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International Power Hazelwood

October 2006 Mine Fire Investigation

Incident Investigation Report

January 2007

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Appendices

1. Executive Summary

1.1 Scope

This document outlines the outcomes from the independent incident investigation undertaken for the mine fire at the International Power Hazelwood Open-Cut Coal Mine between the 12th and the 18th October '06.

The contributing factors and underlying causes leading to the mine fire are documented in order to assist in identifying what led to the event so that effective preventative and corrective actions can be implemented to prevent reoccurrence.

1.2 Terms Of Reference for Incident Investigation

1.2.1 Objectives

The objectives of the incident investigation were to:

- Establish the facts surrounding the event;
- Identify contributing factors and underlying causes;
- Review the adequacy of existing controls and procedures;
- Recommend preventative and corrective actions;
- Report the findings in order to share key learnings; and
- Not apportion blame or liability.

1.2.2 Incident Investigation Process

The incident investigation process was based on the Incident Cause Analysis Method (ICAM), which is widely used in the mining and transportation industries.

The stages in the ICAM investigation process are:

1. Immediate Actions
2. Investigation Planning
3. Data Collection
4. Data Organisation
5. ICAM Analysis
6. Preventative and Corrective Actions
7. Reporting the Findings

The incident investigation process addressed IPRH's key issues of:

- Identifying the initial cause(s) of the incident;
- Identifying the sequence of events and reasons for the fire spreading quickly rather than being contained in the usual manner;
- Available resources;
- Measures taken to mitigate the effect of the fire;
- Adequacy of existing procedures including emergency procedures;
- Compliance with procedures and safe working practices;
- Interfaces with stakeholders;
- Security breaches;
- Review against findings of 1977 fire and any other relevant reports.

1.2.3 Incident Investigation Structure and Responsibilities

Overview Committee

The Overview Committee comprised:

- Graeme York IPRH Chief Executive Officer (Overview Committee Chairman)
- Steve Rieniets IPRH Mining Director
- Kevin Harney IPRH Power Station Management Representative
- Graeme Freshwater - Industry expert
- Peter Tole - Evans & Peck

The responsibilities of the Overview Committee were to:

- Agree the Terms of Reference of the investigation on behalf of IPRH;
- Ensure sufficient site resources were made available at the relevant priority for the investigation;
- Ensure that the investigation was implemented in a no blame manner and with due regard to confidentiality;
- Comment on and sign-off on the final report;
- Present the final report, findings and recommendations to the IPRH Board;
- Review, consider and, where appropriate, implement the findings and recommendations of the incident investigation;
- Arrange an independent review of the report if considered desirable.

Incident Investigation Team

The Incident Investigation Team comprised:

- Incident Investigation Leader;

  Simon Casey, Manager – Risk Management, GHD Melbourne

- Specialists;

  Ken Tabart, Office Manager, GHD Morwell

  Ted Waghorne, Principal Mining Engineer, GHD Morwell

- Support and administration staff;

  Demetra Zuzic, Risk and Safety Consultant, GHD Melbourne

  GHD Morwell Office Administration Staff

The responsibilities of the Incident Investigation Team were to:

- Undertake the investigation in a safe and responsible manner following site procedures where available;
- Brief the incident teams members, incident Overview Committee, site management and employees, and all relevant stakeholders in the incident investigation process;
- Undertake the incident investigation in a manner that did not apportion blame and pay due regard to confidentiality;
- Follow the incident investigation process;
- Communicate and consult appropriately with all relevant stakeholders;
- Produce all deliverables from the incident investigation.

1.3 Incident Cause Analysis Method (ICAM) Investigation Process

The ICAM investigation involved the following key stages:

- The Incident Investigation Leader, Simon Casey, conducted interviews with relevant stakeholders including IPRH employees and contractors and CFA, gathering relevant facts to understand the mine fire incident and the events which led to the incident. Interviews were conducted at the mine site between the 2nd and 15th of November '06.
- Once all relevant data had been collected, it was correlated into a Timeline chart (Refer to Section 6) to depict the sequences of events leading to the mine fire incident. Key events from the Timeline chart were examined to determine the contributing factors.
- The ICAM analysis was undertaken to classify the events with contributing factors and underlying causes into one of the four ICAM categories: Organisational factors, Task/Environmental Conditions, Individual/Team Actions and Absent/Failed Defences. ICAM charts were developed to depict this information. Refer to Section 7.
- Recommendations for preventative and corrective actions were developed by reviewing each contributing factor and underlying causes, depicted in the ICAM charts.
- A review of the recommendations contained in the November 1977 Open Cut Fire report was also conducted to establish progress on lessons learned. Refer to Appendix E.

1.4 Immediate cause

Based on evidence collected by the CFA fire investigation and the ICAM investigation process, two potential immediate causes were identified.

- Hot idler on M620 conveyor. A collapsed bearing was subsequently discovered at the 853 metre mark (frame number 157) of M620 conveyor. The likely ignition was caused by the collapsed bearing falling onto the return side of the belt and travelling towards the tailend where it was ejected onto the coal level at the tailbox. The hot metal smouldered in the coal and was fanned by the strong winds several hours later and eventually caused a fire to start and spread along the level assisted by the strong northerly winds. In addition it is probable that the belt on M620 conveyor eventually caught fire at the 853 metre mark where the hot idler fanned by strong winds ignited it and burnt towards the head end. Idler inspection records show that the idler on frame 157 of M620 conveyor had not been detected and hence not reported for replacement.
- Movement of contractor's vehicle across the coal levels along M620 conveyor during the Fire Alert.

The physical evidence collected by the CFA fire investigation leads to the conclusion that the hot idler is the most probable cause of the fire. However it should be noted that a non-IPRH vehicle crossing the coal formation during a Fire Alert could easily have started a fire and due to the rapid spread of the fire by the wind along the formation, there is also the possibility that the fire started from multiple ignition points. Refer to Appendix G for the CFA Fire Investigation Report.

1.5 Escalation

Whilst reducing the likelihood of future initial causes from hot idlers, vehicles and other sources (eg hot work) is important, the threat of small fires is constant with the IPRH Open Cut Mine experiencing approximately 100 small fires per year.

The significant factor in this fire was the escalation of a small fire into an uncontrollable fire within a short time due to extreme weather conditions and the delay in IPRH providing sufficient resources to combat the initial fire.

1.6 Contributing Factors and Underlying Causes

The following Contributing Factors and Underlying Causes were identified and are covered in more detail in Section 3.

- The annual internal audit of all fire services facilities, systems and procedures as specified in current 'Mine Fire Service Policy and Code' of Practice had not been completed.
- Pre Summer & Fire Season Works Program including training of mine personnel and contractors was underway but had not been completed since it was before the start of the designated fire season.
- October 2006 exhibited severe weather conditions even though it is not classified as part of the fire season.- Appendix A
- The 'Mine Fire Service Policy and Code of Practice' definition of the Pre Summer & Fire Season Works Program designates December and January as the months in which crucial fire preparation is to be undertaken, including fire training. It does not consider current weather, fire or mine conditions.
- No formalised or predefined conditions available for declaring a Fire Alert.

- Fire Alert processes are understood but are not always fully complied with.
- Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed.
- Work procedures and practices within the 'Mine Fire Service Policy and Code of Practice' and the 'Fire Instructions' are not systematically reviewed or updated.
- Level of fire fighting competence variable with IPRH personnel and contractors.
- Fire had escalated by the time the fire was reported to the CFA & their services became available on site.
- No formalised arrangements with the CFA to be put on alert for a fire.
- Some CFA non-Morwell personnel did not have an understanding in fighting coal fires.
- Emergency response took too long to change from the initial reactive response into a strategic ongoing response.
- Roles, responsibilities and procedures outlined within the Emergency Response Plan are not systematically referred to during an emergency and should be more user friendly.
- External fire pump stations PH50 and PH53 were on single power supply and status was not communicated to Operations.
- Interface and communications between Operations, Fire Services and Maintenance needs to be reviewed in terms of fire systems, particularly in relation to the power supply for the fire pumps.
- The IPRH Emergency Response Plan, the IPRH Significant Issue Corporate Response Plan and the IP Corporate Serious Incident Procedure should be more integrated.

1.7 Commendable Activities

The following activities undertaken during the incident were noted and commended:

- The level of fire fighting effort and dedication shown by all IPRH personnel and contractors during the initial response was very commendable.
- The Initial Response was effective with all personnel taking up roles and undertaking activities based on experience, competence and dedication.
- The strategic objective to protect remaining operating equipment and maintain production was clearly communicated throughout the response to all parties.
- Coal production and power station operation was maintained throughout the incident.
- The close relationship between IPRH and CFA worked well to control the fire and to maintain production, particularly the relationship between the IPRH EC and the CFA IC and allocating IPRH operations staff to the CFA strike teams.
- The Significant Issue Corporate Response Plan worked relatively well and removed some of the pressure on the Emergency Commander that had existed in previous incidents. (eg. During the December '05' incident, the Emergency Commander was also required to undertake the Significant Issue Corporate Response role).
- Recovery Plan was implemented in a timely manner.

1.8 Recommendations

The following recommendations were identified and are covered in more detail in Section 5.

Recommendation 1

- In July of each year, a plan should be developed for the upcoming fire season based on weather predictions and mine conditions. Note that with the current conditions, a fire season may need to be designated from October to March.

Recommendation 2

- An annual audit of the fire system should be undertaken prior to the start of the fire season in accordance with the fire season plan (Refer to Recommendation 1). The audit should review all aspects of the fire service facilities, systems and procedures. This should include hardware, documentation (eg. emergency response plans), fire pumps and electrical supply, spray coverage of coal levels and fire fighting training, etc.

Recommendation 3

- Predefined conditions should be identified to assist in determining whether a Fire Alert should be declared. The criteria should not be based solely on CFA Total Fire Bans as the CFA criteria includes factors relating to conditions that are not applicable to an open-cut coal mine. These conditions should include ranges in temperature, humidity, wind direction or speed that can define 'severe weather conditions'.

Recommendation 4

- Fire Alert processes are understood but are not always fully complied with. As the Fire Alert is a critical control to prevent fires, the procedures including roles and responsibilities should be reviewed, updated, reiterated and enforced for mine personnel.

Recommendation 5

- Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed. The review should cover the responsibilities and tasks required by the Fire Services Group including the Fire Services Officer, Supervisor and Operators for the normal daily tasks, during a Fire Alert and during an incident. The review should also cover which mine personnel or contractors would provide a valuable and effective resource to support Fire Services during a Fire Alert and an incident dependent on their roles and responsibilities. For instance, utilising the maintenance crew for additional fire spotting after a Fire Alert has been declared. Refer to Appendix D for Organisational responsibilities in Fire Prevention.

Recommendation 6

- Interface and communications between Operations, Fire Services and Maintenance needs to be reviewed in terms of fire systems, particularly in relation to the power supply for the fire pumps.

Recommendation 7

- Roles, responsibilities and procedures outlined within the IPRH Emergency Response Plan should be reviewed and rewritten utilising a checklist approach so that each person undertaking an emergency role can confirm that they are undertaking their key activities.

Recommendation 8

- In a significant fire, each coal level should be treated as a fire zone and a Zone leader allocated after consultation with the CFA.

Recommendation 9

- Once it has been determined that there is a significant fire, all supervisors should return to the ICP for a briefing and to undertake a role of co-ordinating the fire teams. A co-ordinated approach to fighting fires is more effective than just large numbers of fire fighters.

Recommendation 10

- The ICP should continue to be established as a special facility separate from normal operations or mine activities. The ICP should have available all essential equipment required for an emergency response, that is easily and quickly accessible; and able to be transported to any onsite facility. This equipment may be available as a mobile 'kit'.

Recommendation 11

- IPRH should consider notifying the CFA immediately once a spot fire has been reported and verified on site. The CFA remains on alert for a nominated amount of time (eg. 15 minutes). Within this time frame they must receive further notification from the site that the fire has been extinguished otherwise they will send out an initial response crew in anticipation that the fire has escalated and requires their assistance. This practice is undertaken at other mines in Latrobe Valley.

Recommendation 12

- The IPRH Significant Issue Corporate Response Plan and the IP Corporate Serious Incident Procedure should be reviewed and updated to ensure there are no discrepancies and the IPRH Emergency Response Plan should be consistent with the IPRH Significant Issue Corporate Response Plan.

Recommendation 13

- Work procedures and practices within the 'Mine Fire Service Policy and Code of Practice' and the 'Fire Instructions' should be systematically reviewed and updated.

Recommendation 14

- Whilst it should be recognised that the priority is to ensure that sufficient water is used to control the spread of fires, particularly to ensure no burning coal is transferred to the power station, mine operations should be trained to understand the effects of excessive water transferred to the power station.

Recommendation 15

- The use of thermal imaging cameras and other technology in the detection of faulty idlers should be investigated for their application and used where appropriate.

Recommendation 16

- The use of thermal imaging cameras was effective during the fire fighting and should be considered as well as other technology for wider use in spotting fires within the mine.

Recommendation 17

- A procedure for dealing with Carbon Monoxide (CO) during fire fighting, including the use of CO monitors, should be developed since personnel safety is a major responsibility and concern in fighting coal fires. .

Recommendation 18

- Whilst the efforts of all mine, contractor and CFA personnel are highly commended in their assistance with the fire fighting, it should be emphasised and reinforced to all personnel that no job is so important that they should take excessive risks.

Recommendation 19

- Allocating IPRH operations staff to CFA strike teams during a fire should be included within IPRH procedures (eg. Emergency Response Plan and/or Fire Instructions) and reinforced so that it becomes normal practice.

Recommendation 20

- To ensure that the ongoing efficient operations of the mine are not compromised over the long term as a result of the fire incident, a detailed risk analysis should be carried out to assess the life cycle impact of the fire on maintenance costs and longevity of the mine infrastructure assets.

2. Incident Description

2.1 Details of the Incident

Location: International Power Hazelwood Open-Cut Coal Mine

Date: 12th October 2006

The following details the key events leading up to and during the incident. Refer to Appendix B for photos.

Anticipating the hot and windy day, at approximately 7.30 to 8.00am, mine personnel operated water sprays throughout the mine to suppress coal dust and reduce fire danger. Approximately every second spray was run to keep coal areas wet.

At about 9.50am, the Acting Fire Services Supervisor declared a Fire Alert. The alert was communicated to the Mine Shift Production Manager and to all mine personnel in accordance with normal procedures.

All spray systems were activated after the Fire Alert was declared. Refer to Figure 4 in Appendix B for a photo taken at approximately 10.30am; depicting the activated spray systems.

At approximately 10.45am, a spot fire was noticed at the tail end of M620 conveyor. The Mine Shift Production Manager was notified of the spot fire and conducted a visual check from the Control Centre where he saw smoke from the tail end of M620 conveyor. Others noticed the spot fire and smoke at the tail end at this time.

Some mine personnel and contractors attended the spot fire on the tail end of M620 conveyor.

Personnel who attended the spot fire at M620 conveyor reported that the fire moved towards the head end of M620 conveyor as well as progressing to the M720 conveyor. Spot fires were also reported to have formed along the north side of Dredger 11.

At approximately 11.45am, a call was made to all conveyor attendants and leading hands to assist with suppressing the fire at M620 conveyor.

At 11.50am the Mining Director was notified of the fire. At 12:15pm he assumed the role of Emergency Commander (EC) from the Mine Shift Production Manager and established the IPRH Incident Control Point (ICP).

The Mine Shift Production Manager reported the fire to the CFA at 11.57am subsequent to a request from Fire Services.

The CFA arrived on scene at the International Power Hazelwood Open Cut Mine at 12.07pm.

