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International Power Hazelwood

October 2006 Mine Fire Investigation

Incident Investigation Report

January 2007

Contents

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.

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.

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 - $2.1M
- Coal System 2 - $870K
- Coal System 3 - $40K
- Mobile Slew Conveyor S94 - $220K
- Dredger 11 repairs - $5.5M to $7.5M or replacement option - $13M
- High Voltage Supply - $488K
- IPRH Technical/Support - $267K
- IPRH D8R Bulldozer - $210K

Business Interruption

The increased cost of operating estimate is currently $17,890K.

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 $1,500K including IPRH labour and revenue loss $900K.

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.

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 1

Fire Alert is declared.

Fire Services Supervisor declared a Fire Alert.

Determined a high fire risk for mine site.

Expected temperature >30°C and high wind speed. Total Fire Ban Day issued for all areas except Gippsland.

Severe weather conditions outside of fire season.

Fire Alert processes are implemented but are not fully complied with.

Mine personnel implemented Fire Alert processes but did not strictly adhere to them.

Maintenance work was still being completed after a Fire Alert was declared.

Non-urgent vehicle access to coal levels during a Fire Alert.

Authorisation to access the coal level by a vehicle was given by the Control Centre independent of Fire Services.

Fire Alert procedures including roles and responsibilities should be reviewed, updated, reiterated and enforced for mine personnel.

A spot fire initiates at the tail end of M620 conveyer.

Mine personnel and contractors attend to the fire.

Fire escalates out of control.

Request assistance from CFA Emergency Services.

Spot fires escalated out of control.

Mine personnel and contractors were unable to suppress the spot fires.

No formalised arrangements with the CFA to be put on alert for any fire.

Some mine personnel and contractors were inexperienced in fighting coal fires.

Fire fighting training was not scheduled for completion until November.

The Pre Summer & Fire Season Works Program had not been completed.

The Pre Summer & Fire Season Works Program designated December and January as the months in which crucial fire preparation including fire training was to be undertaken.

'Mine Fire Service Policy and Code of Practice' did not consider current weather, fire or mine conditions.

Mine personnel and contractors were too slow to arrive at location of spot fires.

Unclear of where spot fires were reported.

No logs were kept.

Fire Services were busy preparing fire systems and were 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.

Insufficient numbers of Fire Services and support personnel available to control initial spot fires.

Insufficient fire fighting equipment.

Water spraying was insufficient to wet coal faces.

Wind pushed spray water in other direction.

Water pipes were located too far from faces.

Insufficient spacing between fire fighting areas.

A number of fire hydrants were not functioning.

Missing or incomplete fire fighting equipment not reported to Fire Services.

Annual internal audit of all fire services facilities, systems and procedures had not been completed.

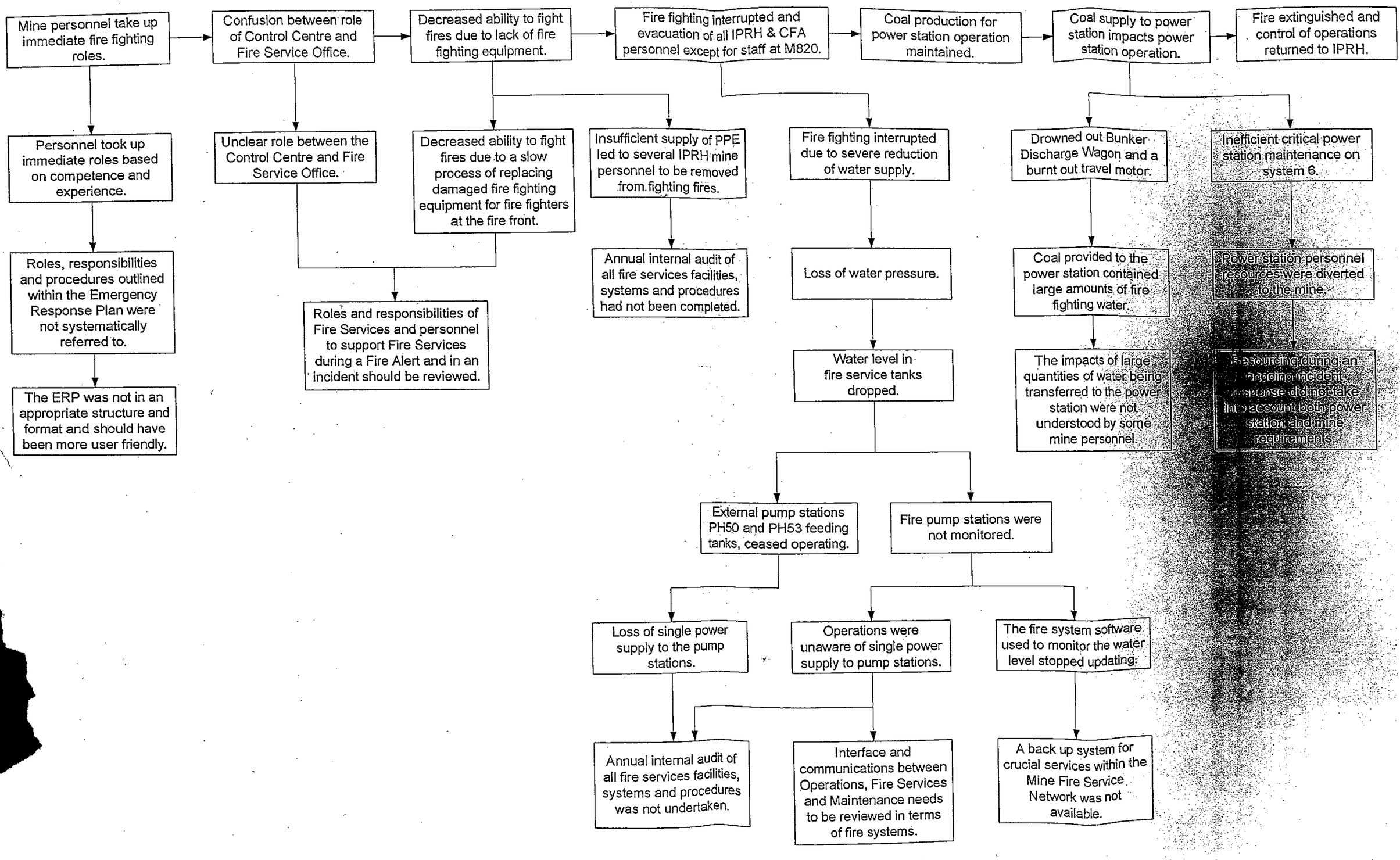
Mobile water tanker units were not full of water and not immediately available on coal levels.

Not all Fire Alert processes were undertaken.

