

Technical Advisor's to the Pike River Families Committee

A method for safe re-entry of Pike River Mine Drift

A new hybrid approach

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12-9-2016

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1. Introduction

Once instructed by the government to determine if re-entry of the Pike River drift was feasible and safe, SENZ (Solid Energy New Zealand) initiated a detailed investigation, design and risk assessment exercise. The senior engineers subsequently announced a plan which they considered met the government criterion for proceeding which they were executing until the Board of SENZ instructed a cessation. The NZ Chief Inspector of Mines also considered the SENZ plan safe and feasible.

The technical advisors to the Families, and others, remain convinced that risks can be satisfactorily controlled to allow safe recovery of the Drift. A new hybrid scheme is proposed combining the advantages of staged recovery and the substance of the method adopted by SENZ. The key factor is that no person will enter the drift until a fresh air atmosphere has been established and measures are in place to control major hazards. The entry plan has been reviewed and agreed as credible by independent experts (Attached).

We accept that the SENZ Board will not agree ours or even their own re-entry plan. Only direct action by the New Zealand Government can decide the outcome. It would appear that re-entry would only proceed if SENZ no longer had any responsibility for the mine. A new ownership structure under government will therefore be required to allow re-entry to proceed.

2. Aim of the report

The aim of this report is to provide a succinct summary of:

1. What has physically changed since the first recovery plan outlined by the technical advisors to the Families that will help to ensure the mine can be accessed safely.
2. The positive benefits of re-entry.
3. Legality under current Health and Safety legislation.
4. The vast amount of data, information and analysis available for detailed hazard identification, planning and risk control.
5. The current status of activities at the mine.
6. The principles which will guide the methodology for re-entry management, planning and execution.
7. The institutional arrangement needed to proceed.

3. What has changed?

Since the mine was first visited by the advisors to the Families, the following changes have occurred, and experience gained, which will enable the access process to be simplified:

- The main ventilation shaft has been sealed which has stabilised gas concentrations and thus the underground gaseous environment can be controlled effectively.
- SENZ has demonstrated the principle that the drift can be effectively degassed using a Venturi/flame trap arrangement to extract gas through borehole No. 48.
- The workings have been gas-filled and therefore oxygen-free for some four years removing spontaneous combustion concerns.
- There is evidence to suggest that the drift could be substantially more stable than originally thought by SENZ including absence of any physical deterioration between the Portal mouth

and 170m stopping, and verbal evidence from an inspection to 300m by the Rescue Services prior to emplacement of the 170m stopping in 2011.

- Additional boreholes have been drilled into the mine associated with the SENZ proposal to inject a “Rocksil” seal providing potential to increase nitrogen purge and ventilation flow prior to re-entry.
- SENZ has completed detailed studies and risk assessments of various drift entry methods and this detail can be used to underpin the new approach.
- It is a fact that our original re- entry plan was staged re- entry in a non-respirable atmosphere and which required rescue workers to wear breathing apparatus for sustained periods. This however, is not now the case. We would simply wish the Mines Rescue to provide the usual rescue back up of emergency cover. They would, as always, be in direct management control of their own officers.

4. Why re-enter the Drift?

Re-entry would allow detailed examination of the Drift and help in establishing what exactly happened and how such tragedies could be better avoided in the future and, in particular, would:

- Allow recovery of any bodies encountered in the drift, and a decent burial.
- Inspect the condition of the Drift and provide factual information to facilitate decision making.
- Reduce uncertainty in understanding the fateful events and their impact and thus help some Families of the bereaved to achieve closure.
- Allow forensic examination of the mine insofar as it can be safely accessed to identify sources of ignition, post explosion damage, flame pathway and impact on mine roadway stability.
- Raise understanding of how to manage gas ignitions, explosion control and survival rates in coal mines (the volume of gas involved was comparable to that in some longwall goafs so the lessons would have wide relevance).
- Assist in preventing fatalities in mines elsewhere as a result of the technical lessons learned.