The IPRH Incident Control Point was being organised on site whilst the CFA Incident Control Centre (ICC) was organised off site at the Morwell CFA Station as they were involved in other fire fighting activities in the region.

At approximately 3.30pm, a loss of power supply to the external pump stations PH50 and PH53 caused the pumps to cease working. Meanwhile, the fire system software used to monitor the water level in the fire services tanks stopped updating. The water level dropped causing water pressure loss for fire fighting and subsequently a severe reduction of water supply.

Pumps at the base of the mine, Dirty Water Pump Station and Clean Water Pump Station, continued to operate. Refer to Appendix C for the schematic of the Mine Fire Service Network.

Shortly after, an evacuation of all IPRH & CFA personnel was initiated except for personnel at M820, who remained and protected the remaining operating conveyor line M820 and Dredger 10.

Fire water services returned in approximately 60-90 minutes, subsequent to the electrical engineer and electrical technician isolating the fault & resetting the feeder.

Fire fighting was initiated again subsequent to reestablishment of sufficient water pressure in the system.

Refer to Figure 6 & 7 in Appendix B for an overview of the likely initial ignition sources and the extent of the fire on the 12th October '06. .

2.2 Events leading up to the Incident

2.2.1 Environmental conditions

Severe weather conditions with increasing temperature and winds were exhibited on 12th October 2006. The day was declared a day of Total Fire Ban in all districts except Gippsland. The Bureau of Meteorology recorded the highest October temperature on record (35.1°C) for Morwell.

Weather logs recorded between 10am to 12pm from the mine site, depicted a North to North Westerly wind direction with wind speeds between 30 to 40 km/hr; and an increasing temperature from 30°C to 35°C. Increasing temperature and strong winds is consistent with observations from IPRH personnel.

Outside humidity depicted a rapid decrease from 80% down to approximately 33% between 5am to 9am. It stabilised at about 27% between 11am to 12pm. The dry conditions would have further contributed to the fire risk on the day. At 12.30pm, the CFA took an approximate humidity reading of under 5% within the open cut mine.

Refer to Appendix A for weather logs recorded from the mine site.

2.2.2 Site preparation on the 12th October 2006

Increasing winds at the open cut mine raised coal dust as the morning progressed.

Anticipating the hot and windy day, mine personnel operated water sprays (every second spray operated) throughout the mine to suppress dust and reduce fire danger.

In response to the Fire Alert, all spray systems were operated.

Mobile Conveyor attendants (undertaking fire spotting duties) were operating at all levels of the mine.

2.2.3 Maintenance activities

Dredger 11, the conveyor M620 and the D8R Bulldozer were all scheduled for maintenance work.

Dredger 11 was taken off line at 7am.

Dredger 11 required relocating to the head end of the M620 conveyor before maintenance work could be undertaken.

The IPRH D8R Bulldozer was also relocated and parked on a clay formation at the head end of M620 conveyor in preparation for maintenance work.

The M620 conveyor belt was visually checked for idler replacements by conveyor attendants.

M620 conveyor was inspected prior to being electrically isolated in preparation for planned maintenance work.

Refer to Figure 5 in Appendix B for an overview of the Plant situated on the coal levels on the 12th October '06.

2.3 Consequences

2.3.1 Health, Safety & Environment

IPRH personnel and contractors suffered a number of first aid incidents during the fire fighting, including:

- Eye irritation
- Minor burns
- Headaches from dehydration and from exposure to carbon monoxide (CO)
- Mild hypothermia during night shift

No medical treatment injuries were sustained.

The CFA recorded 27 injuries to their personnel.

Whilst the number of injuries sustained by IPRH personnel and contactors and the CFA was relatively low, it was noted that some people were prepared to expose themselves to higher than acceptable risks. It should be emphasised that there is no job that is so important that people should take excessive risks.

2.3.2 Property Damage

The main areas of identified property damage are listed below:

Conveyor System CS1 (M620, M640 and M660 conveyors)

- Extensive belt damage (Approximately 2430m).
- Extensive electrical damage (M620 conveyor head end and M640 conveyor).
- Mechanical/structural damage (pulleys, impact curtains, 1200 conveyor idler sets).
- Travelling Hopper H1828 extensively damaged.
- High Voltage supply cable damaged.

Conveyor System CS2 (M720, M740 and M760 conveyors)

- Extensive belt damage (Approximately 630m).
- Extensive electrical damage (M720 head end & M740).
- Mechanical/structural (pulleys, impact curtains, 200 idler sets, painting).
- High Voltage supply cable damaged.

Mobile Slew Conveyor S94

- Extensive electrical damage.

High Voltage Supply System

- Extensive damage to 6.6kV Supply Cables.

Dredger 11

Extent of damage is currently being fully assessed, however significant damage has been identified to the:

- Entire Discharge Boom and suspension system.
- Centre loading chutes.
- Forechute, suspension and structure on the Bucket Wheel Boom.
- Extensive areas of electrical wiring.
- Painting work.
- Pulleys, idlers, belts.
- Bucket Wheel Shaft and is recommended for complete replacement.

2.3.3 Plant Damage and Business Interruption Approximate Cost Estimates as at 30th November 2006

Plant Damage

- Coal System 1
- Coal System 2
- Coal System 3
- Mobile Slew Conveyor S94
- Dredger 11 repairs -
- High Voltage Supply
- IPRH Technical/Support
- IPRH D8R Bulldozer

Business Interruption

The increased cost of operating estimate is currently

This consists mostly of overburden to be removed by truck and shovel to assist the smaller Dredger 24 whilst Dredger 11 is being repaired.

Fire Fighting

Approximately : including IPRH labour and revenue loss

Long Term Impact

A detailed risk analysis and budget estimate will be carried out to assess the long term impact on future mine maintenance costs and the reduced life of the mine infrastructure assets.

3. Contributing Factors and Underlying Causes

In order to identify the contributing factors and underlying causes, the incident was split in to 6 stages:

- Preparation – encompasses all events relating to the mine site preparation prior to the incident. Events include the wetting down of coal levels with spray water from anticipation of windy conditions and the implementation of Pre Summer & Fire Season Works Program.
- Fire Alert – encompasses events initiated from the declaration of Fire Alert on the mine site.
- Initial Fire – encompasses events from the observation of the spot fires at M620 conveyor and the response to these fires.
- Fire Escalation – encompasses events subsequent to spot fires spreading throughout M620 conveyor and spreading out of control.
- Initial Response (first day) – encompasses events from the establishment of the ICP until it was operating in a strategic manner rather than a reactive manner.
- Ongoing Response – encompasses events subsequent to the initial response when the ICP was operating in a strategic manner.

3.1 Preparation

Contributing Factors	Underlying Causes
Hottest October day on record in Morwell and significantly lower rainfall during preceding winter period.	According to the 'Mine Fire Service Policy and Code of Practice', the Pre Summer & Fire Season Works Program designates December and January as the months in which crucial fire preparation is to be undertaken, including fire training. It does not consider current weather, fire or mine conditions. Annual internal audit of all fire services facilities, systems and procedures as specified in current 'Mine Fire Service Policy and Code of Practice' had not been completed.
Pre Summer & Fire Season Works Program including training of mine personnel and contractors had not been completed since it was before the start of the designated fire season.	
Fire fighting training of mine personnel was not scheduled for completion until November '06.	
Wet test of the mine's water reticulation system had not yet been completed as part of the 'Pre Summer & Fire Season Works Program'.	According to the 'Mine Fire Service Policy and Code of Practice', the wet testing system is required on or about the 12th December each year. This predefined date does not consider current weather, fire or mine conditions nor does it consider ensuring a continual functioning system.

Contributing Factors	Underlying Causes
Water spraying insufficient to wet coal faces since water pipes are located too far from coal faces, particularly as wind pushed spray water in other direction. It is not practical to wet all coal faces.	Annual internal audit of all fire services facilities, systems and procedures as specified in current 'Mine Fire Service Policy and Code of Practice' had not been completed. Work procedures and practices within the 'Mine Fire Service Policy and Code of Practice' and the 'Fire Instructions' are not systematically reviewed.
A collapsed bearing smouldering in the coal on the M620 conveyer is undetected.	The detection of smouldering bearings from faulty idlers relies on visual inspection from mine personnel. The use of thermal imaging cameras in the detection of faulty idlers should be investigated for their application and used where appropriate.
A daily inspection for coal build-up is undertaken more diligently during the fire season.	Organisational responsibilities in fire prevention and safety precautions on plant, outlined within the 'Fire Instructions' for Hazelwood Power Mine' are not systematically reviewed.

3.2 Fire Alert

Contributing Factors	Underlying Causes
Weather forecasts available on the previous day warned of high fire danger on the 12th October '06.	No formalised or predefined conditions available for declaring a Fire Alert.
Differing mine personnel opinions on the criteria for declaring a Fire Alert.	
Reliant on CFA Total Fire Ban Days to assist with determining Fire Alert conditions.	No formalised or predefined conditions available for declaring a Fire Alert. The CFA use the McArthur Wheel, which is not appropriate for predicting Fire Alerts for mine conditions.
Insufficient Fire Services Operators during a Fire Alert to undertake fire patrol (spotting), as they are busy preparing fire system.	Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed.
A comprehensive log of events was not maintained after Fire Alert was declared.	

Contributing Factors	Underlying Causes
Maintenance crews could not be used for fire patrolling (spotting) and fire fighting as they were sent off site or deployed elsewhere during the Fire Alert.	
Maintenance work was still being completed after the Fire Alert was declared.	Fire Alert processes are understood but are not always fully complied with.
Non-urgent vehicle access to coal levels during Fire Alert.	
Authorisation to access the coal level by a vehicle was given by the Control Centre independent of Fire Services.	
Mobile water tanker units were not full of water and were not immediately available on coal levels as they were being used for wetting down elsewhere (eg. on roads).	

3.3 Initial Fire

Contributing Factors	Underlying Causes
Fire Service Operators are busy preparing fire systems and are not available to undertake fire spotting during initial reports of spot fires.	Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed.
Too few mine personnel available to control initial spot fires.	
No logs were kept and personnel were unclear of when or where spot fires were reported, and were too slow to arrive at location of fire.	

3.4 Fire Escalation

Contributing Factors	Underlying Causes
Some hydrants were damaged resulting in wider spacing between fire fighting areas, which required the use of extra hoses.	Annual internal audit of all fire services facilities, systems and procedures as specified in current 'Mine Fire Service Policy and Code of Practice' had not been completed.
Some water pipes took longer to charge since they were in remote status and required valves to be manually opened. This is normal practice, however some personnel were not familiar with this practice.	
Some mine personnel were inexperienced in fighting coal fires since training was not scheduled for completion until November '06.	According to the 'Mine Fire Service Policy and Code of Practice', the Pre Summer & Fire Season Works Program designates December and January as the months in which crucial fire preparation is to be undertaken, including fire training. It does not consider current weather, fire or mine conditions.
Dredger 9 and 25 were initially incorrectly connected to fire water supply as they were connected by personnel who were inexperienced with the use of Dredgers.	
Decreased ability to fight fires due to a slow process of replacing damaged or used fire fighting equipment for fire fighters at the fire front (eg. replacement of damaged hoses).	Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed.
Status of power supply to the external fire pump stations at PH50 and PH53 not known by Operations.	Annual internal audit of all fire services facilities, systems and procedures as specified in current 'Mine Fire Service Policy and Code of Practice' had not been completed. Interface and communications between Operations, Fire Services and Maintenance needs to be reviewed in terms of fire systems, particularly in relation to the power supply for the fire pumps.
Fire had escalated by the time the fire was reported to the CFA & their services became available on site.	No formalised arrangements with the CFA to be put on alert for any fire.
Some CFA non Morwell personnel were inexperienced in fighting coal fires.	Some CFA non Morwell personnel did not have an understanding in fighting coal fires.
Diamond Protection (Site Services Provider) was not contacted to assist with fighting fires.	Review the use of Diamond Protection in terms of fire fighting within the open cut mine.

3.5 Initial Response (First Day)

Contributing Factors	Underlying Causes
Mine personnel took up immediate roles very quickly and efficiently, based on competence and experience.	Roles, responsibilities and procedures outlined within the Emergency Response Plan are not systematically referred to during an emergency and should be more user friendly.
Assignment of emergency roles and responsibilities for the strategic ongoing emergency response was a slow process due to lack of knowledge and duplication of roles and responsibilities.	
Emergency response took too long to change from the initial reactive response into a strategic ongoing response.	
Initially there were no records kept of who or where personnel were on site during the initial response.	
The ICP did not have good communications or access to equipment and documentation to use in an incident.	Inadequate preparation and establishment of the ICP. The ICP should continue to be established as a special facility established separate from normal Operations. The ICP should have a kit available of all essential equipment required in an emergency response, that is easily and quickly accessible; and able to be transported to any onsite facility.
Unclear role between Control Centre and Fire Service Office.	Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed.
Damaged equipment including stands on the fire monitor trailers require fire fighting personnel to manhandle.	Annual internal audit of all fire services facilities, systems and procedures as specified in current 'Mine Fire Service Policy and Code of Practice' had not been completed.
Insufficient supply of PPE led to IPRH mine personnel being removed from fighting fires.	

Contributing Factors	Underlying Causes
Fire fighting was interrupted due to loss of power supply to the external fire pump stations at PH50 and PH53 that led to severe reduction of water supply.	Roles, responsibilities and procedures outlined within the Emergency Response Plan are not systematically referred to during an emergency and should be more user friendly. Interface and communications between Operations, Fire Services and Maintenance needs to be reviewed in terms of fire systems, particularly in relation to the power supply for the fire pumps. Annual internal audit of all fire services facilities, systems and procedures as specified in current 'Mine Fire Service Policy and Code of Practice' had not been completed. A back up system for crucial services within the Mine Fire Service Network is not available.
The fire pumps were not monitored when the fire system software stopped updating the status of the system and led to the loss of water pressure.	
Too many personnel went to fight the fire, and not enough co-ordination of fire fighting.	Roles, responsibilities and procedures outlined within the Emergency Response Plan are not systematically referred to during an emergency and should be more user friendly. Once it was clear that the fire was out of control, supervisors should return to the ICP and take on role of co-ordinating teams and not fighting fire. In consultation with the CFA, a Zone leader should be allocated to each coal level and treated as a fire zone.
The Production Supervisor was controlling too many fire fighting activities at all coal levels.	

3.6 Ongoing Response

Contributing Factors	Underlying Causes
Lack of communication initially between the ICP and the ICC located at a remote location.	No formalised communication protocol between the ICC and the ICP. An IPRH Officer should be located at the ICC at all times and maintain communication with the IPRH Emergency Commander.
Issues with media communication protocol between IPRH and CFA.	
The CFA's ICC was involved in other fire fighting activities and was located off-site from IPRH.	

Contributing Factors	Underlying Causes
Confusion between IPRH Significant Issue Corporate Response Plan and the IP Corporate Serious Incident Procedure.	Discrepancies between the IPRH Significant Issue Corporate Response Plan and the IP Corporate Serious Incident Procedure.
Counselling could have been initiated earlier.	Roles, responsibilities and procedures outlined within the Emergency Response Plan are not systematically referred to during an emergency and should be more user friendly.
Coal provided to the power station contained large amounts of water, causing significant issues, including a drowned Bunker Discharge Wagon and burnt out travel motor.	Whilst it should be recognised that the priority was to control the spread of fires, some mine personnel did not understand the impacts of large quantities of water being transferred to the power station.
Power station resources being diverted to mine caused problems in undertaking critical power station maintenance on system 6.	Resourcing during an ongoing incident response did not take into account both power station and mine requirements.

4. Key Findings

4.1 Immediate cause

Based on evidence collected by the CFA fire investigation and the ICAM investigation process, two potential immediate causes were identified.