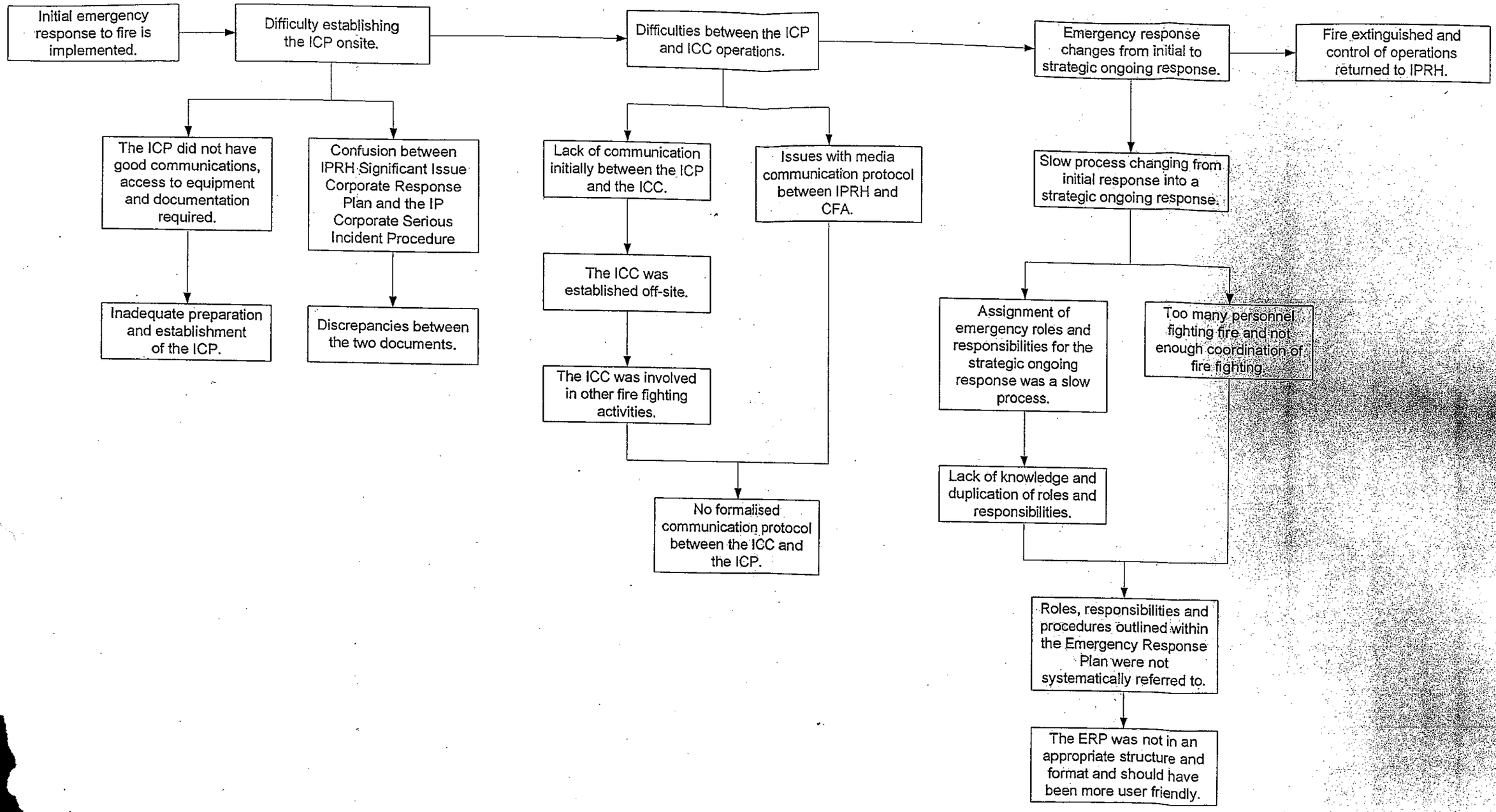
Not all Fire Alert processes are always complied with.

Fire Alert procedures including roles and responsibilities should be reviewed, updated, reiterated and enforced for mine personnel.

TIMELINE CHART – STAGE 2



TIMELINE CHART – STAGE 3



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

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.		Insufficient supply of fire fighting equipment to the fire front.	Fire fighting & Emergency Response
	Decreased ability to fight fires.			
	Confusion between role of Control Centre and Fire Service Office.		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.		Insufficient supply of PPE.	
	Fire fighting personnel required to manhandle damaged equipment.	Missing or incomplete fire fighting equipment not reported to Fire Services.	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.	
	External fire pump stations PH50 and PH53 ceased operating due to loss of single power supply.			
A back up system for crucial services within the Mine Fire Service Network is not available.	Evacuation of all IPRH and CFA personnel except for staff at M820.		Severe reduction in fire water supply.	
	Fire fighting interrupted.			
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.	
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.	

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Appendix A

Weather Logs

Figure 1

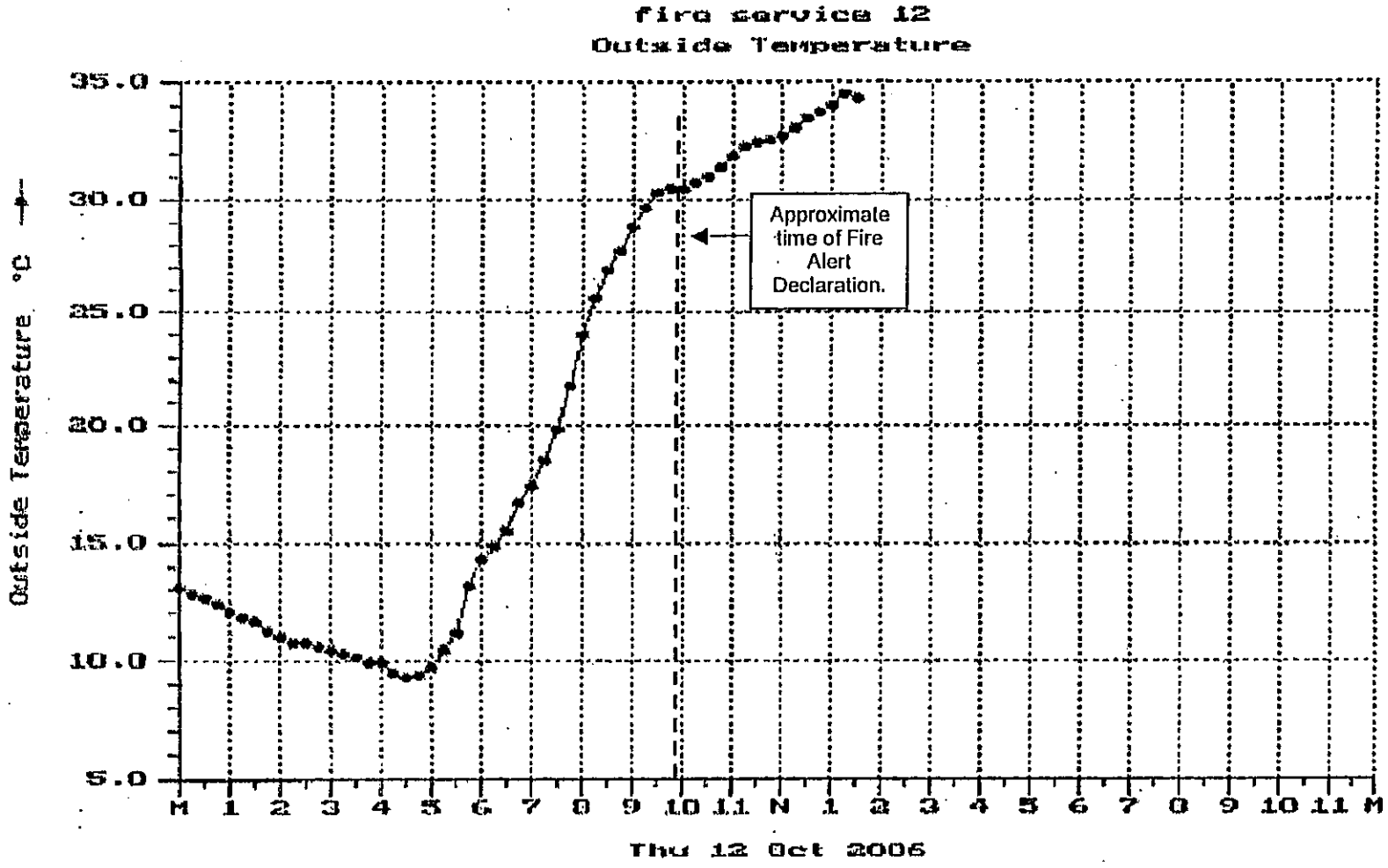
fire service 12
Outside Temperature
Outside Temperature °C
35.0
30.0
25.0
20.0
15.0
10.0
5.0
Approximate time of Fire Alert Declaration.
M 1 2 3 4 5 6 7 8 9 10 11 N 1 2 3 4 5 6 7 8 9 10 11 M
Thu 12 Oct 2006