5. Legality under health and safety legislation

There is no 'legal' barrier to prevent recovery of this Drift under a specified 'emergency' health and safety management system.

Reference: Reg 170, in particular Reg 170 (3)(a)no requirement for a second egress if work is being conducted "under the health and safety management scheme" i.e. to recover the Drift, or, Reg 170 (3)(b) in a single- entry drive (which the Drift is).

6. Hazard identification and risk management

The planning team would identify the Principal Hazards associated with Drift Recovery (ground control, irrespirable atmospheres, spontaneous combustion, equipment fire and explosion being the most significant) and produce Principal Hazard Management Plans (PHMP) as part of the legislative submission to WorkSafe High Hazard Unit (Mines Inspectorate).

In terms of the baseline risk assessments, the staged re-entry and remote seal risk assessments, as public documents will be available. These will provide a sound foundation for preparing

comprehensive risk appraisal documentation and designing safe systems of work for the new hybrid recovery scheme.

The Ventilation Study commissioned by SENZ shows that all the necessary gas and ventilation controls to allow for safe entry can be achieved.

All equipment used underground will be certified as safe for use in mines where flammable gases are likely to be present.

All mobile and fixed equipment will be strictly maintained in accordance with manufacturers' instructions

To ensure all expert views were heard an INCIDENT CONTROL COMMITTEE would be established with all decisions fully discussed, agreed and recorded.

7. The current situation

The Owners and Operators of the Pike River Mine have had an Improvement Notice served upon them by the Enforcement Authority that requires them to make the Pike River mine "safe". The mine is currently safe with a rated 'type C' seal completed. A massive monolithic seal was intended to provide a permanent barrier to allow the mine site to be abandoned. For reasons outlined below, this is no longer representative of the 'current state'.

Prior to the final seal being placed the existing methane rich atmosphere against the 170m. stopping was migrated 10m further into the drift to allow the door of the stopping to be opened in a fresh-air environment and the rear of the stopping examined for any accumulation of water or debris. This partial re ventilation was achieved by extracting methane from the mine using a venturi/flame trap arrangement sited at the top of borehole PRBH 48. We believe this door has been fastened back and will remain permanently open. When the activity had been completed the venturi arrangement at the top of the borehole was turned off.

When the families of the deceased found out what had occurred their obvious question was "if you can ventilate 10m" then why not the drift? They withdrew their previous agreement to the mine being finally sealed. Prior to this event we believe that the majority of the families were in agreement with this action.

Given these recent developments in conjunction with the considerable time lapse of some six years from the initial event the Families advisors consider that a re- evaluation of present circumstances is required.

However, it is accepted that SENZ, the Owners/Operators of the mine, do not wish to open the mine for body recovery and forensic examination. They emphasise that they do not wish to place any person at undue risk to recover the Drift. We fully support them in this matter, as neither do we.

8. Recovery plan framework

The drift itself is 2.3km. in length formed to 4.5m high by 5.5m width. The drift was won mainly by drill and blast methods. The drift was and remains a single-entry driveage.

To re-establish work in the mine an Emergency Operating Plan would be implemented which would control and limit the numbers of persons working in the mine to absolute minimums for the work being undertaken.

A nitrogen plant would be established at the mine to provide inert gases as required. The proposed methodology would not involve the use of overland nitrogen pipes or injection of a "Rocsil" plug.

Surface boreholes would serve as "return airways" and venturi/flame trap arrangements would be installed at the PRDH48 and PRDH35-Grizzly boreholes.

The 170m stopping would be ventilated and air / or nitrogen allowed into the mine using a combination of methane buoyancy, natural ventilation pressure and positive fan pressure at the portal to displace and dilute the methane. The gas compositions at the ventilation boreholes would be monitored to establish when a respirable atmosphere existed in the drift.