- Hot idler on M620 conveyor. A collapsed bearing was subsequently discovered at the 853 metre mark (frame number 157) of M620 conveyor. The likely ignition was caused by the collapsed bearing falling onto the return side of the belt and travelling towards the tailend where it was ejected onto the coal level at the tailbox. The hot metal smouldered in the coal and was fanned by the strong winds several hours later and eventually caused a fire to start and spread along the level assisted by the strong northerly winds. In addition it is probable that the belt on M620 conveyor eventually caught fire at the 853 metre mark where the hot idler fanned by strong winds ignited it and burnt towards the head end. Idler inspection records show that the idler on frame 157 of M620 conveyor had not been detected and hence not reported for replacement.
- Movement of contractor's vehicle across the coal levels along M620 conveyor during the Fire Alert.

The physical evidence collected by the CFA fire investigation leads to the conclusion that the hot idler is the most probable cause of the fire. However it should be noted that a non-IPRH vehicle crossing the coal formation during a Fire Alert could easily have started a fire and due to the rapid spread of the fire by the wind along the formation, there is also the possibility that the fire started from multiple ignition points. Refer to Appendix G for the CFA Fire Investigation Report.

4.2 Escalation

Whilst reducing the likelihood of future initial causes from hot idlers, vehicles and other sources (eg hot work) is important, the threat of small fires is constant with the IPRH Open Cut Mine experiencing approximately 100 small fires per year.

The significant factor in this fire was the escalation of a small fire into an uncontrollable fire within a short time.

4.3 Underlying Causes

The Underlying Causes of this incident are:

- Annual internal audit of all fire services facilities, systems and procedures as specified in current 'Mine Fire Service Policy and Code of Practice' had not been completed.
- The 'Mine Fire Service Policy and Code of Practice' definition of the Pre Summer & Fire Season Works Program designates December and January as the months in which crucial fire preparation is to be undertaken, including fire training. It does not consider current weather, fire or mine conditions,
- No formalised or predefined conditions available for declaring a Fire Alert.
- Fire Alert processes are understood but are not always fully complied with.
- Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed.

- Work procedures and practices within the 'Mine Fire Service Policy and Code of Practice' and the 'Fire Instructions' are not systematically reviewed.
- According to the 'Mine Fire Service Policy and Code of Practice', the wet testing system is required on or about the 12th December each year. This predefined date does not consider current weather, fire or mine conditions nor does it consider ensuring a continual functioning system.
- Organisational responsibilities in fire prevention and safety precautions on plant, outlined within the 'Fire Instructions for Hazelwood Power Mine' are not systematically reviewed.
- No formalised arrangements with the CFA to be put on alert for a fire.
- Some CFA non-Morwell personnel did not have an understanding in fighting coal fires.
- Roles, responsibilities and procedures outlined within the Emergency Response Plan are not systematically referred to during an emergency and should be more user friendly.
- Interface and communications between Operations, Fire Services and Maintenance needs to be reviewed in terms of fire systems, particularly in relation to the power supply for the fire pumps.
- Inadequate preparation and establishment of the ICP.
- No formalised media communication protocol between the ICC and the ICP.
- Differing information between the IPRH Significant Issue Corporate Response Plan and the IP Corporate Serious Incident Procedure.
- The detection of smouldering bearings from faulty idlers relied on visual inspection from mine personnel.
- Whilst it should be recognised that the priority was to ensure that sufficient water was used to control the spread of fires, some mine personnel did not understand the impacts of large quantities of water being transferred to the power station.
- Resourcing during an ongoing incident response did not take into account both power station and mine requirements.

4.4 Commendable Activities

The following activities undertaken during the incident were noted and commended:

- The level of fire fighting effort and dedication shown by all IPRH personnel and contractors during the initial response was very commendable.
- The Initial Response was effective with all personnel taking up roles and undertaking activities based on experience, competence and dedication.
- The strategic objective to protect remaining operating equipment and maintain production was clearly communicated throughout the response to all parties.
- Coal production and power station operation was maintained throughout the incident.
- The close relationship between IPRH and CFA worked well to control the fire and to maintain production, particularly the relationship between the IPRH EC and the CFA IC and allocating IPRH operations staff to the CFA strike teams.
- The Significant Issue Corporate Response Plan worked relatively well and removed some of the pressure on the Emergency Commander that had existed in previous incidents (eg. 'December '05').

- The use of thermal imaging cameras was effective and should be considered for wider use in spotting fires within the mine.
- Recovery Plan was implemented in a timely manner.

5. Recommendations

Subsequent to the incident investigation many of the underlying causes related to the lack of review, implementation and adherence to organisational documentation including procedures, roles and responsibilities. Recommendations for preventative and corrective actions were developed to address deficiencies in system defences and organisational processes by reviewing each contributing factor and underlying cause, depicted in the ICAM charts.

Recommendation 1

- ***In July of each year, a plan should be developed for the upcoming fire season based on weather predictions and mine conditions. Note that with the current conditions, a fire season may need to be designated from October to March.***

The 'Pre Summer & Fire Season Works' program is based on a fire season that starts in January and requires a number of activities to be undertaken in December. Developing a plan would ensure that this program is rescheduled according to the most recent fire conditions.

Recommendation 2

- ***An annual audit of the fire system should be undertaken prior to the start of the fire season in accordance with the fire season plan (Refer to Recommendation 1). The audit should review all aspects of the fire service facilities, systems and procedures. This should include hardware, documentation (eg. emergency response plan), fire pumps and electrical supply, spray coverage of coal levels and fire fighting training, etc.***

The 'Mine Fire Service Policy and Code of Practice' states that an annual audit of all fire service facilities, systems and procedures is to be undertaken using checklist information.

As reported from the incident investigation, the fire service equipment, services and procedures were not as effective as they should have been including the following:

- Some hydrants were damaged resulting in wider spacing between fire fighting areas, which required the use of extra hoses.
- Water spraying was insufficient to wet coal faces since water pipes were located too far from coal faces particularly as wind pushed spray water in other direction.
- Fire fighting was interrupted due to loss of power supply to the external fire pump stations at PH50 and PH53 that led to severe reduction of water supply.
- Insufficient supply of PPE led to IPRH mine personnel being removed from fighting fires.
- Damaged equipment including stands on the fire monitor trailers required fire fighting personnel to manhandle.

An annual audit of the fire service facilities, systems and procedures would ensure that the above listed fire systems including crucial systems such as the pump system power supply would have been reviewed and controlled or mitigated accordingly prior to an incident.

Recommendation 3

- ***Predefined conditions should be identified to assist in determining whether a Fire Alert should be declared. The criteria should not be based solely on CFA Total Fire Bans as the CFA criteria includes factors relating to conditions that are not applicable to an open-cut coal mine. These conditions should include ranges in outside temperature, outside humidity, and wind direction and speed that can define 'severe weather conditions'.***

Currently the declaration of Fire Alert varies according to differing opinions of mine personnel, their interpretation of 'severe weather conditions', and the CFA Total Fire Bans. Pre defined conditions could include consideration of outside temperature, outside humidity and wind conditions in addition to mine personnel experience. The CFA criteria are inconsistent with the mine conditions as they include factors that are not applicable to an open-cut coal mine.

Recommendation 4

- ***Fire Alert processes are understood but are not always fully complied with. As the Fire Alert is a critical control to prevent fires, the procedures including roles and responsibilities should be reviewed, updated, reiterated and enforced for mine personnel.***

Subsequent to the Fire Alert declared on the 12th of October '06 there were a few contributing factors that could have been managed if the Fire Alert procedures were reviewed, updated, reiterated and enforced for mine personnel. These factors included:

- Maintenance work was still being completed after the Fire Alert was declared.
- Non-urgent vehicle access to coal levels during Fire Alert.
- Authorisation to access the coal level by a vehicle was given by the Control Centre independent of Fire Services.
- Mobile water tanker units were not full of water and were not immediately available on coal levels as they were being used elsewhere (eg. on roads) for wetting down.

Recommendation 5

- ***Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed. The review should cover the responsibilities and tasks required by the Fire Services Group including the Fire Services Officer, Supervisor and Operators for the normal daily tasks, during a Fire Alert and during an incident. The review should also cover which mine personnel or contractors would provide a valuable and effective resource to support Fire Services during a Fire Alert and an incident dependent on their roles and responsibilities. For instance, utilising the maintenance crew for additional fire spotting after a Fire Alert has been declared.***

The incident investigation determined that after the Fire Alert was declared, there were insufficient Fire Service resources to undertake all the required tasks including the fire spotting, event logging, the sourcing and setting up of fire equipment. The number of personnel initially available on the 12th of October '06 was also insufficient to assist in suppressing all the spot fires reported.

The following factors would require review within the Fire Services as they were contributing factors to this incident that could have been managed to eliminate or minimise the impact of the incident:

- Insufficient Fire Service resources during a Fire Alert to undertake fire patrol (spotting), as they are busy preparing fire system.
- Maintenance crews were not used for fire patrolling (spotting) and fire fighting as they were sent off site or deployed elsewhere during the Fire Alert.
- Fire Service Operators are busy preparing fire systems and are not available to undertake fire spotting during initial reports of spot fires.
- Too few mine personnel available to control initial spot fires.
- A comprehensive log of events was not maintained after Fire Alert was declared.
- Personnel were unclear of when or where spot fires were reported, and were too slow to arrive at location of fire.
- Decreased ability to fight fires due to a slow process of replacing damaged or used fire fighting equipment for fire fighters at the fire front (eg. replacement of damaged hoses).
- Unclear role between Control Centre and Fire Service Office.

Recommendation 6

- ***Interface and communications between Operations, Fire Services and Maintenance needs to be reviewed in terms of fire systems, particularly in relation to the power supply for the fire pumps.***

During the incident, Operations and the IPRH EC were unaware that the external fire pump stations PH50 and PH53 were operating on a single power supply. As a result once the single power supply was no longer available, fire fighting was interrupted due to a severe reduction of water supply.

Recommendation 7

- ***Roles, responsibilities and procedures outlined within the IPRH Emergency Response Plan should be reviewed and rewritten utilising a checklist approach so that each person undertaking an emergency role can confirm that they are undertaking their key activities.***

Roles, responsibilities and procedures were not systematically referred to during an emergency as mine personnel took up and immediate roles very quickly and efficiently, based on competence and experience. The current Emergency Response Plan defines many roles and creates confusion between each role, as it is not user friendly.

Contributing factors to this included:

- Too many personnel went to fight the fire, and not enough co-ordination of fire fighting.
- The Production Supervisor was controlling too many fire fighting activities at all coal levels.
- Assignment of emergency roles and responsibilities for the strategic ongoing emergency response was a slow process due to lack of knowledge and duplication of roles and responsibilities.
- Emergency response took too long to change from the initial reactive response into a strategic ongoing response.

- Fire fighting was interrupted due to loss of power supply to the external fire pump stations at PH50 and PH53 that led to severe reduction of water supply.

Resourcing of personnel during an ongoing incident response should also be reviewed and take into account both power station and mine requirements.

Recommendation 8

- ***In a significant fire, each coal level should be treated as a fire zone and a Zone leader allocated after consultation with the CFA.***

Recommendation 9

- ***Once it has been determined that there is a significant fire, all supervisors should return to the ICP for a briefing and to undertake a role of co-ordinating the fire teams. A co-ordinated approach to fighting fires is more effective than just large numbers of fire fighters.***

Recommendation 10

- ***The ICP should continue to be established as a special facility separate from normal operations or mine activities. The ICP should have available all essential equipment required for an emergency response, that is easily and quickly accessible; and able to be transported to any onsite facility. This equipment may be available as a mobile 'kit'.***

There was inadequate preparation and establishment of the ICP including lack of communications, access to equipment and documentation required in the incident. Establishing this special facility with easily and quickly accessible essential equipment would assist in managing these problems for future incidents.

Recommendation 11

- ***IPRH should consider notifying the CFA immediately once a spot fire has been reported and verified on site. The CFA remains on alert for a nominated amount of time (eg. 15 minutes). Within this time frame they must receive further notification from the site that the fire has been extinguished otherwise they will send out an initial response crew in anticipation that the fire has escalated and requires their assistance. This practice is undertaken at other mines in Latrobe Valley.***

The initial spot fires on the 12th of October '06 escalated to out of control fires within a small time interval primarily with the assistance of adverse weather conditions and lack of resources to control the amount of spot fires.

The Emergency Response Plan (Issued 5/09/05) notes:

'A coal fire or series of spot fires that do not spread beyond their initial point of ignition, do not constitute an emergency notifiable to CFA. Mine Fire Alerts are not notifiable.'

In this incident, CFA notification could have assisted with initiating an earlier initial response to the escalating fires.

Recommendation 12

- ***The IPRH Significant Issue Corporate Response Plan and the IP Corporate Serious Incident Procedure should be reviewed and updated to ensure there are no discrepancies; and the IPRH Emergency Response Plan should be consistent with the IPRH Significant Issue Corporate Response Plan.***

There was confusion between IPRH Significant Issue Corporate Response Plan and the IP Corporate Serious Incident Procedure since there were discrepancies between the two documents. Once these documents are reviewed they should also be consistent with the IPRH Emergency Response Plan to avoid further confusion.

Recommendation 13

- ***Work procedures and practices within the 'Mine Fire Service Policy and Code of Practice' and the 'Fire Instructions' should be systematically reviewed and updated.***

The 'Mine Fire Service Policy and Code of Practice' (Rev: Sept 1995) is an existing document at the IPRH site. The purpose of this document as stated *'is to achieve the Fire Protection Policy requirements by providing acceptable operating procedures for fire protection services for Mining Operations'*.

The main aspects of this document that require specific review and updating are listed below:

- Resources for Protection including 'The 'Pre Summer & Fire Season Works' program and 'High Fire Risk Days (Declaration of Fire Alert)';
- Plant and Equipment; and
- Fire Service Audits and Documentation.

The 'Fire Instructions- Hazelwood Power Mine' (Issued: 30 Oct '96) is another existing document at the IPRH mine site. As stated, the instructions apply to all personnel working in the Hazelwood Power Mine and they should be aware of their responsibilities in relation to the prevention, reporting and fighting of fires in or near the mine. Currently, the 'Mine Fire Service Policy and Code of Practice' states that the 'Fire Instructions' are maintained for each open cut and reissued to Supervisory staff and key operating personnel by the beginning of October each year.

The key aspects within this document that require specific review and updating are listed below:

- Organisational responsibilities in relation to Fire Prevention;
- Fire Prevention;
- Declaration of a Fire Alert; and
- Procedures on plant during fire.

Recommendation 14

- ***Whilst it should be recognised that the priority is to ensure that sufficient water is used to control the spread of fires, particularly to ensure no burning coal is transferred to the power station, mine operations should be trained to understand the effects of excessive water being transferred to the power station.***

The IPRH mine continued to provide coal to the power station throughout the incident. As a result, coal exposed to large quantities of water at the mine, particularly on the conveyors, was transported to the power station. This caused significant issues to operations at the power station.

It should be recognised that the priority is to ensure that sufficient water is used to control the spread of fires, particularly to ensure no burning coal is transferred to the power station. However, operations should understand the effects of excessive water being transferred to the power station.

Recommendation 15

- ***The use of thermal imaging cameras and other technology in the detection of faulty idlers should be investigated for their application and used where appropriate.***

The likely ignition of the spot fires at the M620 conveyor was due to a collapsed bearing smouldering in the coal at the M620 conveyer and detection currently relies upon visual inspection from mine personnel.