Figure 2

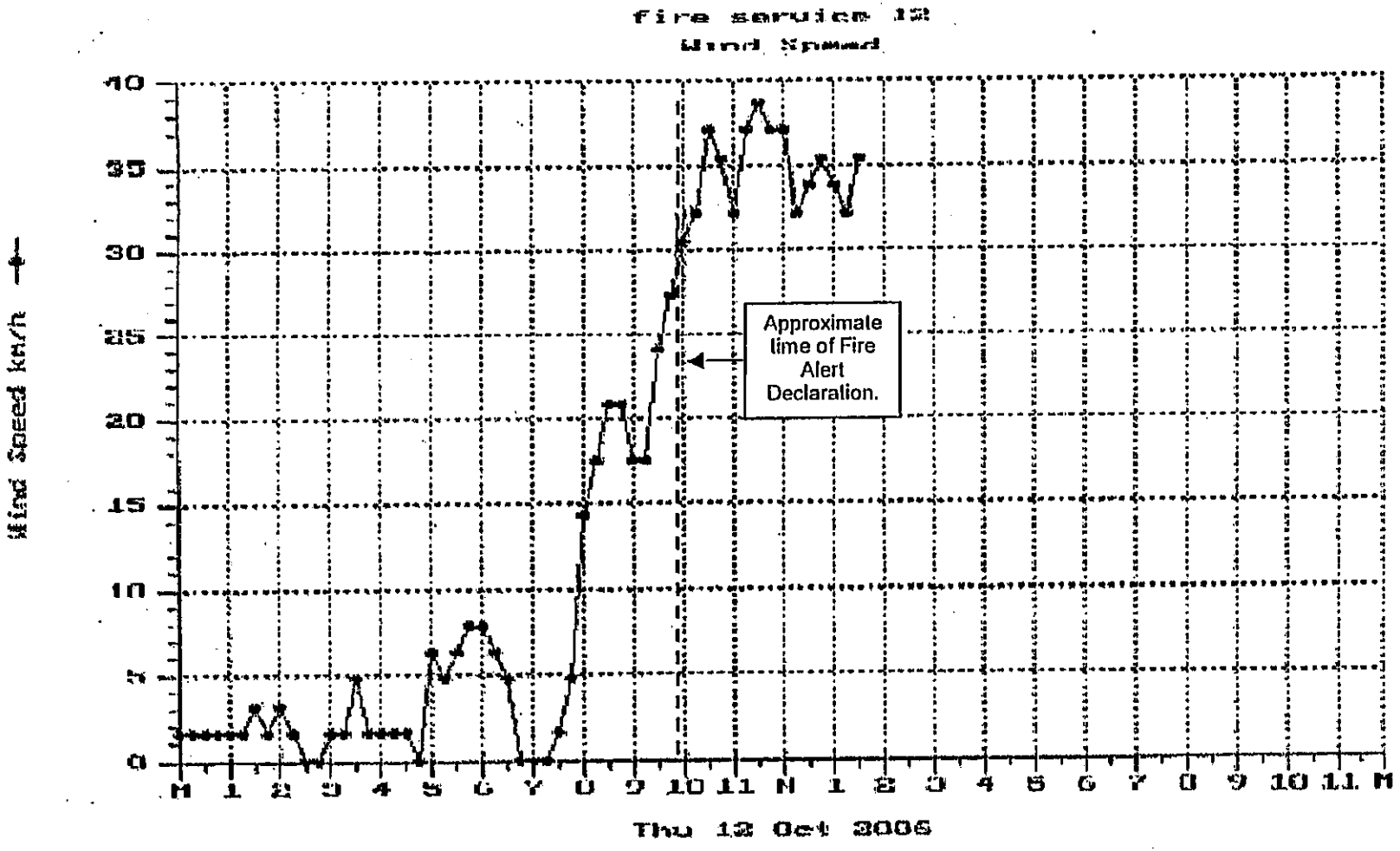
Fire service 15
Wind Speed
Wind Speed km/h
Approximate time of Fire Alert Declaration.
Thu 12 Oct 2006

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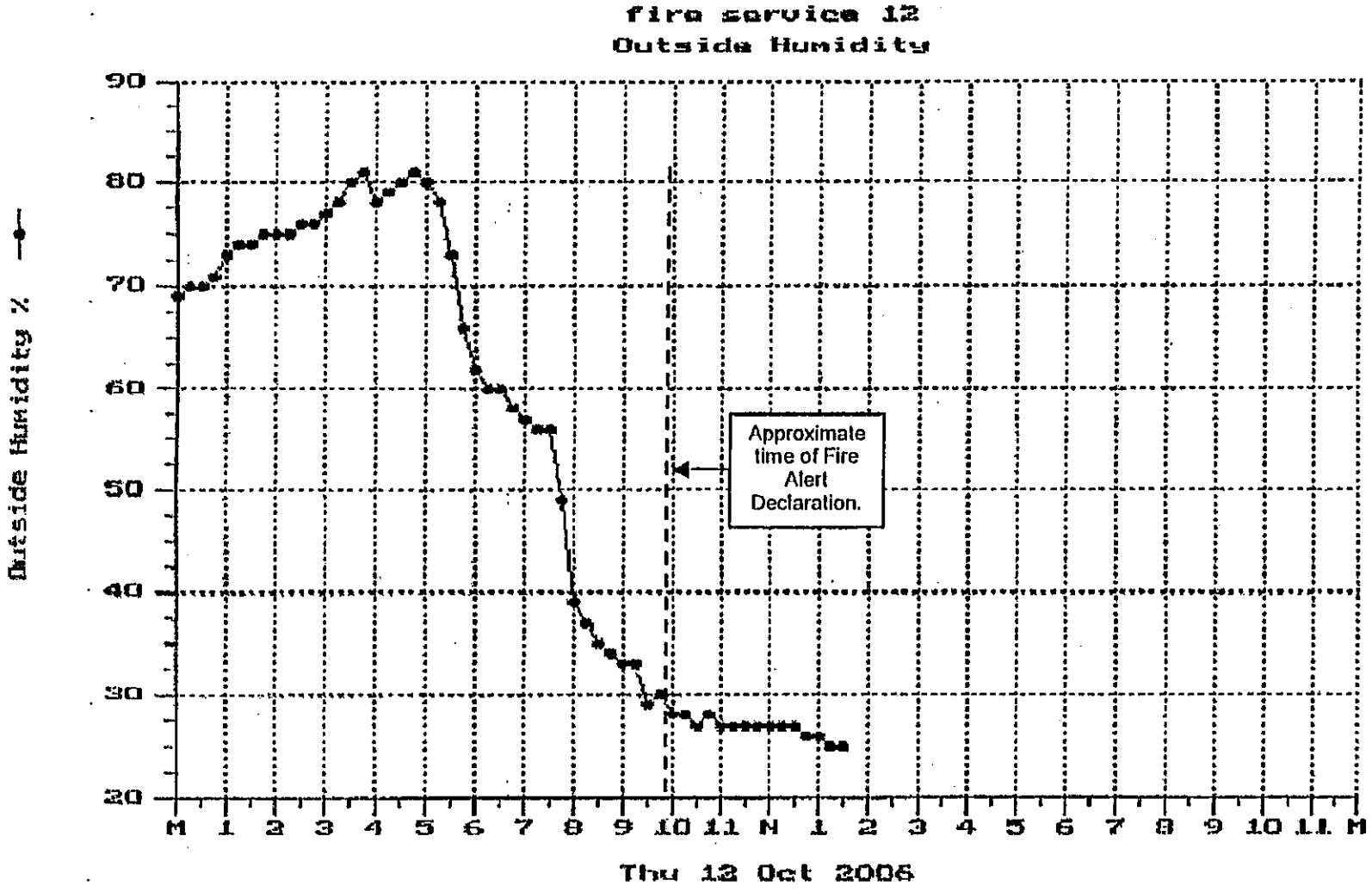
Figure 3