Auxiliary fans, (main fan and back up), would be established at the drift entrance fitted with a controllable de gassing unit to control air flow into the mine. The auxiliary ventilation system would be capable of ducting around 20m³/s of air to a distance of 2.3km, more than double the quantity of air required to dilute the measured methane flow to a safe 1% methane in air. The ducting would be extended in increments ensuring positive air flow and removing methane layering (nitrogen pockets) as required.

Special attention would be given to the maintenance bays at 1900m which are offset to the drift. Such areas will require positive de gassing under controlled conditions. Temporary stoppings would be placed as exposed conditions required.

We consider that the drift can be re ventilated by this combined free flow/auxiliary system and the initial de-gassing does not require any persons to be below ground.

Once the Drift is re ventilated the next stage is to isolate the inbye workings to remove any risk of heating and to reduce gas emissions. This would be achieved by erecting a rated seal and purging the up-dip side with nitrogen to maintain an inert atmosphere. By this time some 47% of the workings will have been degassed thus simplifying continuing gas control. The preferred site for the seal would be the location previously selected for the "Rocsil" plug.

All re-ventilating operations would be carried out to ensure the minimum time possible from the introduction of oxygen to erecting an effective seal at the pre-determined 'Rocsil seal location'. If this site was not available, the seal would be erected at a suitable location inbye 'Pit Bottom in Stone'.

As the drift is entered, roof, wall and floor conditions would be inspected before men proceed. In any areas where the drift condition creates concern, additional support will be installed. Camera evidence shows a fall of strata in the Spaghetti Junction area and strata monitoring indicated 180mm. of movement on the Hawarra fault some 180m inbye. Areas can therefore be identified which cannot be traversed until made safe. This type of work is considered normal mining practice and would typically involve the installation of passive supports to whatever standards were necessary.

Major obstructions such as the Juggernaut and floor debris will be removed to minimise hazards to miners in transit and to allow use of vehicular transport for materials transport and rapid evacuation of miners to the surface.

9. Conclusions

The fundamental principles to be employed that will ensure risks can be satisfactorily managed in a new method for re-entering the Drift are:

- A robust and clear command structure will be established.
- All activities undertaken will be compliant with New Zealand mining laws and regulations.
- Risk-based decision making will be supported by an incident committee of experts.
- No person will enter the drift until the methane is within recognised safe concentration limits.
- An intermediate stage of purging the drift with nitrogen prior to ventilating is envisaged.
- Only experienced, competent miners will be admitted underground.
- The number of persons allowed underground at any time will be limited.
- Mines Rescue will provide safety cover for the underground workforce.
- Auxiliary forcing ventilation will be advanced in the drift in stages to ensure any gas flowing into the drift from the former mine workings is satisfactorily diluted and dispersed, and any layered methane or gas pockets are cleared.
- Workers will be withdrawn in the event pre-set monitored parameter Trigger Action Response limits are exceeded.
- An underground stopping will be erected at a suitable location, ideally near to the intended placement location of the “Rocksil” seal which will not be used. The mine space beyond will be inertised with nitrogen piped underground.

10. Recommendations

There is no technical mining reason that a re- entry into Pike River Drift could not be achieved safely. A detailed plan should be developed to deliver such a result.

As the Families’ experts and SENZ Board cannot reach a joint position then only the Government can decide what the future of this mine is. The legal implications of who the future Owners/Operators of the mine would be should be considered as soon as possible.

Re-entry into the drift as far as 2.1km to 2.3km as a first step should be achievable without exposure to unacceptable risk and would provide the necessary information on how to proceed. We consider that this first step at least should be sanctioned and would meet in part the Governments initial promises to the families.

We the Families’ advisors would not countenance any unacceptable exposure to risks and if evidence suggests that to progress at any stage will be too high risk then we will be the first to tell the Families that the recovery should be halted and the mine should be finally sealed.

The way forward would require transfer of all responsibilities and liabilities from SENZ to a government entity. The re-entry process should be subject to the oversight of independent professionals with detailed knowledge of the mine and no direct affiliation to the Families who can professionally advise the government and work constructively with the recovery team and the technical advisors to the Families Committee.