Recommendation 16

- ***The use of thermal imaging cameras was effective during the fire fighting and should be considered as well as other technology for wider use in spotting fires within the mine.***

Recommendation 17

- ***A procedure for dealing with Carbon Monoxide (CO) during fire fighting, including the use of CO monitors, should be developed since personnel safety is a major responsibility and concern in fighting coal fires.***

Mine personnel reported headaches from exposure to carbon monoxide whilst fire fighting. The use of CO monitors would ensure that personnel exposure to CO would be kept within the 'safe' exposure levels.

Recommendation 18

- ***Whilst the efforts of all mine, contractor and CFA personnel are highly commended in their assistance with the fire fighting, it should be emphasised and reinforced to all personnel that no job is so important that they should take excessive risks.***

Recommendation 19

- ***Allocating IPRH operations staff to CFA strike teams during a fire should be included within IPRH procedures (eg. Emergency Response Plan and/or Fire Instructions) and reinforced so that it becomes normal practice.***

Some CFA non Morwell personnel were inexperienced in fighting coal fires. The allocation of IPRH personnel to CFA strike teams became an efficient and effective method of assisting the inexperienced CFA personnel in fighting coal fires. This method should be reviewed and included within IPRH procedures (eg. Emergency Response Plan and/or Fire Instructions) so that it becomes normal practice in response to all fires.

Recommendation 20

- ***To ensure that the ongoing efficient operations of the mine are not compromised over the long term as a result of the fire incident, a detailed risk analysis should be carried out to assess the life cycle impact of the fire on maintenance costs and longevity of the mine infrastructure assets.***

6. Timeline Chart

Three timelines have been drawn as part of the timeline chart depicting the separate sequence of events that led to the incident.

Stage 1: Fire Alert is declared → Request assistance from CFA Emergency Services.

Stage 1 depicts the sequence of events that led to the declaration of a Fire Alert and the fire escalating out of control requiring the assistance from the CFA.

Stages 2 & 3 describe concurrent sequences of events:

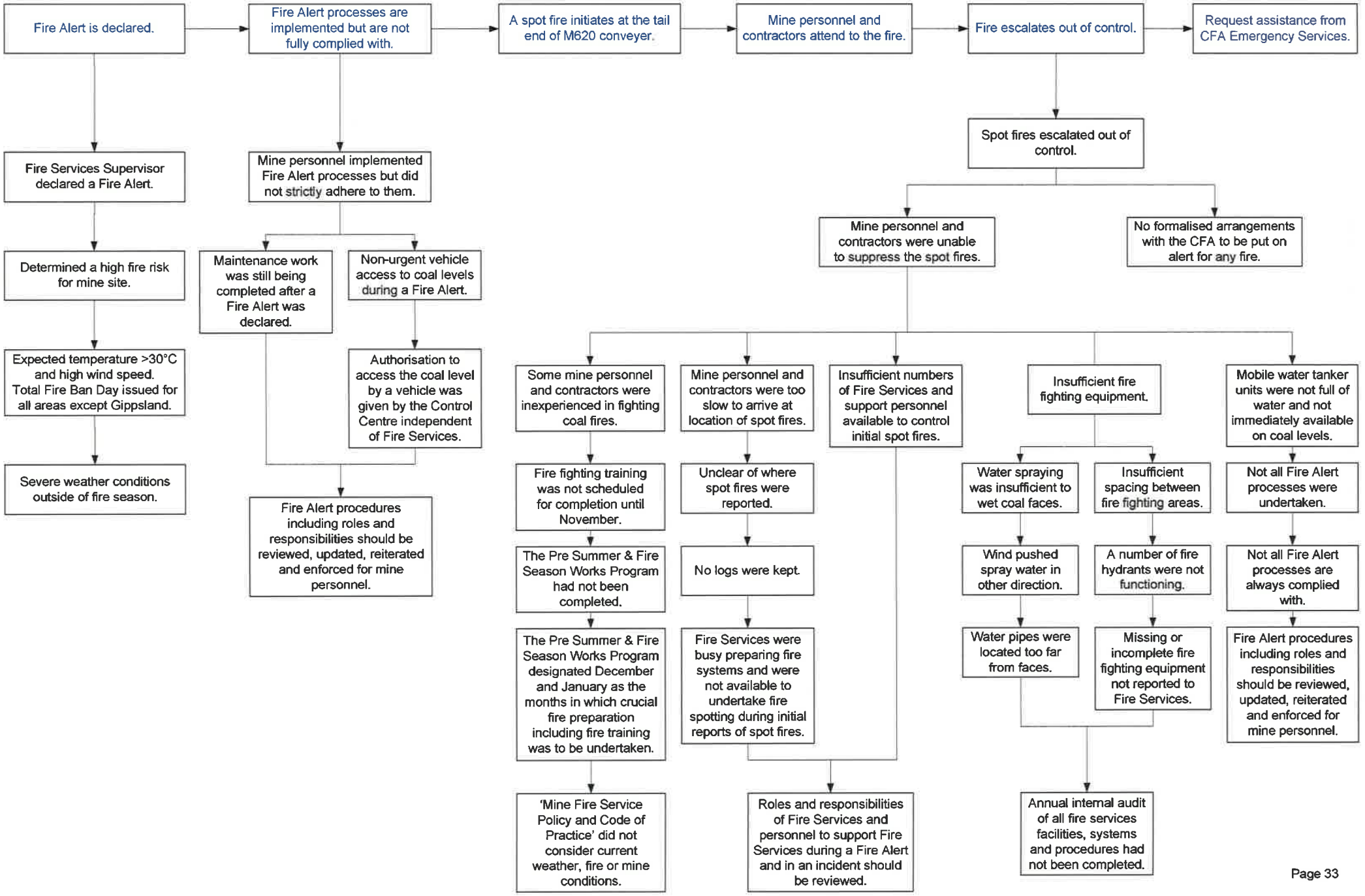
Stage 2: Mine personnel take up immediate fire fighting roles → Fire extinguished and control of operations returned to IPRH.

Stage 2 depicts the sequence of events that involved fire fighting activities.

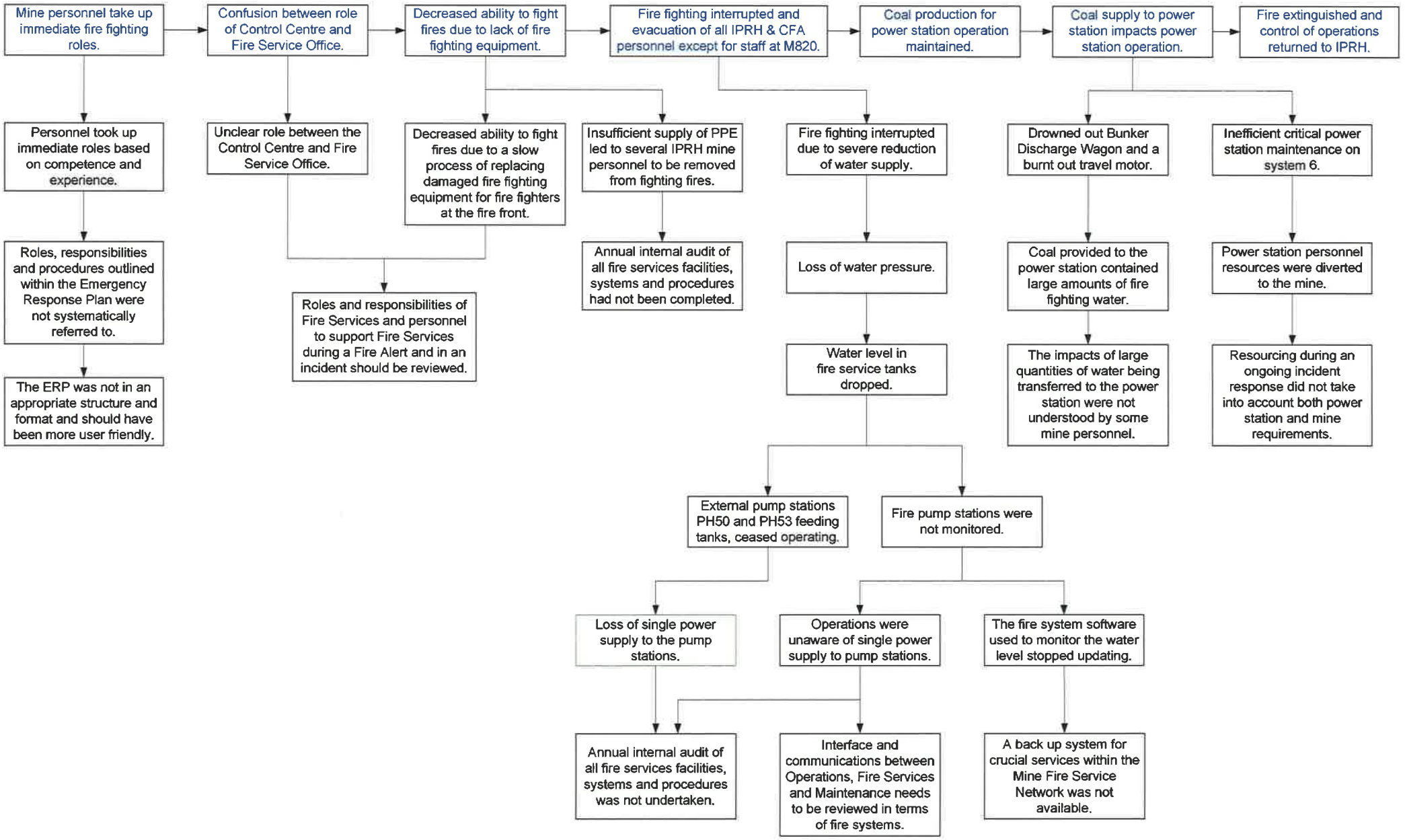
Stage 3: Initial emergency response to fire is implemented → Fire extinguished and control of operations returned to IPRH.

Stage 3 depicts the sequence of events that occurred throughout the emergency response to the incident.

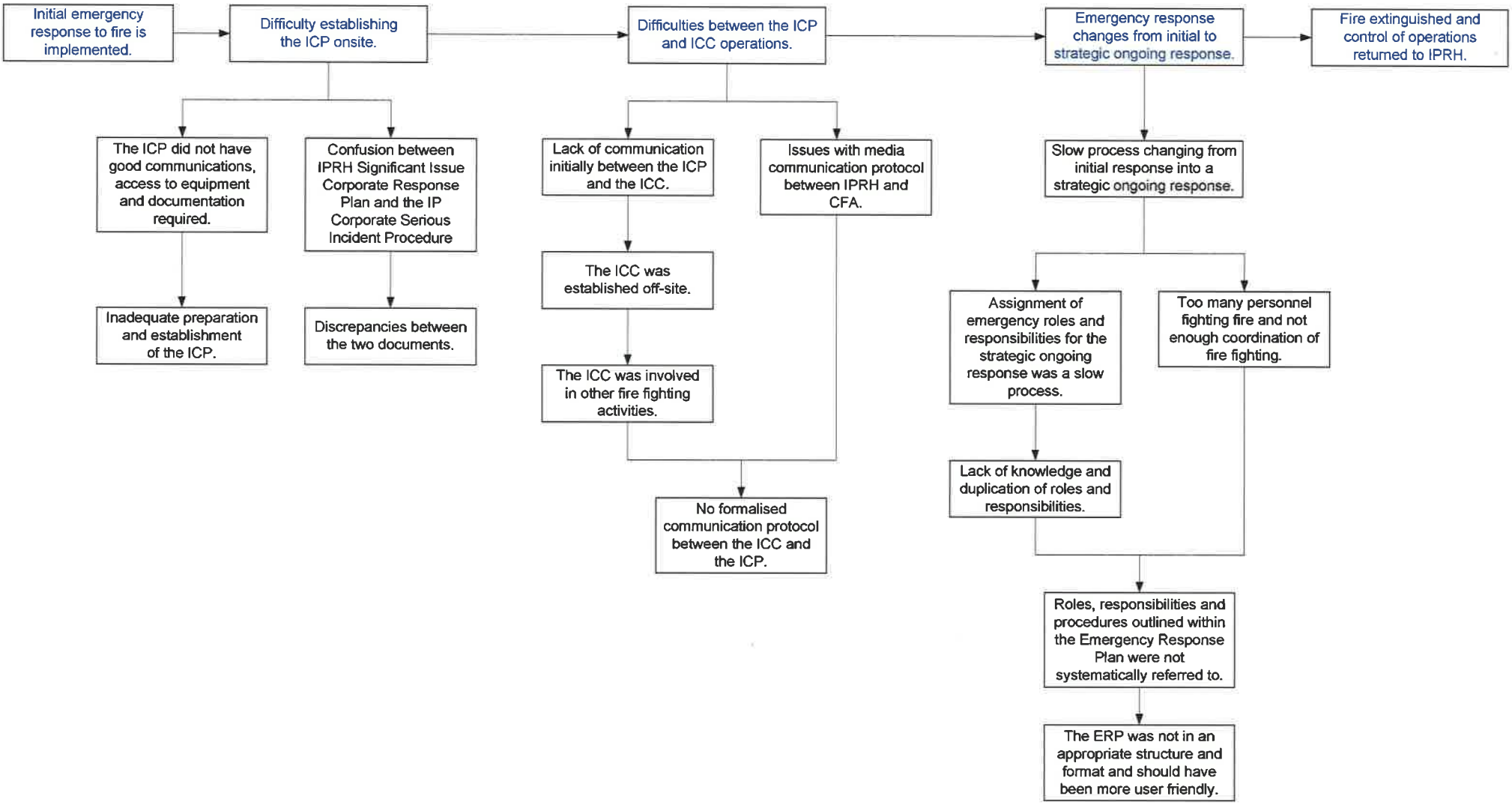
TIMELINE CHART – STAGE



TIMELINE CHART – STAGE



TIMELINE CHART – STAGE



7. ICAM Chart

ICAM charts were developed to classify the sequence of events into one of the four ICAM categories: Organisational factors, Task/Environmental Conditions, Individual/Team Actions and Absent/Failed Defences.

Absent/Failed Defences

Defences are those measures designed to prevent the consequences of a human act or component failure producing an incident. Defences are equipment or procedures for detection, warning, recovery, containment, escape and evacuation, as well as individual awareness, protective equipment and rescue.

These failures result from inadequate or absent defences that failed to detect and protect the system against technical and human failures. These are the last minute measures that did not prevent the outcome of the incident or mitigate/reduce its consequences.

Task/Environmental Conditions

These are the conditions in existence immediately prior to or at the time of the incident that directly influence human and equipment performance in the workplace. These are the circumstances under which errors and violations took place and relate to task demands, the work environment, individual capabilities and human factors.

Individual/Team Actions

These are the errors or violations that led directly to the incident. They are typically associated with personnel such as operators or maintainers having direct contact with equipment or material. They are always committed 'actively' (someone did or didn't do something) and have a direct relation with the incident. For most of the time however, the defences built into our operations prevent these 'Human errors' from causing harm.

Organisational Factors

These are the underlying organisational factors that produce the conditions affecting performance in the workplace. They may lie dormant or undetected for a long time within an organisation. Their effect only becomes apparent when they combine with the local conditions and errors or violations to breach the system's defences.

The sequence of events associated with the incident are depicted over two ICAM charts.