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Appendix B
Photographs

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

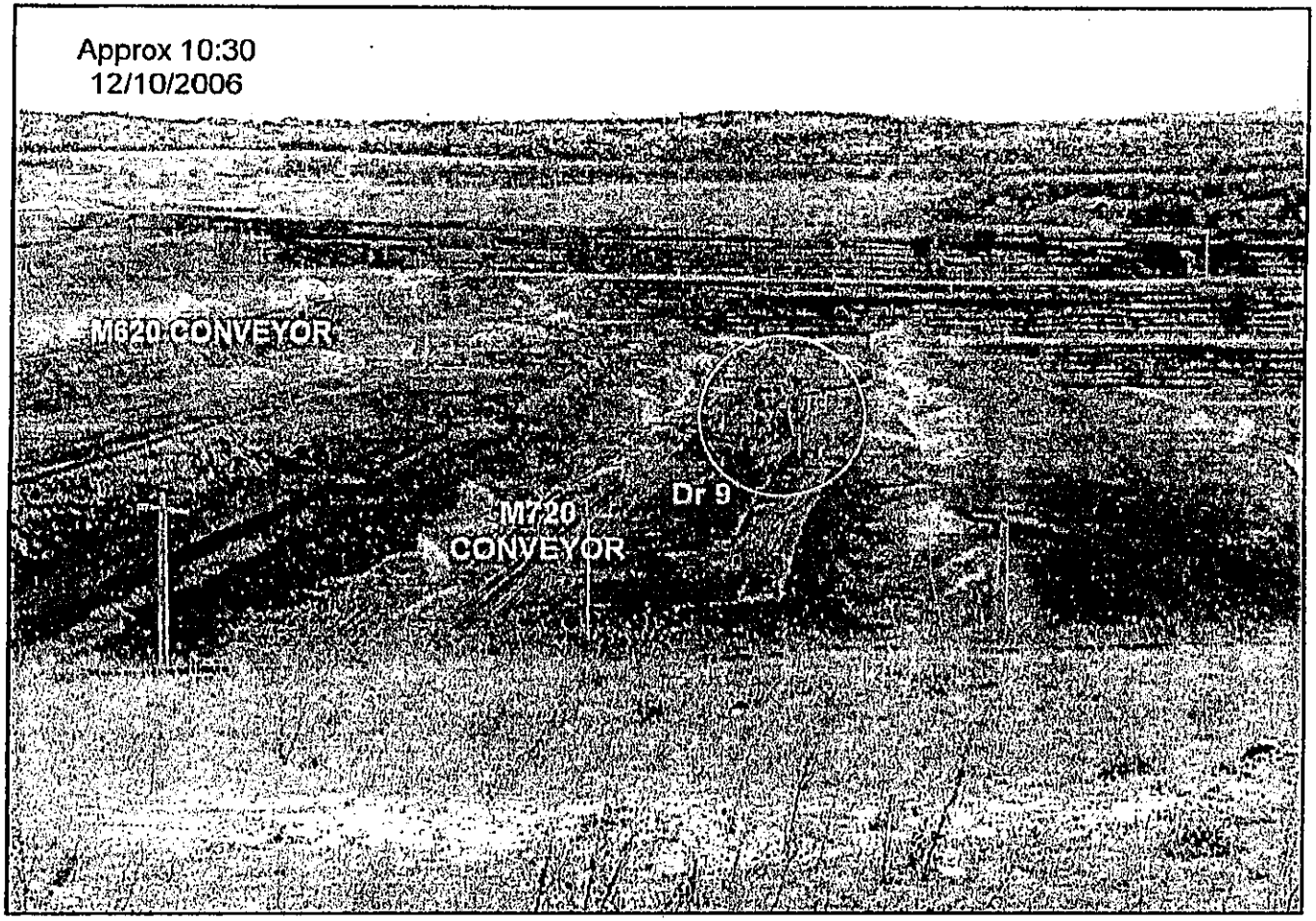

Figure 5 -- Location of Plant at time of fire (12/10/06 – 10:45am)

