug and nitrogen chamber isolates working area from other workings i.e. prevent the migration of air from the drift to the pit workings or contaminates into the drift	I agree that this is a critical risk control and take the view that it is an essential component of the plan
12	The inspection arrangements to include additional monitoring for CO make	I agree this is good practice. The monitoring for CO is expected in all underground mining operations
13	Validation and interpretation of spontaneous combustion monitoring to be peer reviewed by a competent third party	I agree that this is good practice
14	Install smoke line, cones and blind man sticks in the drift	I agree that this is standard practice (regulation 174) In the Pike River situation, these emergency provisions are likely to be very effective
15	All sumps will be barricaded to reduce the risk of fall and maintain the correct escape path	I agree this is good practice
16	The Refuge Chamber and Recharge Station to have location lights to highlight location of refuges in low visibility conditions	I agree this is good practice (regulation 174)
17	Specific protocols developed for managing work at pit bottom in order to ensure that the workforce (including police experts) are fully cognizant of	I am unable to comment

	the hazards and specific risk management requirements. Unique protocols to be rehearsed by teams	
18	Respirable air is in the drift to drill hole 53	I agree that any alternative air supply in an escapeway would be good practice
19	In the event of one machine needing to leave the work area – all personnel will evacuate to the surface on the principle of 'one out all out' (personnel and machines) as an operational control during drift recovery. There is no situation where two diesel machines work separately	I believe this exceeds any industry practice. I consider that this control is a very conservative one and significantly reduces the risk of workers and others being trapped inbye of a fire
20	Machines are not to be left running when not in use	I agree this is standard practice
21	Non-flammable barricade between the fan and other infrastructure located in the vicinity (i.e. compressor/transformer/substation).	I agree this is standard practice
22	Machines to be inspected for loose flammable material during mechanical pre-start check each day, and pressure cleaning to be performed if required	I agree this is standard practice
23	The number of diesel vehicles permitted underground is restricted by ventilation quantity	I agree this is standard practice
24	Compressed air and water firefighting outlets available in the vicinity of diesel machines in the working area	I agree this is standard practice and a regulatory requirement
25	Confirm if monitors are able to audible alarm notifying control room and locally to satisfy requirements of regulation	I agree that this is standard practice (regulation 157)
26	The Agency's mine workforce includes 12 fully trained New Zealand Mines Rescue brigades men from which any emergency first response will be drawn	I agree that this is a high ratio of trained brigade's men to mine workers
27	All of the workforce will be qualified, competent and fully trained in all aspects of underground operations in which they are involved. Critical elements and unique activities will be rehearsed.	I agree that this is standard practice. The Act and regulations require adequately trained and/or supervised workers

The Ventilation and Gas Management Plan – Design Basis & Strategy

15. In the application, the PRRA commented that its Ventilation and Gas Management Plan – Design Basis & Strategy document and process was grounded on information about the current status of the mine and the effects of managing and monitoring nitrogen purging in the mine over the last 6 months. I agree that to date the PRRA has maintained a stable mine environment.

16. I acknowledge the mine environment may change with progress of the recovery of the drift. I expect that PRRA's management system will respond to any changes accordingly.

The Entry and Exit Execution Plan (EEE)

17. The PRRA has developed an EEE plan that is supported by a risk assessment. The plan is a step by step process design for undertaking the re-entry work that includes the forensic examination.

18. The PRRA advised that 89 risk controls or actions were recommended following the EEE risk assessment, which were additional to the existing controls pertained in all the management plans.

Additional Safety Measures Adopted

19. On page 9 of the PRRA exemption request letter, PRRA notes that a risk assessment was carried out to consider escaping in return air and then lists additional safety measures that PRRA consider above and beyond what is required by the Regulations to mitigate the risks associated with escaping in a return roadway. The measures are listed from (a) to (d). The listed controls are somewhat of a repeat of comments made earlier in the PRRA application.