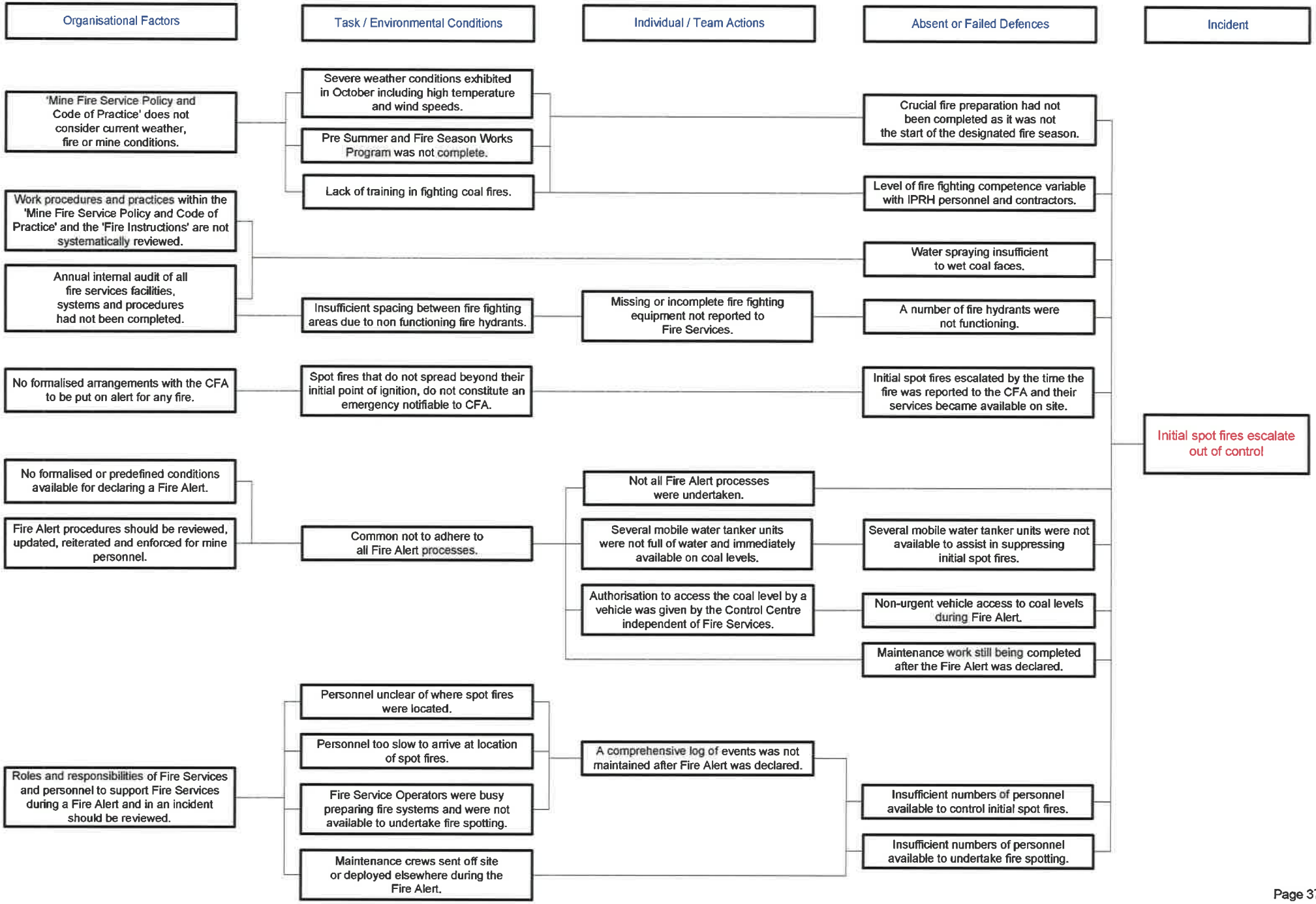
ICAM Chart 1: Incident – Initial spot fires escalate out of control.

This chart classifies all events leading up to the initial spot fires escalating out of control.

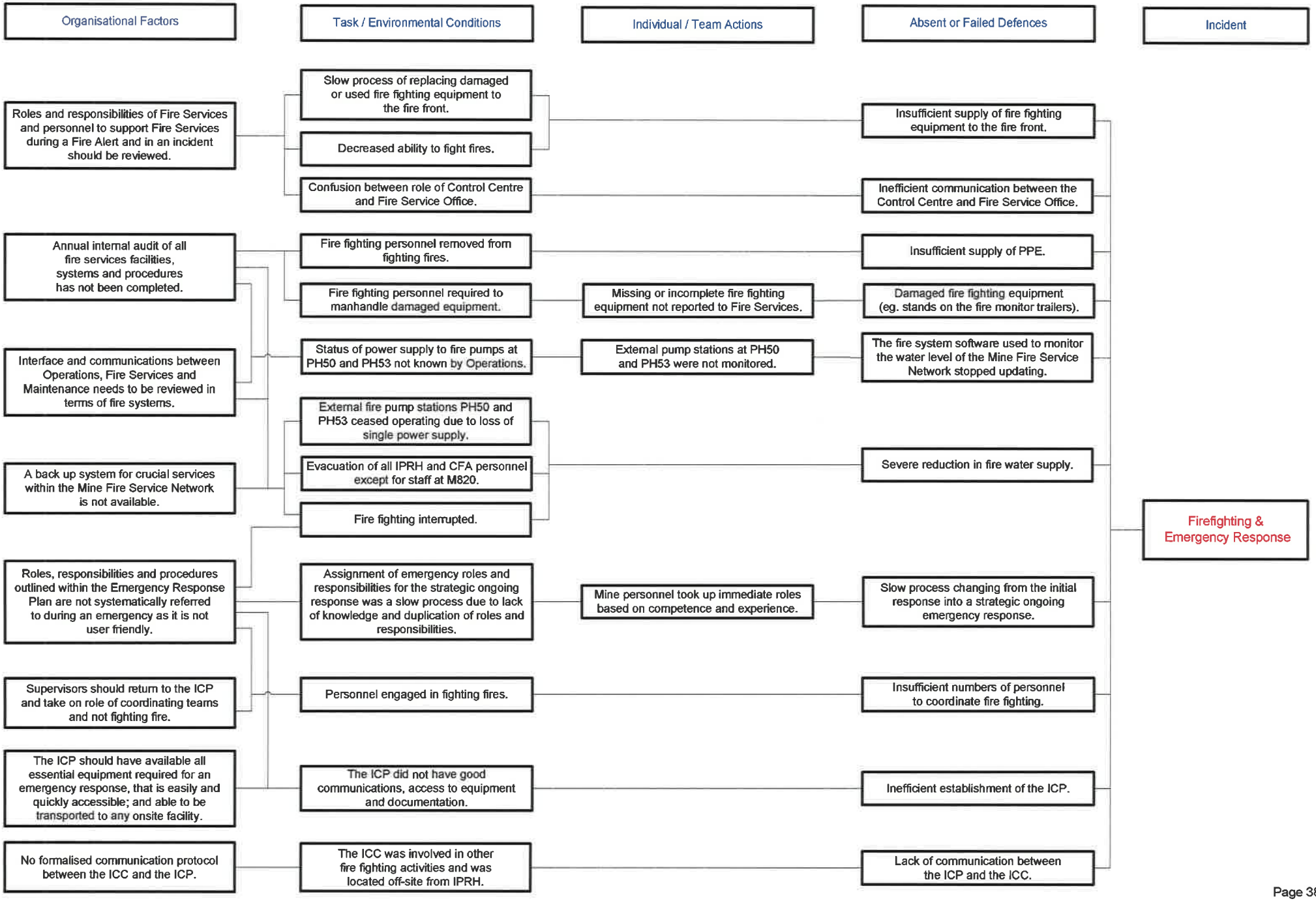
ICAM Chart 2: Incident – Fire fighting and emergency response.

This chart classifies all events that involved the emergency response to the fire.

ICAM CHART 1


Organisational Factors
Task / Environmental Conditions
Individual / Team Actions
Absent or Failed Defences
Incident
'Mine Fire Service Policy and Code of Practice' does not consider current weather, fire or mine conditions.
Work procedures and practices within the 'Mine Fire Service Policy and Code of Practice' and the 'Fire Instructions' are not systematically reviewed.
Annual internal audit of all fire services facilities, systems and procedures had not been completed.
No formalised arrangements with the CFA to be put on alert for any fire.
No formalised or predefined conditions available for declaring a Fire Alert.
Fire Alert procedures should be reviewed, updated, reiterated and enforced for mine personnel.
Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed.
Severe weather conditions exhibited in October including high temperature and wind speeds.
Pre Summer and Fire Season Works Program was not complete.
Lack of training in fighting coal fires.
Insufficient spacing between fire fighting areas due to non functioning fire hydrants.
Spot fires that do not spread beyond their initial point of ignition, do not constitute an emergency notifiable to CFA.
Common not to adhere to all Fire Alert processes.
Personnel unclear of where spot fires were located.
Personnel too slow to arrive at location of spot fires.
Fire Service Operators were busy preparing fire systems and were not available to undertake fire spotting.
Maintenance crews sent off site or deployed elsewhere during the Fire Alert.
Missing or incomplete fire fighting equipment not reported to Fire Services.
Not all Fire Alert processes were undertaken.
Several mobile water tanker units were not full of water and immediately available on coal levels.
Authorisation to access the coal level by a vehicle was given by the Control Centre independent of Fire Services.
A comprehensive log of events was not maintained after Fire Alert was declared.
Crucial fire preparation had not been completed as it was not the start of the designated fire season.
Level of fire fighting competence variable with IPRH personnel and contractors.
Water spraying insufficient to wet coal faces.
A number of fire hydrants were not functioning.
Initial spot fires escalated by the time the fire was reported to the CFA and their services became available on site.
Several mobile water tanker units were not available to assist in suppressing initial spot fires.
Non-urgent vehicle access to coal levels during Fire Alert.
Maintenance work still being completed after the Fire Alert was declared.
Insufficient numbers of personnel available to control initial spot fires.
Insufficient numbers of personnel available to undertake fire spotting.
Initial spot fires escalate out of control

ICAM CHART 2


Organisational Factors
Task / Environmental Conditions
Individual / Team Actions
Absent or Failed Defences
Incident
Roles and responsibilities of Fire Services and personnel to support Fire Services during a Fire Alert and in an incident should be reviewed.
Slow process of replacing damaged or used fire fighting equipment to the fire front.
Decreased ability to fight fires.
Confusion between role of Control Centre and Fire Service Office.
Insufficient supply of fire fighting equipment to the fire front.
Inefficient communication between the Control Centre and Fire Service Office.
Annual internal audit of all fire services facilities, systems and procedures has not been completed.
Fire fighting personnel removed from fighting fires.
Fire fighting personnel required to manhandle damaged equipment.
Missing or incomplete fire fighting equipment not reported to Fire Services.
Insufficient supply of PPE.
Damaged fire fighting equipment (eg. stands on the fire monitor trailers).
Interface and communications between Operations, Fire Services and Maintenance needs to be reviewed in terms of fire systems.
Status of power supply to fire pumps at PH50 and PH53 not known by Operations.
External pump stations at PH50 and PH53 were not monitored.
The fire system software used to monitor the water level of the Mine Fire Service Network stopped updating.
A back up system for crucial services within the Mine Fire Service Network is not available.
External fire pump stations PH50 and PH53 ceased operating due to loss of single power supply.
Evacuation of all IPRH and CFA personnel except for staff at M820.
Fire fighting interrupted.
Severe reduction in fire water supply.
Roles, responsibilities and procedures outlined within the Emergency Response Plan are not systematically referred to during an emergency as it is not user friendly.
Assignment of emergency roles and responsibilities for the strategic ongoing response was a slow process due to lack of knowledge and duplication of roles and responsibilities.
Mine personnel took up immediate roles based on competence and experience.
Slow process changing from the initial response into a strategic ongoing emergency response.
Firefighting & Emergency Response
Supervisors should return to the ICP and take on role of coordinating teams and not fighting fire.
Personnel engaged in fighting fires.
Insufficient numbers of personnel to coordinate fire fighting.
The ICP should have available all essential equipment required for an emergency response, that is easily and quickly accessible; and able to be transported to any onsite facility.
The ICP did not have good communications, access to equipment and documentation.
Inefficient establishment of the ICP.
No formalised communication protocol between the ICC and the ICP.
The ICC was involved in other fire fighting activities and was located off-site from IPRH.
Lack of communication between the ICP and the ICC.

Appendix A

Weather Logs

Figure 1

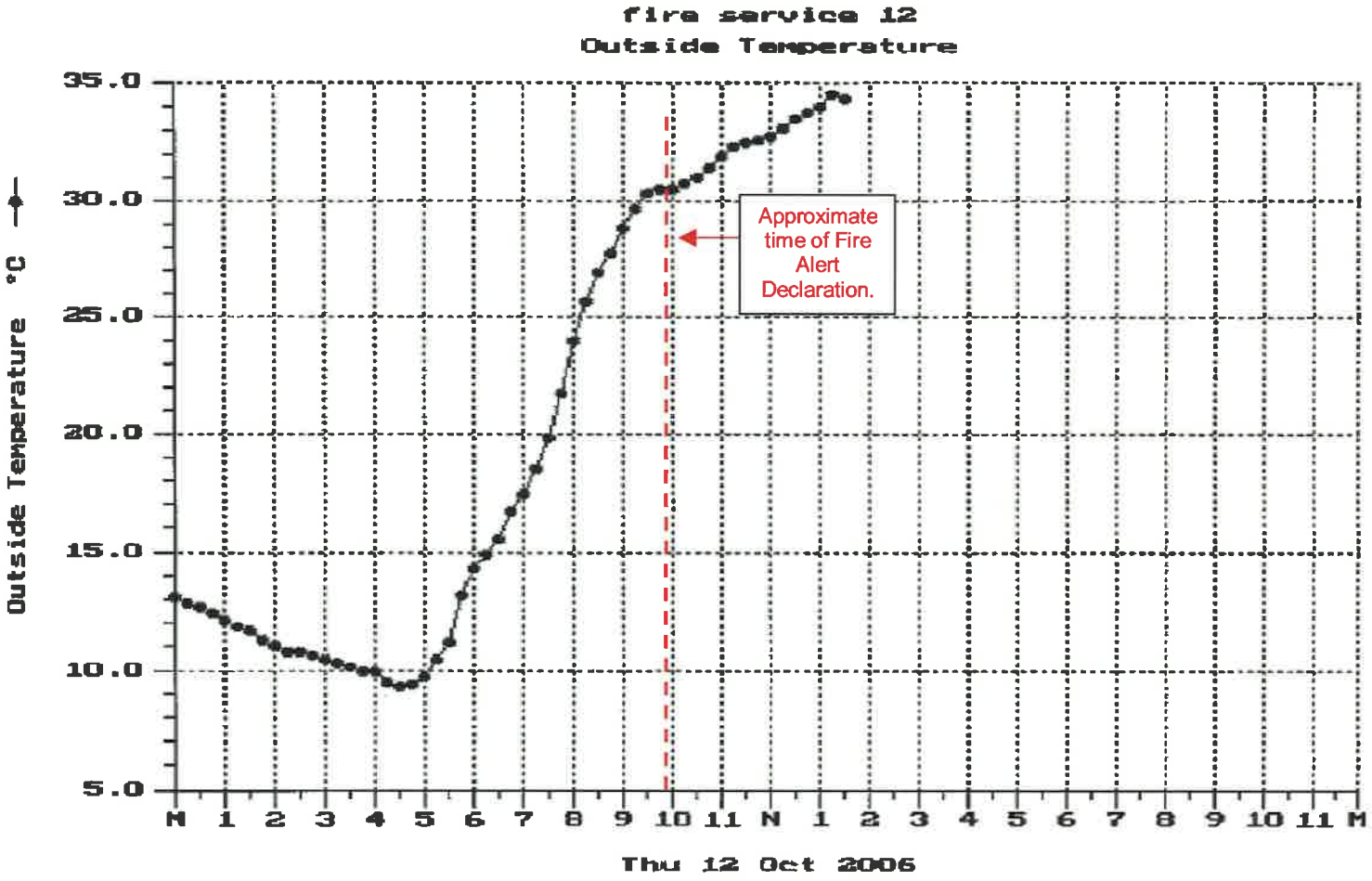

fire service 12
Outside Temperature
Outside Temperature °C
35.0
30.0
25.0
20.0
15.0
10.0
5.0
N 1 2 3 4 5 6 7 8 9 10 11 N 1 2 3 4 5 6 7 8 9 10 11 M
Thu 12 Oct 2006
Approximate time of Fire Alert Declaration.