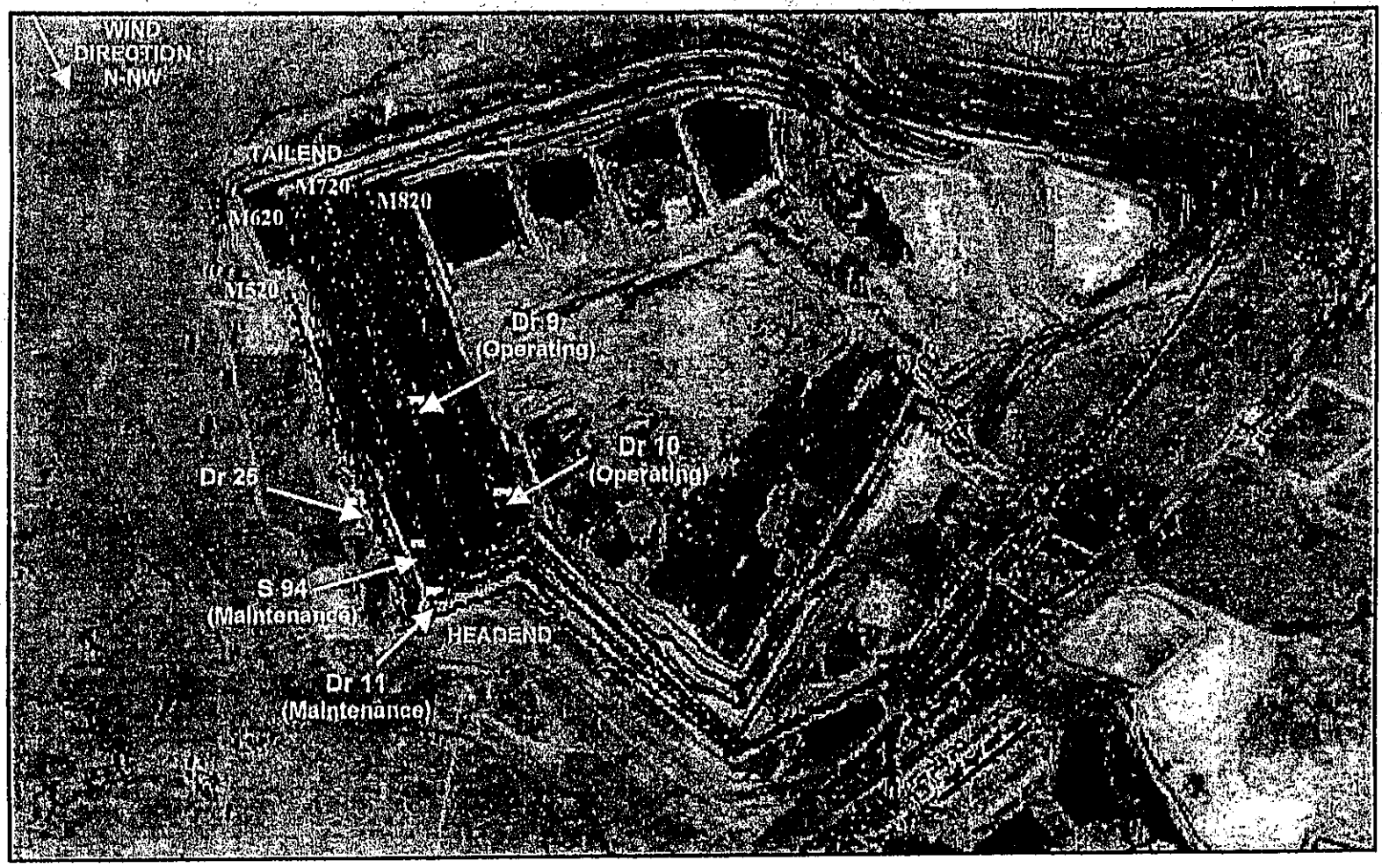

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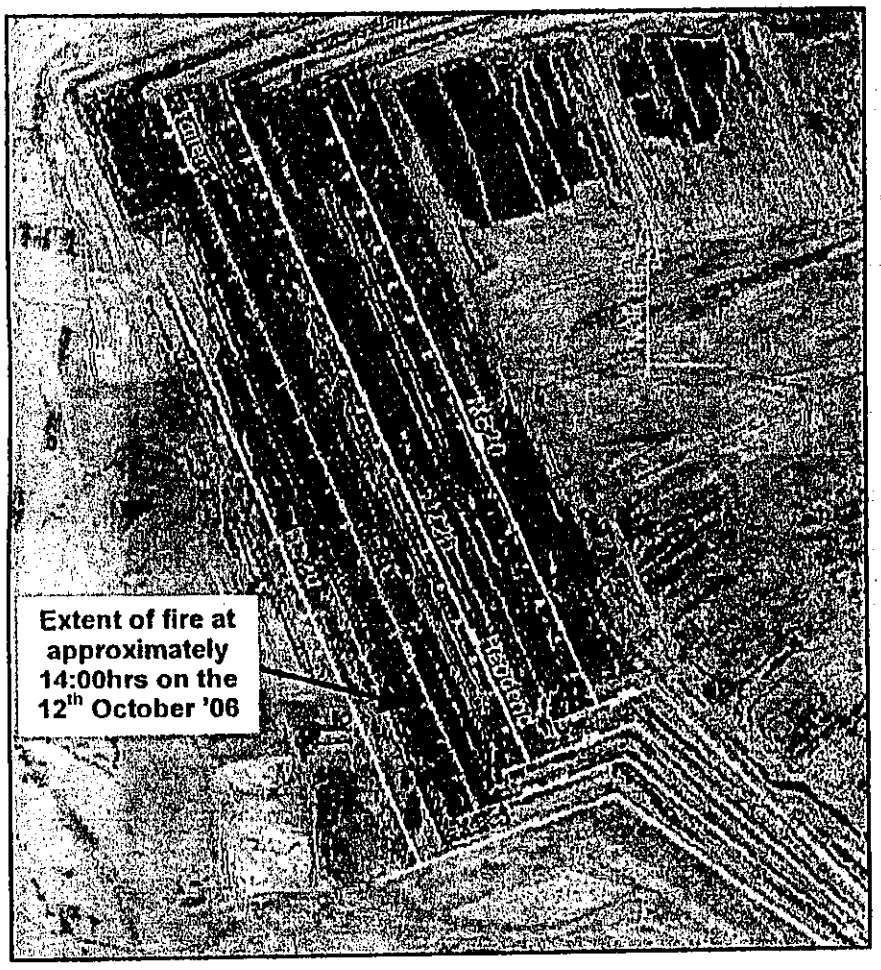
Figure 6 - Extent of Fire (12/10/06)