20. I make the following observations in relation to these controls.

PRRA submission	I made the following observations
Installation of a phenolic plug and nitrogen chamber at the end of the tunnel out-bye of the roof fall separating the mine workings from the tunnel	I agree that this is a critical risk control and take the view that it is an essential component of the plan
A refuge chamber for mine workers in the drift. The refuge chamber will be installed within 200m of the Operations Zone	I agree this is good practice (regulation 174)
CABA sets for all mine workers underground in two locations at the working operational area and on the personnel carrier	The use of CABA is good practice. The installation of CABA at the back of the personnel carrier is an additional control and is best practice
A recharge station underground so the CABA sets can be refilled while evacuating	This is good practice

Appendix 3 – WorkSafe's technical reviewers

External

Andy Self – Australian Mining Consultants - External Ventilation Expert

Richard Campbell – BlackRock Mining Solutions External Geotechnical Reviewer

Internal

Paul Hunt – Chief Inspector

Dave Bellett – Deputy Chief Inspector

Priscilla Page – Inspector Geotechnical Specialist

Bryan Harrington – General inspector First Class Mine Manager

Johnny Ewen – General inspector – Mechanical Superintendent

Appendix 4 – Experts engaged in the PRRA risk assessment process

			Risk Assessment					Principal Control Plans			Principal Hazard Management Plans			
Company	**Name** ***Position***	Years in industry	Camera, Lighting and Survey Equipment required for Forensic work during the drift re-entry	Nitrogen Purging Process for the Drift	Mine Entry and Exit Strategy	Escape in Return Air	Drift Re-entry Exhausting and Forcing Ventilation	Ventilation	Electrical Engineering	Mechanical Engineering	Roads and other Vehicle Operating Areas	Air Quality	Spontaneous Combustion	Ground or Strata Instability
PRRA	**Sec9(2)(a)** *Mine Worker*	32					✓							
	Sec9(2)(a) *(Terra Firma) Ventilation Officer*	22		✓	✓	✓	✓	✓				✓	✓	
	Sec9(2)(a) *Mine Worker*	18									✓			✓
	Sec9(2)(a)		✓											
	Sec9(2)(a) *Geotech Engineer*	17												✓
	Sec9(2)(a) *Electrical Technician*								✓					
	Sec9(2)(a) *Electrical Superintendent*	23	✓		✓	✓			✓					
	Dave Gawn *CE*	1			✓									
	Sec9(2)(a) *Technical Specialist*	40+			✓	✓								
	Dinghy Pattinson *Site Senior Executive/COO*	40+	✓		✓	✓								

	Sec9(2)(a) *Mine Worker*	21			✓		✓	✓		✓				✓
PRRA	Sec9(2)(a) *Underviewer/H&S Coordinator*	40+		✓	✓	✓	✓		✓	✓	✓			✓
	Sec9(2)(a) *Consultant*	40+			✓									
	Sec9(2)(a) *Deputy*	30		✓	✓	✓		✓				✓	✓	
	Sec9(2)(a) *Senior Project Manager*	8	✓		✓									✓
	Sec9(2)(a) *Mechanical Superintendent*	25+	✓	✓	✓	✓				✓	✓			
	Sec9(2)(a) *H&S Coordinator*	29			✓	✓	✓							
	Sec9(2)(a) *Technical Advisor (Facilitator)*	40+	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Sec9(2)(a) *Mine Worker*	10					✓				✓			✓
	Sec9(2)(a) *Mine Worker*	9			✓							✓	✓	
	Sec9(2)(a) *Engineering Assistant/Task Manager*	32								✓	✓			
	Sec9(2)(a) *Mine Worker*	12								✓				
unknown	Sec9(2)(a) *Workers/Rep*	9		✓				✓				✓	✓	
New Zealand Mines Rescue Service	Sec9(2)(a)	28	✓											
	Sec9(2)(a) *General Manager*	38			✓	✓								
Palaris	Sec9(2)(a) *Mining Engineer*	40			✓	✓								

	Sec9(2)(a) *Facilitator*	15			✓	✓								
SCT	**Sec9(2)(a)** *Geotech*	17				✓								
SCT	**Sec9(2)(a)** *Geotech Engineer*	29			✓									
Air Quality Solutions	**Sec9(2)(a)** *Advisor Police*	27			✓									
New Zealand Police	**Sec9(2)(a)**		✓											
	Sec9(2)(a)		✓											
Roa Mining Ltd	**Sec9(2)(a)**	17								✓				
WorkSafe	**Bryan Harrington** *Inspector*	38			✓									
Company	**Name** ***Position***	Years in industry	Camera, Lighting and Survey Equipment required for Forensic work during the drift re-entry	Nitrogen Purging Process for the Drift	Mine Entry and Exit Strategy	Escape in Return Air	Drift Re-entry Exhausting and Forcing Ventilation	Ventilation	Electrical Engineering	Mechanical Engineering	Roads and other Vehicle Operating Areas	Air Quality	Spontaneous Combustion	Ground or Strata Instability
			Risk Assessment					Principal Control Plans			Principal Hazard Management Plans			

Appendix 5 – Flowchart of Entry and Exit Execution plan