Figure 2

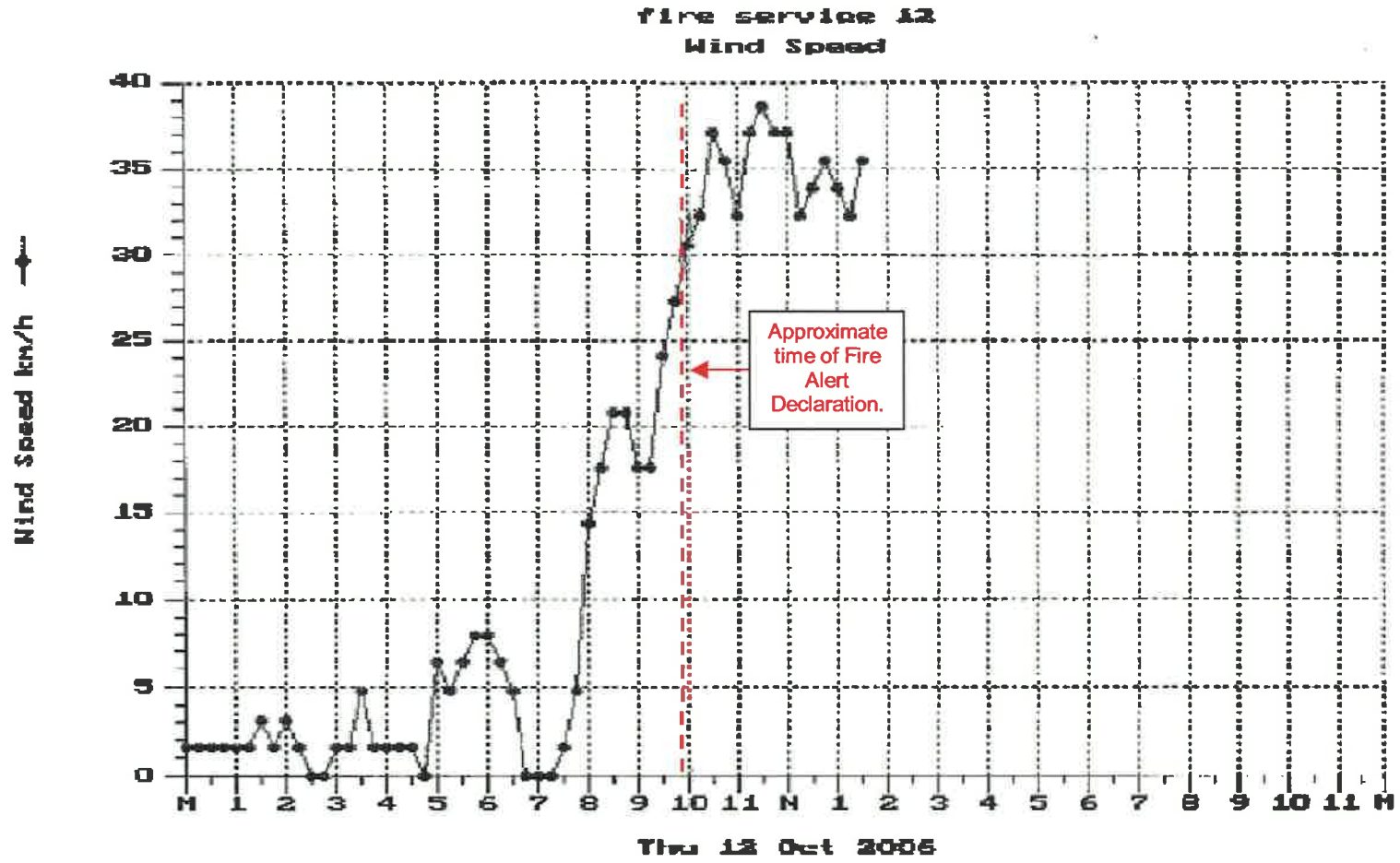
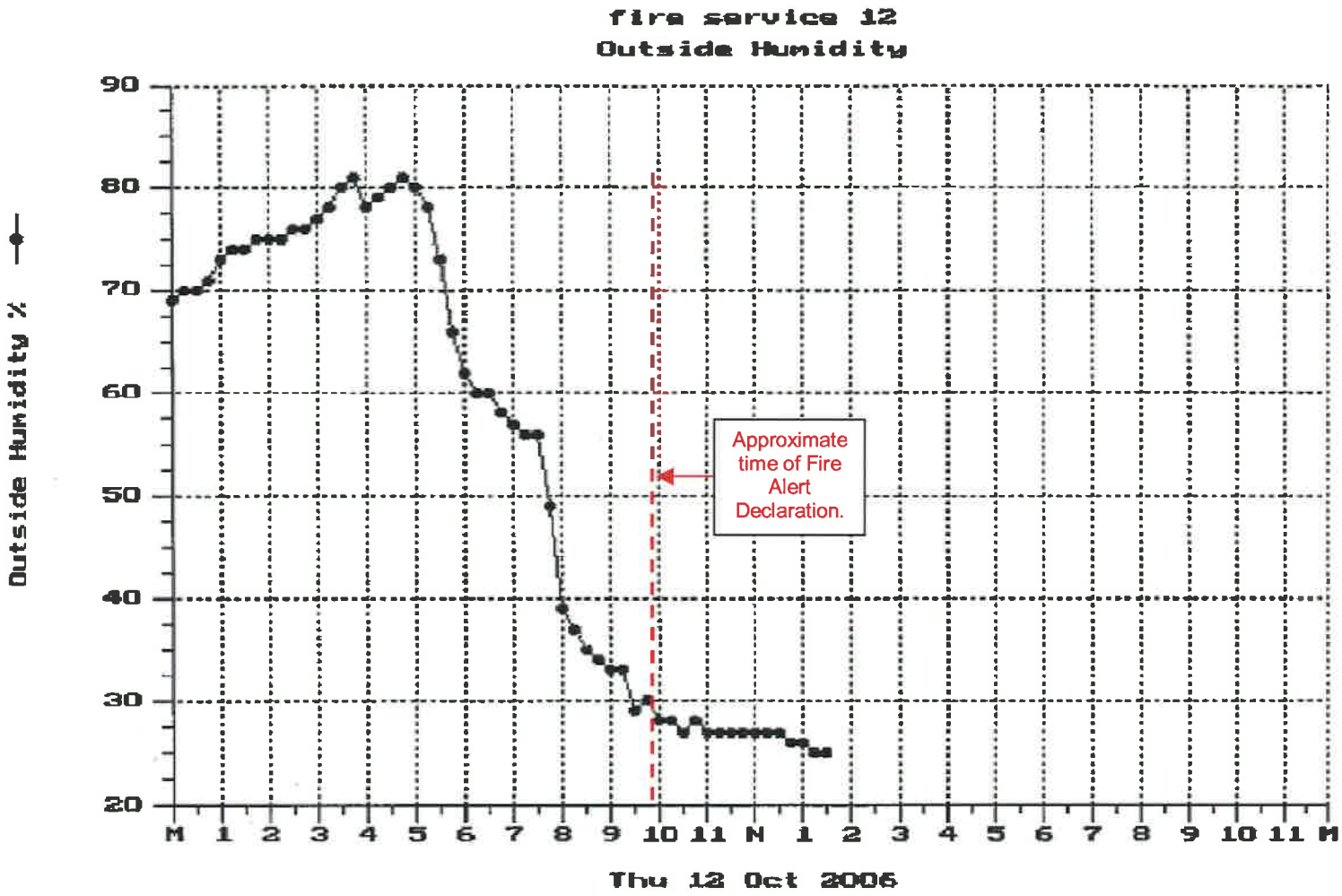

fire service 12
Wind Speed
Wind Speed km/h
40
35
30
25
20
15
10
5
0
M 1 2 3 4 5 6 7 8 9 10 11 N 1 2 3 4 5 6 7 8 9 10 11 M
Thu 12 Oct 2006
Approximate time of Fire Alert Declaration.

Figure 3


fire service 12
Outside Humidity
Outside Humidity %
90
80
70
60
50
40
30
20
M 1 2 3 4 5 6 7 8 9 10 11 N 1 2 3 4 5 6 7 8 9 10 11 M
Thu 12 Oct 2006
Approximate time of Fire Alert Declaration.

Appendix B

Photographs

Figure 4 – Extent of Water Sprays at Time of Fire Alert (12/10/06 – 10.30am)

Figure 5 – Location of Plant at time of fire (12/10/06 – 10:45am)

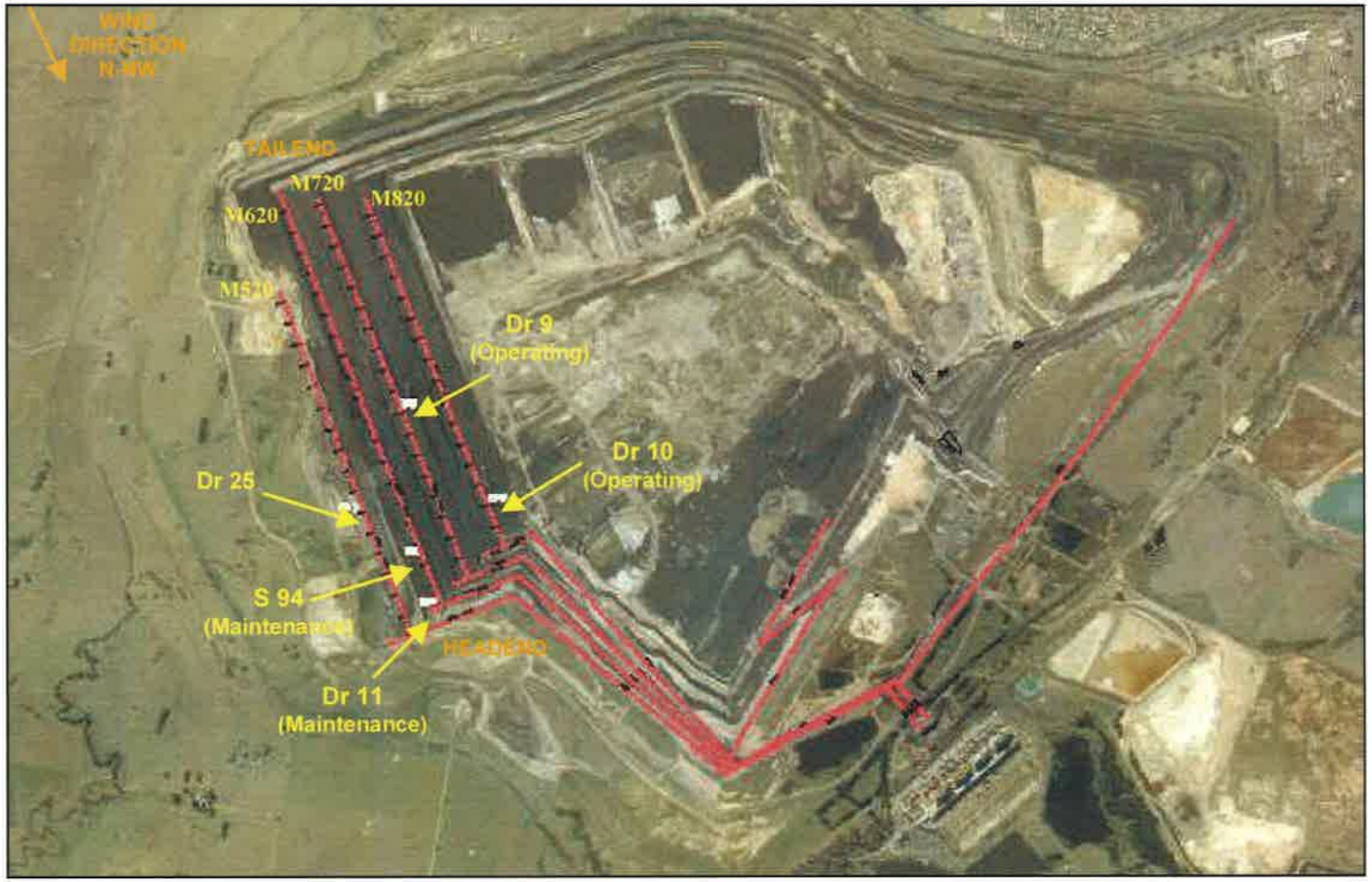
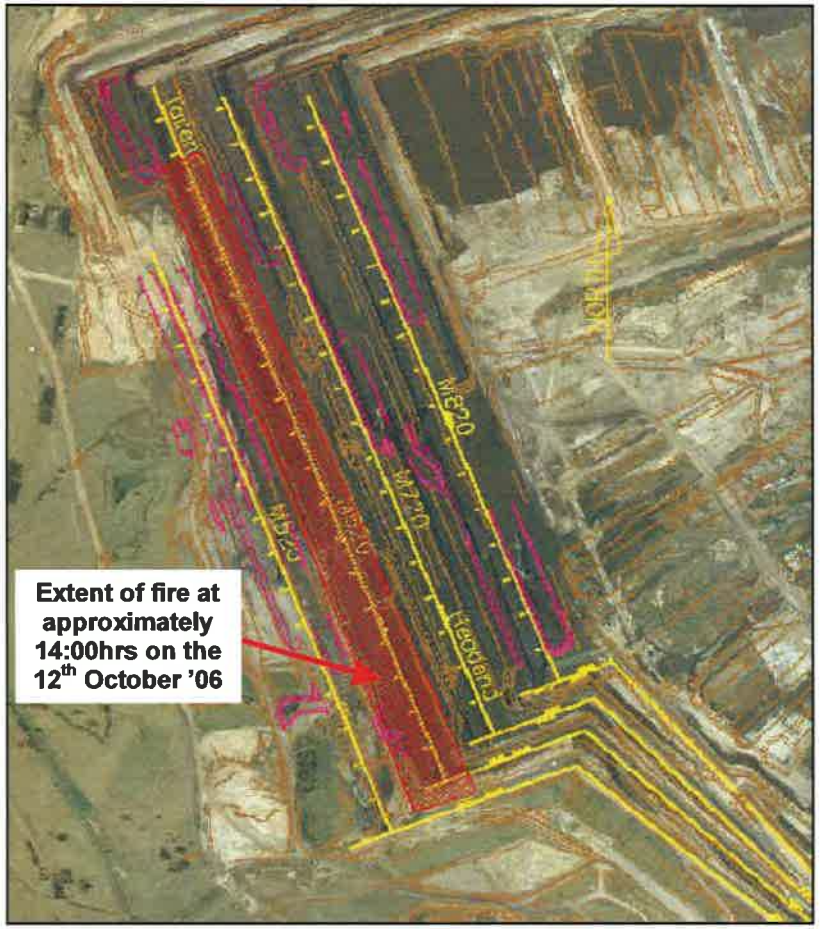


Figure 6 - Extent of Fire (12/10/06)