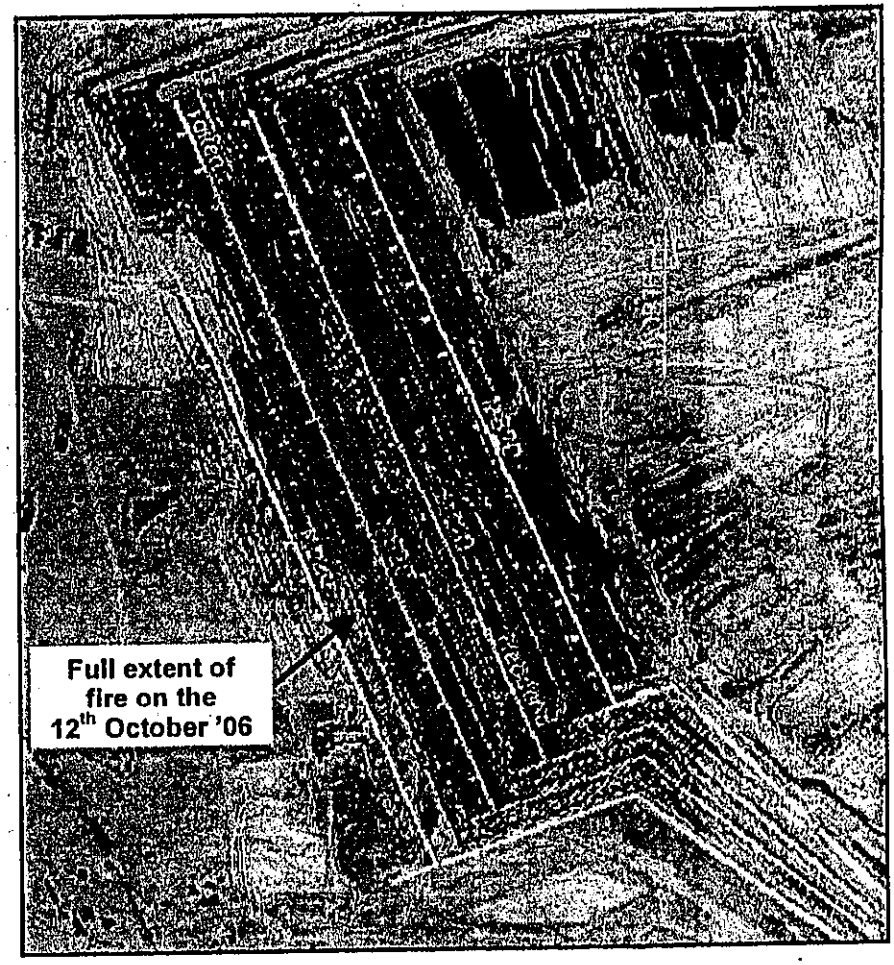


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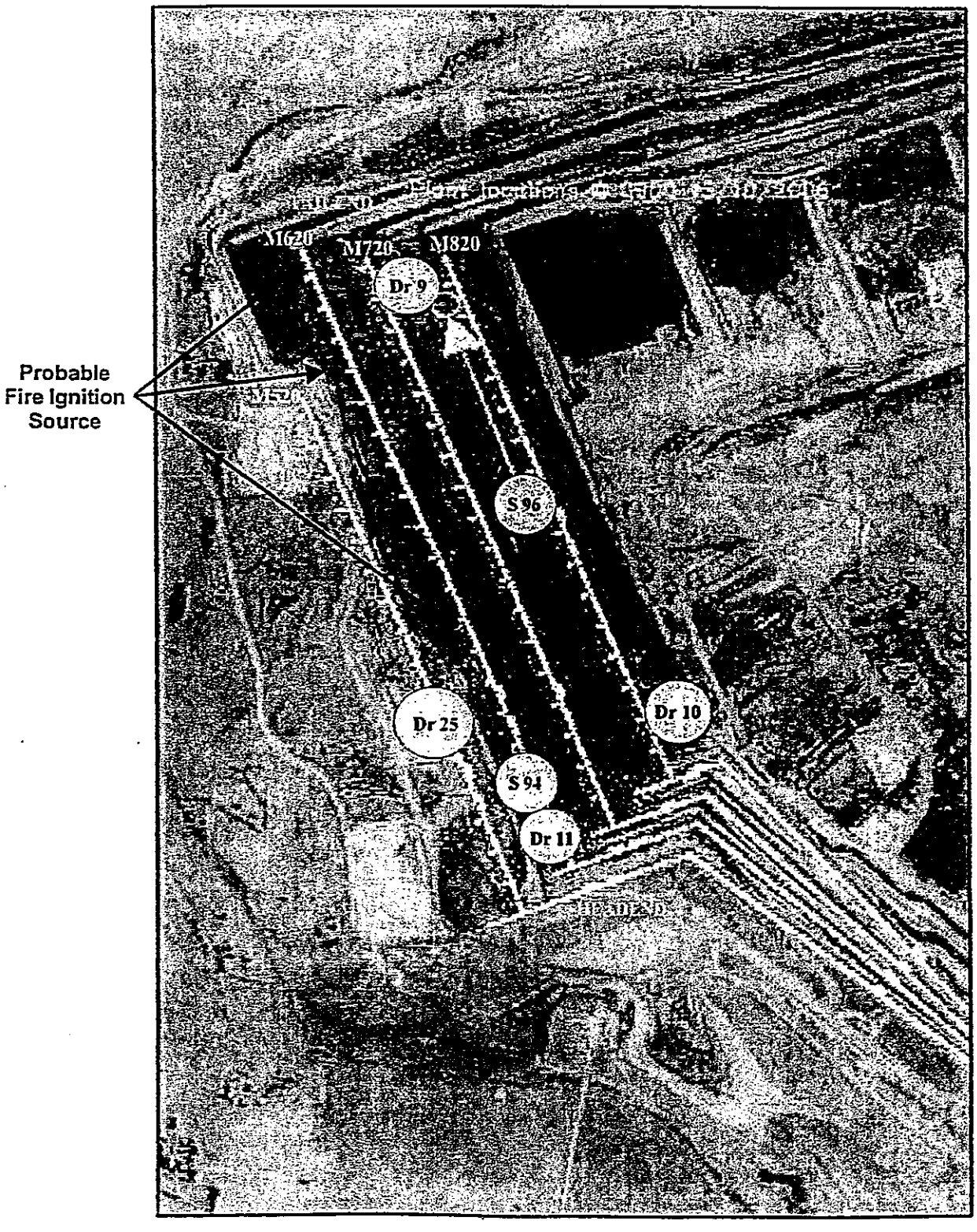
Figure 7 - Likely Initial Fire Ignition Sources



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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.

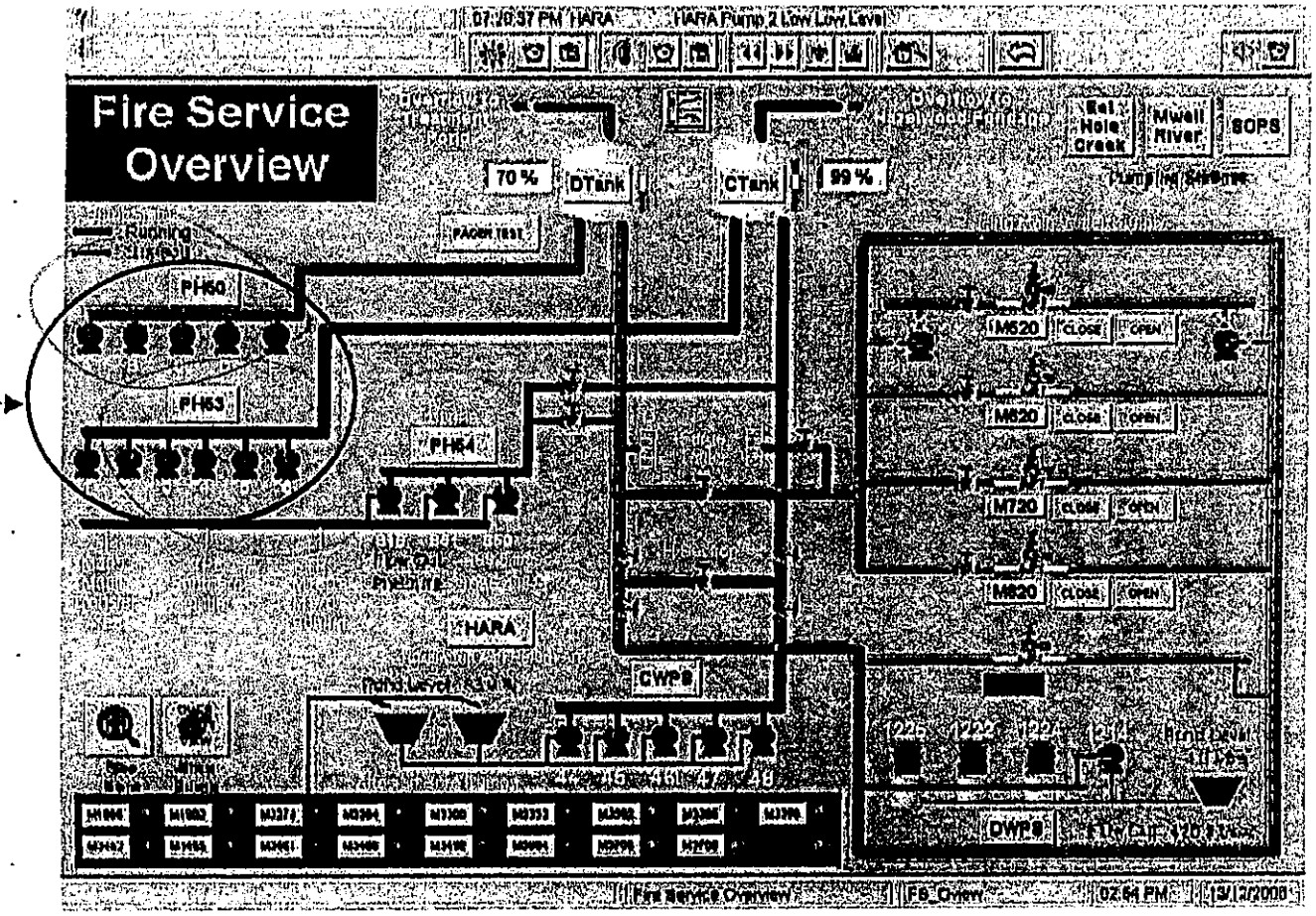
As per the Mine Fire Service Policy, the loss of one of the main four pumping stations discussed above (DWPS, CWPS, PH50, PH53) would not completely compromise the system.

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

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Appendix D

Organisational Responsibilities in Fire Prevention

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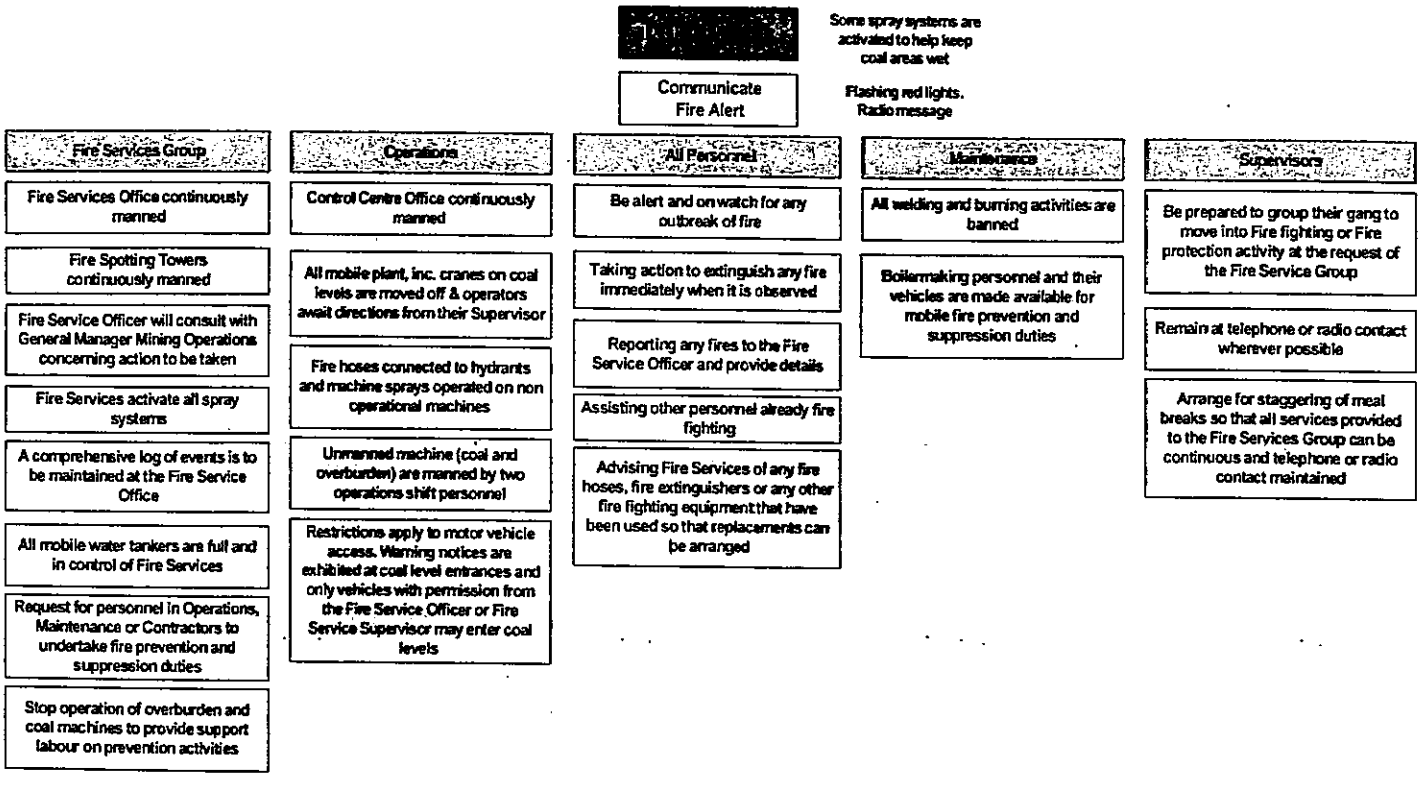
Organisational Responsibilities in Fire Prevention

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.

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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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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	D Zuzic	S Casey		S Casey		Dec 06
1	D Zuzic	S Casey		S Casey		Jan 07

Country Fire Authority
Fire Investigation Report
Fire & Incident Reporting System (FIRS) Number: 1074299

FINAL REPORT
MORWELL OPEN CUT MINE FIRE, MORWELL, VICTORIA, 3840.

12/10/2006

Disclaimer

The Country Fire Authority (CFA) and its employees and volunteers make no representation as to the completeness, accuracy or suitability for any purposes of the statements, information and opinions contained in this document. It is recommend that any person reading this document conduct their own investigations and/or seek independent advice in relation to the matters contained within it.

The CFA and its employees and volunteers accept no responsibility for any loss or damage, whether direct or consequential, suffered by any person as a result of or arising from the reliance on the statements, information or opinions in this document.

The purpose of this document is to provide information in relation to the fire that occurred. It is not the purpose of this document, nor is it the CFA's intention to apportion or determine liability with respect to any loss or damage to property, occasional by occupants.

All information and details regarding the incident are based on the best available data and observations made during the on-site data collection phase, and on any additional information provided during the preparation of this document.

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Country Fire Authority
Fire Investigation Report
Fire & Incident Reporting System (FIRS) Number: 1074299

Fire Details

Region:	10.
Date of Fire:	12/10/2006.
Time of Fire call:	11:57 Hours – Reported to the Morwell Fire Station Watchroom.
Time of ignition:	Approximately 1040 to 1100 Hours.
Address:	MORWELL OPEN CUT MINE, MORWELL, 3840.
Mapping System:	Region 9 & 10 Map Book
Map Reference:	pg 529, ref 440 665.
Property Type:	Coal mine and power generation facility.
Incident Controller:	
Rank:	
Primary Brigade:	MORWELL.
Support Brigades:	There were 95 support brigades that attended this fire, their details are listed in Attachment 1.