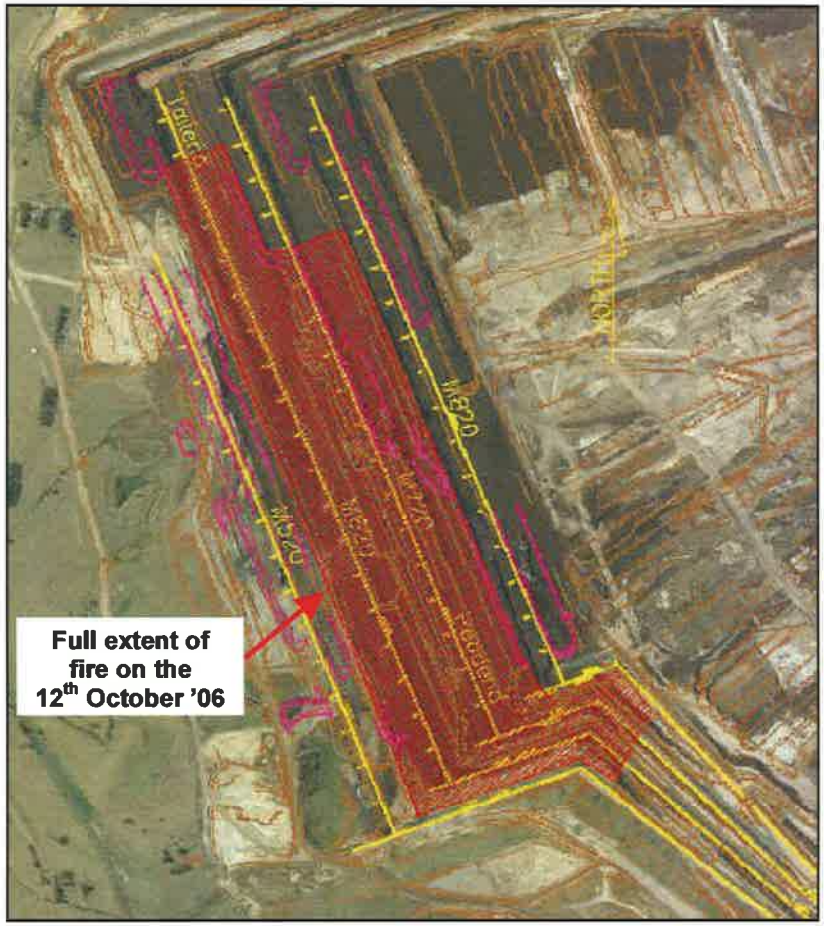
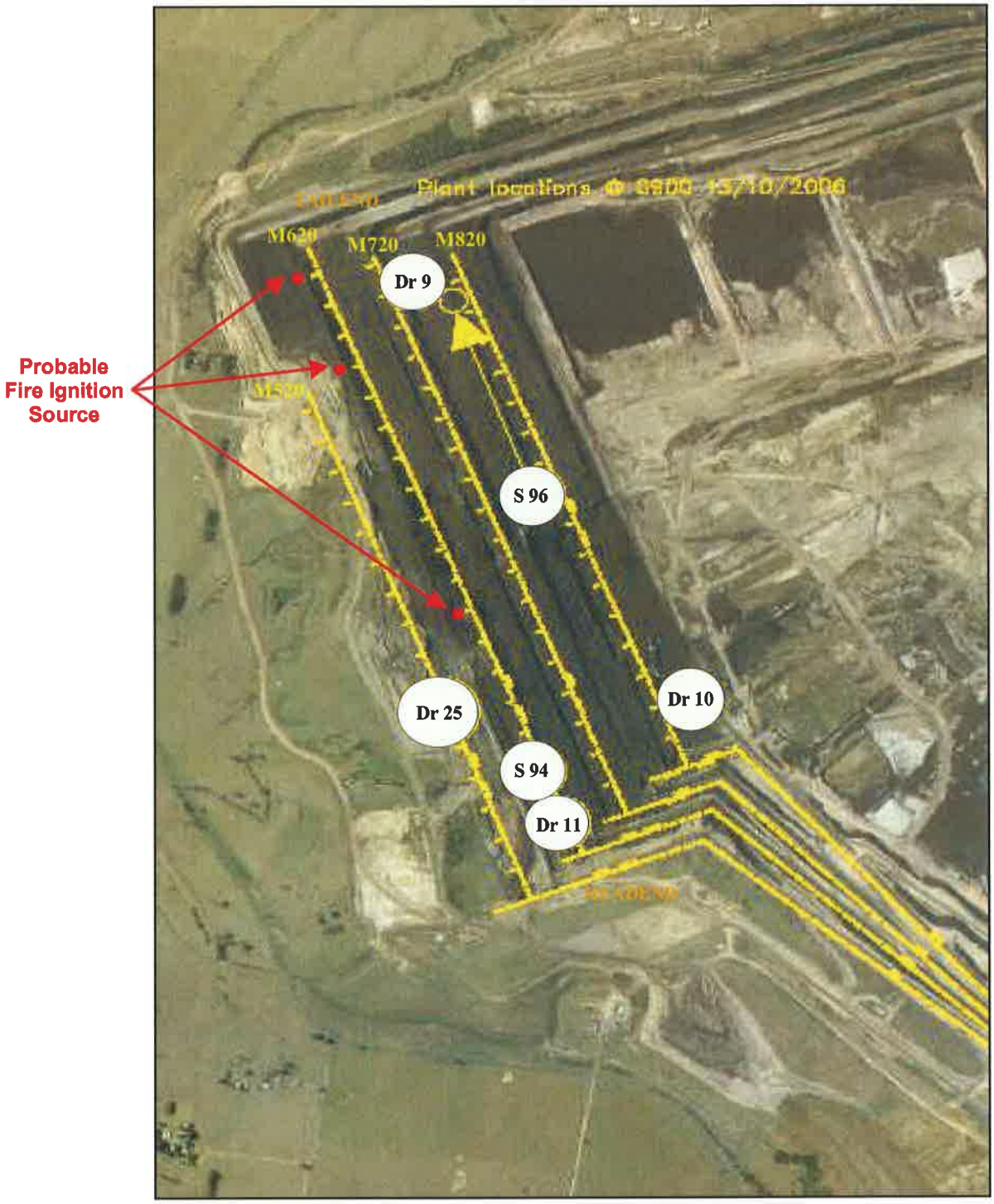


Figure 7 - Likely Initial Fire Ignition Sources



Appendix C

Mine Fire Service Network

Summary of IPRH Mine Fire Service Network – Refer to schematic in Figure 8

In the International Power Hazelwood Mine, there are two water systems:

Clean water (CW)– pumped from artesian bores

Dirty water (DW) – recycled water laden with coal

There are also two pumping stations at the base of the mine:

Clean Water Pumping Station (CWPS)

Dirty Water Pumping Station (DWPS)

The purpose of the pumping systems is to dewater the mine and prevent flooding and maintain stability and provide adequate water supply for fire suppression.

Clean Water Pumping Station (CWPS)

There are nominally five pumps at the CWPS with a capacity of 230L/s each (1150L/s)

The CWPS primary function is to pump artesian water out of the mine into the Hazelwood Cooling Pond via C-tank.

Artesian Bore Pumps feed the Clean Water Pond for aeration prior to discharge pumping.

Dirty Water Pumping Station (DWPS)

There are nominally four pumps at the DWPS with a capacity of 200L/s each. (800L/s)

The primary function of the DWPS is to pump water into D-tank for discharge out of the mine.

It also can charge the Ring Main Water Pipe for use by the face conveyors in dust suppression and fire fighting. This pump station is the initial supply for fire fighting.

C-tank and D-tank

High level storage tanks that enable gravity pressure into the Ring Main Water Supply.

C-tank can receive water from both the Hazelwood Cooling Pond and the CWPS.

When C-tank is full, it overflows to the Hazelwood Cooling Pond.

D-tank can receive water from both the Hazelwood Cooling Pond and the DWPS.

When D-tank is full, it overflows to a treatment pond, before discharging to the Hazelwood Cooling Pond.

There are two external pumping stations at Hazelwood Cooling Pond that can pump water back into the mine – when demand exceeds CWPS and DWPS combined output (1950L/s).

- Pump House 53 (PH53)
- Pump House 50 (PH50)

Pump House 53 (PH53)

There are nominally six pumps at PH53 with a capacity of 260L/s each (1560L/s)

This pump station tops up C-tank, which provides gravity fed water to the mine.

Pump House 50 (PH50)

There are nominally five pumps at PH50 with a capacity of 260L/s each (1300L/s)

This pump station tops up D-tank, which provides gravity fed water to the mine.

Pump House 54 (PH54)

There are nominally three pumps at PH54 with a capacity of 150L/s each (450L/s)

The pumps at PH54 are booster pumps only and are used for adding pressure to the ring main at higher level conveyor systems.

H section

The purpose of the H-Section is to combine the Clean Water and Dirty Water systems during times of high water demand to the mine (typically for a fire situation).

Opening the H-Section gives a combined capacity of 1950L/s (DWPS + CWPS)

If this is still a not sufficient volume of water, PH50 and PH53 can be switched on to supply further volume of water back into the mine via D-tank and C-tank respectively and is gravity fed into the system.

With all pumps operating in this manner, a total demand of 4810L/s can be met.

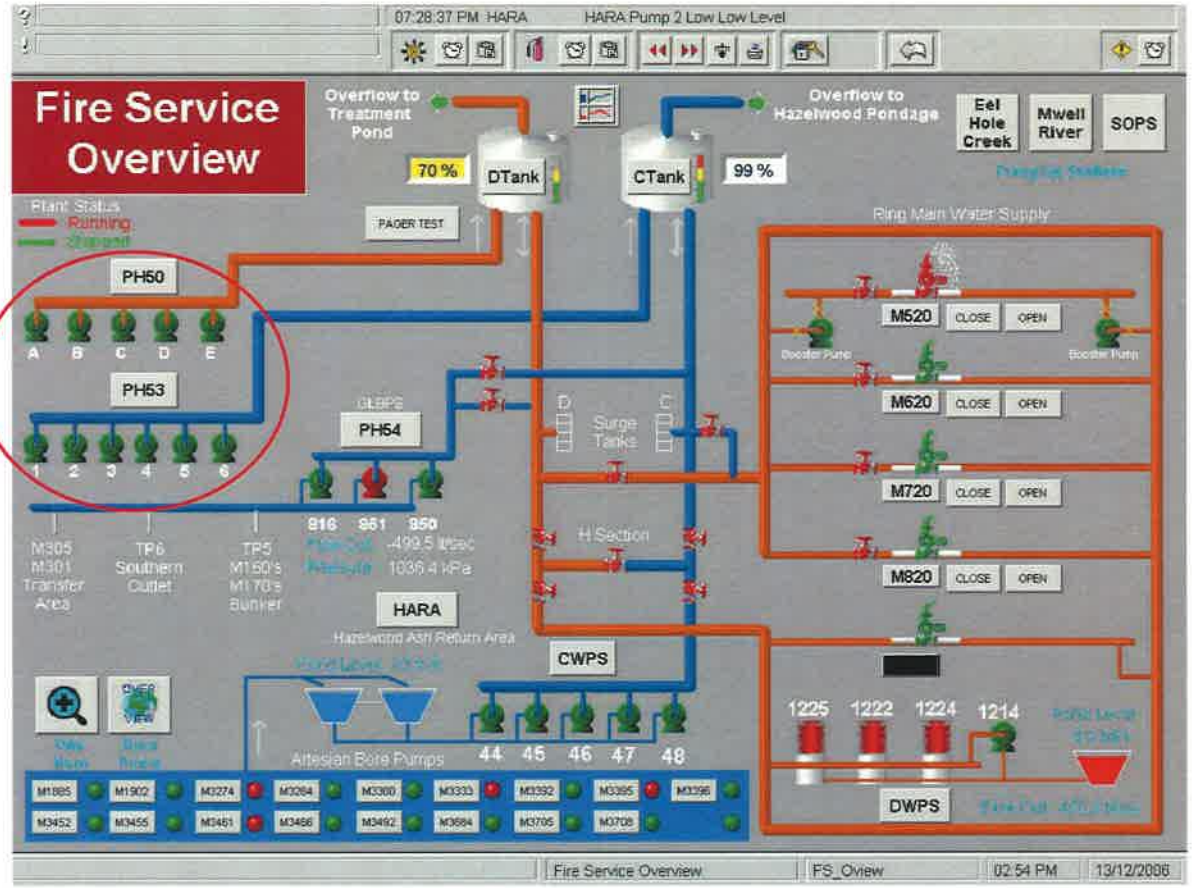
As per the Mine Fire Service Policy, the loss of one of the main four pumping stations discussed above (DWPS, CWPS, PH50, PH53) would not completely compromise the system.

If more than one pumping station is lost during a maximum demand scenario (eg: large scale fire) then the system will not be able to cope with the demand.

This occurred on 12 October 2006, when power supply was lost to PH50 and PH53, therefore reducing supply to the capacity (1950L/s) of the DWPS and the CWPS only.

This water was sufficient to meet water demand at the bottom levels only until power supply was restored to PH50 and PH53.

Figure 8 Schematic of the Mine Fire Service Network



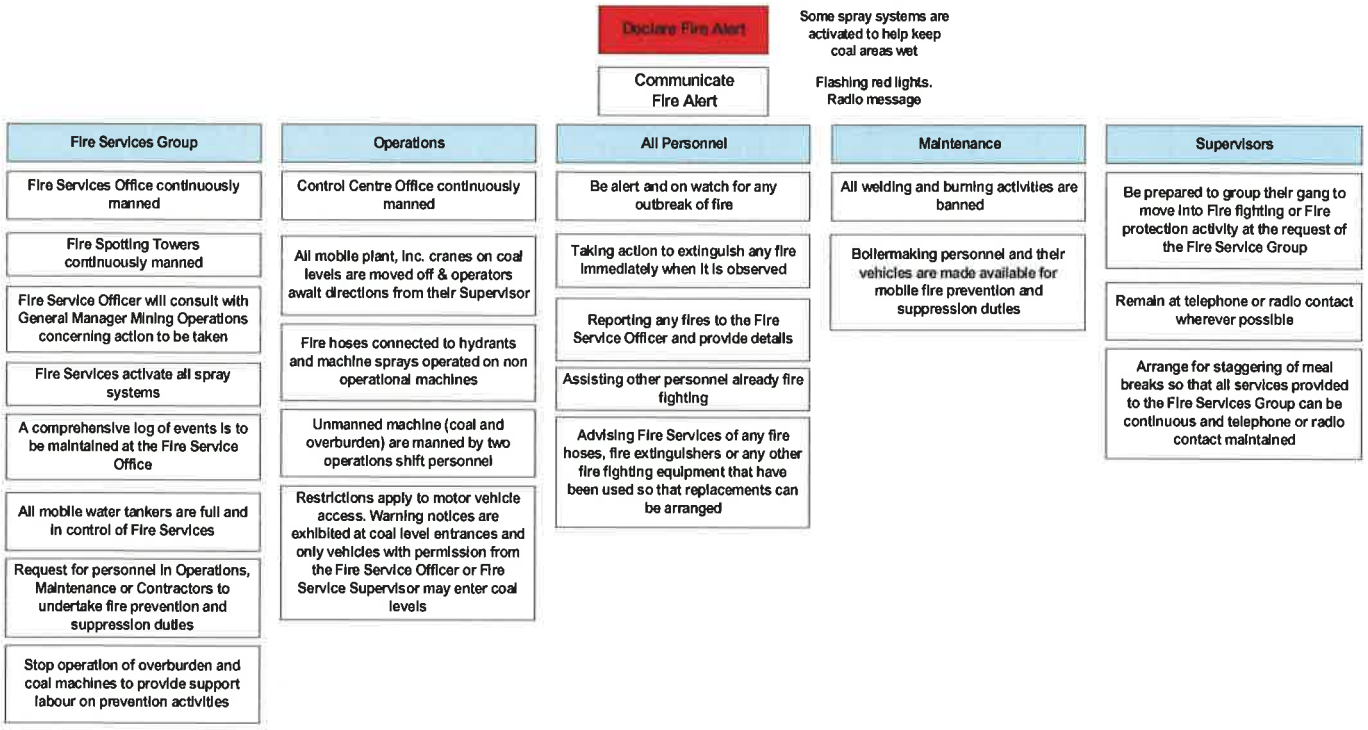
Pump sets PH50 & PH53 ceased operating due to loss of power supply

Appendix D

Organisational Responsibilities in Fire Prevention

Organisational Responsibilities in Fire Prevention

The following diagram summaries the organisational responsibilities in a Fire Alert.



Fire Instruction (Rev 30th Oct '96)

The following activities and responsibilities are directed.

<u>All personnel</u>

The Fire Instructions state that all personnel have a responsibility in relation to fire prevention.

All personnel are responsible for:

- Being alert and on watch for any outbreak of fire;
- Taking action to extinguish any fire immediately when it is observed;
- Reporting the fire to the Fire Service Officer as soon as possible and provide details (location, size, type of fire, plant in danger)
- Assisting other personnel already fire fighting;
- Advising the Fire Services Officer of any fire hoses, fire extinguishers or any other fire fighting equipment that have been used so that replacements can be arranged;
- Not using fire fighting equipment for purposes other than fire fighting; and
- Reporting to the Fire Services Officer any missing or incomplete fire fighting equipment.

Operators of Dredges, Travelling Stackers, Conveyors, Mobile Slewing Conveyers, Mobile Plant and Motor Vehicles are also responsible for:

- Following the Fire precautions appropriate to the plant item or vehicle they are operating.
- Ensuring that the fire fighting equipment on the plant or vehicle is available and ready for use.
- Reporting any faults, problems or risks.

Fire Service Officer (FSO)

The Fire Services Officer is responsible to the Production Manager (Mining Operations) for the operation and maintenance of the fire protection procedures, installations and related services in the mine. This includes arranging the pumping and operation of major control valves to ensure adequate water supply and pressure.

Their tasks also include directing or ensuring:

- Fire fighting operations.
- Reporting all serious fires and fire risk to the Production Manager (Mining Operations).
- Inspection of all fire fighting equipment.
- Training of all personnel in fire fighting methods.
- Approval/recording the access of vehicles and plant to coal surfaces on Fire Alert days.
- Declaration of Fire Alert after consultation with the General or Production Manager.

Production Manager Mining Operations

The Production Manager is responsible to the General Manager Mining Operations for:

- The detailed implementation of the Fire Instructions.
- The management of the Fire Service Group.

General Manager Mining Operations (Director of Mining)

The General Manager Mining Operations is responsible for all fire protection activities for the mine and defined surrounds.

Shift Production Manager

This officer is responsible for:

- Fire fighting until such time as the FSO or Fire Service Availability Officer takes control.
- Reporting all Fires to the FSO or the Fire Services Supervisor on duty.
- Ensuring that all unmanned plant is inspected at least twice per shift and non operating conveyors once per shift.
- Ensuring that all locations where welding and/or burning have taken place are inspected within four hours of completion of work and then at least twice per shift for the following shift.
- The duties and responsibilities of the FSO after normal hours until the FSO or their deputy, attend and take control.

Declaration of Fire Alert

When hot, dry or windy conditions are expected, there is a high risk of Fire rapidly spreading in the mine. When such conditions are expected, a Fire Alert will be declared by the General Manager, the Production Manager or the Operations Availability Officer (who may delegate his authority for declaration to the Fire Service Officer).

A Fire Alert may or may not be proclaimed for the mine on a CFA or Works Area Only Day of Total Fire Ban depending on the severity of weather conditions in the mine area. The duration will be confirmed to the period of severe conditions.

Communications to Personnel of Fire Alert

When a Fire Alert has been declared, the following communication procedure will be initiated to warn personnel entering or working near the mine.

- A prepared radio message broadcast on all three H.P.C. radio frequencies informing personnel of action required.
- Flashing red lights are activated at all dredgers, TS2 and at the Control Centre, Fire Service Office and No3 Transfer House.
- The General Manager Mining Operations or the Fire Services Availability Officer may in very severe conditions decide to alert other officers within the corporation or in other businesses, guided by the Emergency Response Plan regarding personnel to be contacted.

When a fire danger has passed, a prepared radio message broadcast from the H.P.C radio frequencies will inform all personnel that the Fire Alert has been formally cancelled. The flashing red lights will be turned off.

Actions required of personnel when a Fire Alert has been declared.

The Fire Service Officer will consult with the General Manager Mining Operations or Operations Availability Officer concerning action to be taken during the Fire Alert. The Fire Service Office shall be continuously manned by the Fire Service Officer or a Fire Service Supervisor.

The Control Centre Office shall be continuously manned by a Shift Operations staff member.

The Fire Service Group shall ensure that cable protection sprays are turned on for initial wetting down and that wetting down is undertaken out on coal surfaces, conveyors and transfer points to provide fire protection and to check the spread of any fire. All tankers shall be full of water, manned and under the control of the Fire Services Officer. The fire spotting towers are to be manned continuously. A comprehensive log of events is to be maintained at the Fire Service Office during every Fire Alert.

Boilermakers- All welding and burning activities are banned. Immediately check that their work is safe from fire, leave coal levels and report to their Supervisor; and them with their vehicles shall be made available for mobile fire prevention & suppression duties as required by the Fire Services Group and as directed by their Supervisor.

All mobile plant, including cranes on coal levels, are to moved off the levels and operators are to await directions from their supervisor for duties.

Dredger and TS2 crews shall turn on machine Fire Alert lights on all manned dredgers. Manned non operational machines are to have machine fire hoses connected to hydrants and machine sprays operated to wet down machine and coal area in immediate vicinity.

The Shift Production Manager shall arrange for each unmanned machine (coal and overburden) to be manned by two operations shift personnel on each and that the instructions for Dredger and TS2 are followed.

Motor vehicle access to coal levels is restricted. Warning notices will be exhibited at coal level entrances and only vehicles with permission from the Fire Services Officer or Fire Services Supervisor may enter coal levels.

Actions required of Supervisory Staff when a Fire Alert has been declared.

- Check that vehicles under their control have the knapsack spray charged with water and Fire suppression pack.
- Be prepared to group their gang to move into Fire fighting or Fire protection activity at the request of the Fire Service Group.
- Remain at telephone or radio contact wherever possible.
- Arrange for staggering of meal breaks so that all services provided to the Fire Services Group can be continuous and telephone or radio contact maintained.
- Radio- personnel shall keep radio usage to a minimum to allow for urgent communication.
- Fire Spotting- all personnel must be on lookout for Fire and report any outbreak and must attempt to extinguish or contain any Fire immediately.

Further actions

The Production Manager and Fire Services Officer may also decide the following actions:

- Supplement Fire Service personnel by diversion of labour from Operations Supervisor day gangs working overtime under the direction of their normal supervision and as required by the Fire Services Officer.
- Call upon assistance of contractors employed at the mine to provide support of water tankers for mobile patrol and/or other fire prevention duties.
- Stop operation of overburden and coal machines to provide support labour for fire prevention activities under the direction of their normal supervision and as required by the Fire Services Officer.

Mine Fire Service Policy and Code of Practice (Rev Sept '95)

The responsibilities of all personnel is identical to the Fire Instructions except that the use of fire fighting equipment is only for fire fighting purposes unless authorised by the Fire Service Officer.

The Code of Practice also redefines a role as the Mining Operation's Manager who is responsible for all fire protection within the mine and surrounding associated areas. Specific responsibilities include:

- Authorisation of fire instructions and emergency procedures.
- Ensuring fire service audits are carried out and recommended corrective actions taken.
- Declaration of Fire Alert days.
- Notification of the CFA where a fire has the potential to spread beyond the initial point of ignition or for other emergency situations.

The FSO's responsibilities are identical except for some additions that include:

- Monitoring and reporting on the status of the mine in relation to the Code of Practice.
- Reporting all fires.
- Providing support to the CFA IC or the DISPLAN coordinator, where required, in the event of an emergency situation.
- Issuing all welding and burning permits and defining precautions.

The Shift Production Manager is also responsible for ensuring all personnel follow Fire Instructions and that all engineers have the responsibility to ensure all work under their control meets the requirements of the Code of Practice.

Annual internal audit of all fire service facilities

The annual internal audit of all fire service facilities, systems and procedures, to ensure compliance with both Statutory Requirements and the requirements of the Code of Practice needs to be carried out. The General Manager Mining Operations shall arrange for a formal inspection to be carried out and a report presented in September or October each year regarding compliance, action to be undertaken where non compliant and the status of fire protection facilities, systems and procedures.

Appendix E

Review of Recommendations of November 1977 Morwell Open Cut (now IPRH) Fire

	RECOMMENDATIONS FROM THE NOVEMBER 1977 OPEN CUT FIRE REPORT BY THE REVIEW COMMITTEE	COMPARISON WITH THE OCTOBER 2006 IPRH MINE FIRE INVESTIGATION
1	That the Review Committee continue in existence to oversight progress of action arising out of this report, and that a follow-up report be submitted to the Assistant General Manager (Ops).	Recommendation is no longer relevant.
2	That an inter-departmental committee review present Latrobe Valley radio facilities and recommend the changes which should be made so as to provide more effective service for operational requirements which can be readily adapted to emergencies such as an open cut fire. The recommendations are to include the special equipment which should be provided for such emergencies to equip control offices, monitoring points, personnel, switchboards etc.	Recommendation is no longer relevant.
3	Develop and implement an Area Emergency Mobilisation Plan. It is envisaged that such a plan would be designed to cover any major emergency and would prescribe co-ordinative measures and responsibilities for the effective marshalling and deployment of front line and support resources and for the associated welfare of personnel. It would be expected that overall control of the emergency situation would rest with the Department in which the emergency arises.	Mutual Aid plan exists. This recommendation was not a contributing factor during this incident.
4	Improved design for modified exhaust systems to be investigated and developed.	Modified exhausts implemented on IPRH vehicles. This recommendation was not a contributing factor during this incident.
5	Criteria for entry to open cuts to be reviewed and an assessment made of any additional Latrobe Valley vehicles which may require the fitment of modified exhaust systems.	This recommendation was not a contributing factor during this incident.
6	Investigate the feasibility of providing a nucleus of specialised fire vehicles with a dual capacity of fighting high-rise industrial and coal batter fires.	Crane mounted monitors now fulfil this role.

7	Investigate the feasibility of employing Elevating Platform Vehicles more effectively by providing hose control brackets for attachment to buckets and by operating these units in tandem with two-stage pumps.	Recommendation is no longer relevant.
8	Implement an immediate programme for the inspection of all 'slip on' vehicles, tanks, pumps and ancillary equipment for serviceability and recommend any necessary replacement or upgrading.	Recommendation is no longer relevant.
9	Allocate a ready loaded 'slip-on' tanker to Fire Service Officer, Coal Production.	Recommendation was completed.
10	Review and recommend mobile floodlighting facilities necessary to provide essential lighting suitable for normal and emergency operations.	Recommendation was completed.
11	As the planning for a second stage development of Morwell Open Cut and Dewatering Installations is scheduled to commence in 1978, it is recommended that the concept and application of Report DD49 be reviewed at this stage with the aim of simplifying the system and reducing the dependence on the artesian bores as a major source of water in a fire emergency.	Recommendation is no longer relevant.
12	That the HV distribution system adopted be reviewed with a view to minimising the extent of plant de-energised by faults and to providing duplicate or more secure supplies to vital pumps and plant. Where duplicate or standby supplies are provided, consideration should be given to the use of automatic change over switching.	Significant issue. Whilst the recommendations have been implemented, the underlying causes were still present in this incident. Namely the complexity of the HV distribution system, the limited number of people who were aware that there was no duplicate power feed, the outage time of water pumps.
13	That the methods of planning and executing work concerned with extensions to the fire system be reviewed, if necessary allocating specific resources to this work.	This recommendation was not a contributing factor during this incident.
14	Review location of existing Fire Service Office in the light of the recent fire experience and planned development of the open cut. Allocate a new location if appropriate.	Recommendation was completed.

15	Design and erect new Fire Service Office with adequate and separate facilities for fire control co-ordination, communications and team briefing. Specific provision should be made available for group leaders of internal and external fire fighting and emergency service groups. Consideration should be given to a demountable, modular type structure which can be relocated, if necessary, as the cut develops.	Recommendation was completed.
16	Establish two tanker stand pipes on each major operating level of the cut (one each, north and south sides) and additional stand-pipes with drive through facilities at a suitable point near the Fire Service Office.	Recommendation was completed.
17	Develop and implement a system of open cut sign posting.	Recommendation was completed. Allocating IPRH personnel to CFA strike teams is a more efficient method of assisting the CFA.
18	As an immediate measure, ensure that the mine power cables are provided with adequate sand or clay protection wherever practicable and that poles as approved for open cut installation are protected at their bases by a covering of clay or sand or a minimum diameter of 10 metres. Implement a programme of inspection to ensure maintenance of this protection.	Recommendation was completed.
19	Examine the feasibility of providing more substantial and permanent protection for essential power lines.	Recommendation was completed.
20	Review and implement as found necessary- ◗ types, or mix of types, of hoses and associated fittings best suited to open cut operations; ◗ number and location of such hoses and fittings required to be located in the open cut for fire-line attack.	Recommendation was completed. However, access to hoses and fittings was still an issue during this incident.
21	Establish an inter-departmental working group to critically examine and report on- ◗ complement and location of back up reserves, bearing in mind the need for dedicated facilities in production areas.	Recommendation was completed.

22	The present investigation of fire service installation on dredgers to be expedited.	Recommendation was completed.
23	As an immediate measure, the installation of additional hydrant manifolds on operation levels in the Morwell Open Cut should be considered.	Recommendation was completed.
24	Establish and implement a specific policy for the clay covering of dormant batters and levels. In developing this policy, consideration should be given to the operational feasibility and economics of batter redesign to facilitate the application of clay cover.	Recommendation was completed.
25	While the substance of these reports still appear valid, they are now 13 years old, and should be reviewed in detail, updated and repromulgated in the light of more recent experience and related recommendations contained in this report.	Recommendation was completed. However, there needs to be a process for continually updating the Fire Instructions etc.
26	The fire fighting instruction classes in all Latrobe Valley based Departments include at least a brief coverage of the techniques to be used in fighting coal fires and that the more experienced personnel be trained to be able to assume command and instruction of a crew of inexperienced personnel.	Recommendation was completed. Allocating IPRH personnel to CFA strike teams is a more efficient method of assisting the CFA.
27	Review the roles of each of the departmental fire protection services and develop a statement defining area protection philosophy and the inter relationship of departmental fire protection services.	Recommendation is no longer relevant.
28	The Committee or an individual member of the Committee, as appropriate, is to ensure that participants in the various investigations are properly briefed.	Recommendation was completed.

Appendix F

Glossary of Abbreviations

Abbreviation	
CFA	Country Fire Authority
CO	Carbon Monoxide
CS	Conveyor System
DISPLAN	Disaster Plan
Dr	Dredger
EC	Emergency Commander (IPRH Role)
ERP	Emergency Response Plan
FSO	Fire Services Officer
FSS	Fire Services Supervisor
HV	High Voltage
ICAM	Incident Cause Analysis Method
IC	Incident Controller (CFA Role)
ICC	Incident Control Centre (CFA Morwell)
ICP	Incident Control Point (IPRH)
IP	International Power Corporate
IPRH	International Power Hazelwood
PH	Pump House
PPE	Personal Protective Equipment
S 94	Slewing Conveyor 94
TS	Travelling Stackers

Appendix G

CFA Fire Investigation Report

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