Fire Investigators

Fire Officer
Dandenong Fire Station.

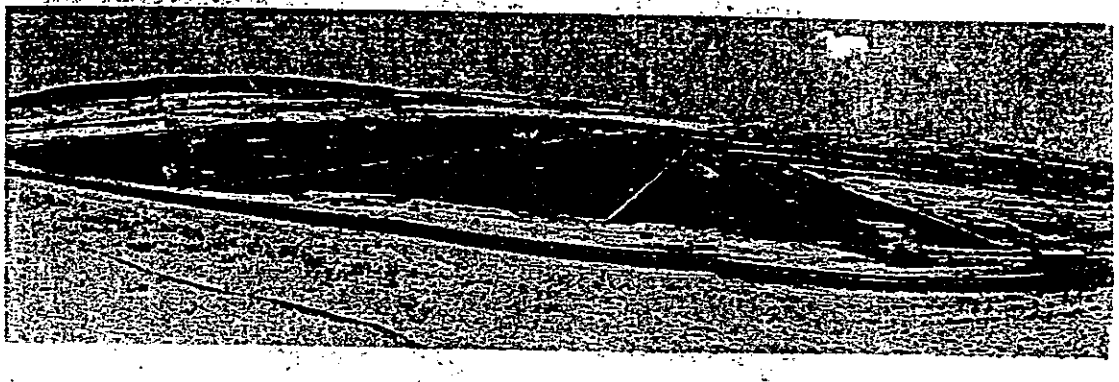
Fire Officer
Geelong Fire Station.

Investigation Log.

Time Called:	19/10/2006 16:00 Contacted by SFIC
Time Attended Scene:	22/10/2006 10:00 Commenced canvassing of workers at mine.
Time Departed Scene:	24/10/2006 19:30
Time To Compile Report:	In excess of 150 hours.
Total Time on Scene:	42:00 each investigator.
Accumulated Total Time:	
- All Investigators	240 Hours.

Introduction to Morwell Open cut mine.

The Morwell Open-cut mine is located several kilometers southwest of the township of Morwell in the Latrobe Valley. This is a brown coal mine that produces fuel for the 1600 megawatt, Hazelwood Power Station located on the southern perimeter of the open cut. The Morwell open-cut and Hazelwood Power Station are both owned and operated by International Power.



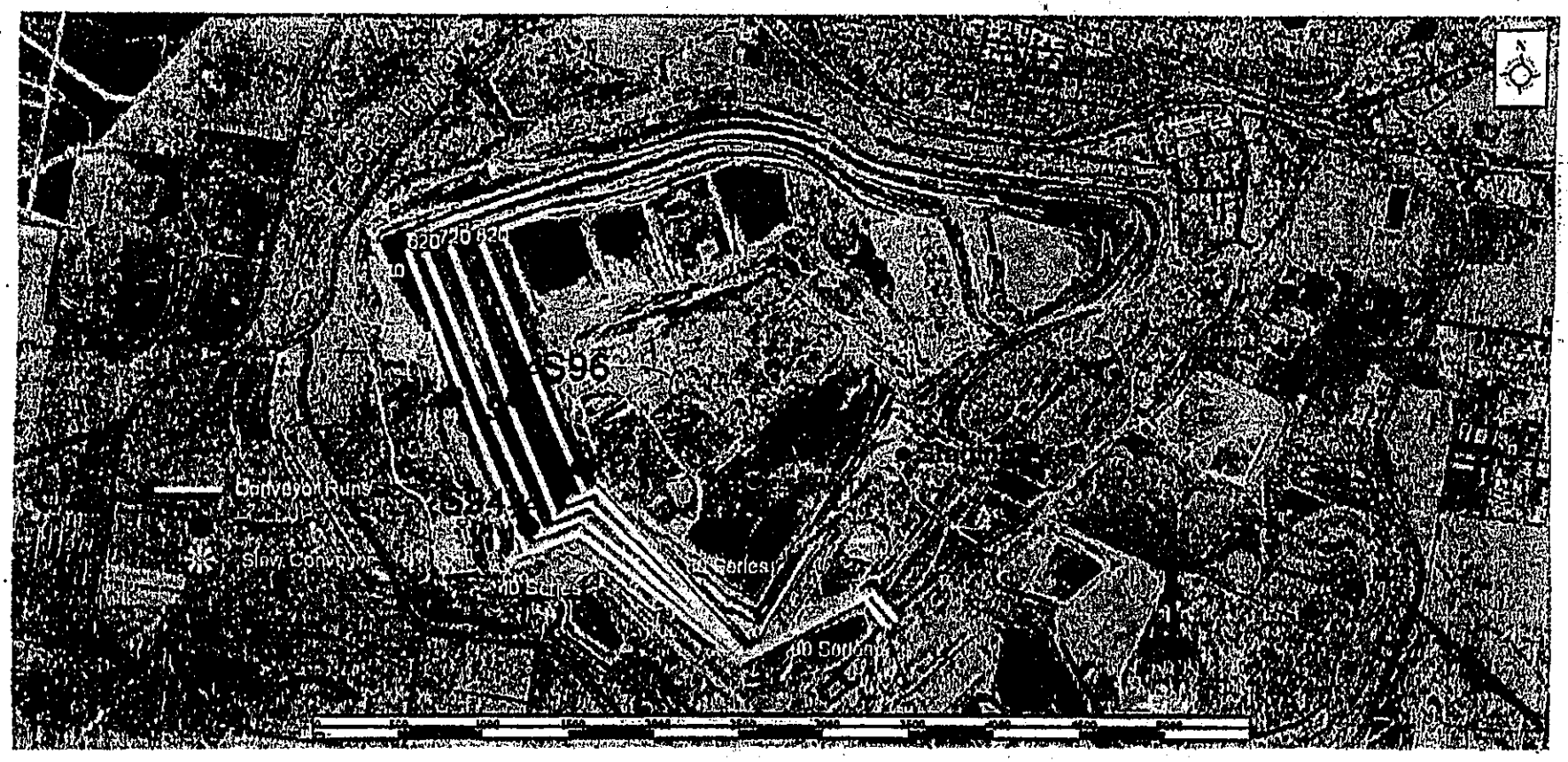
The mine area exceeds 900 Hectares and has a perimeter of over 14 kilometers. Brown coal is located below overburden with an average depth of 18 meters and has an obtainable depth of approximately 100 meters. The coal is mined using bucket wheel dredgers, these machines remove coal from a series of levels within the mine and are coordinated to ensure the continuous supply of fuel to the power station while other machines are either on maintenance, removing overburden or out of service for other reasons.

At the time of the fire there were 4 "bucket wheel dredgers" (DR) operating in the mine at the following locations:

- DR 25 was removing overburden on level M520.
- DR 11 was out of service for maintenance work at the south or "headend" of M620 with a "slewing conveyor" (S) attached. S94.
- DR 9 was operating on M720 with S96.
- DR 10 was operating at the head end of M820, on the lowest level in the mine.

See map on following page.

Country Fire Authority
Fire Investigation Report
Fire & Incident Reporting System (FIRS) Number: 1074299



Coal is transferred to the power station via a large network of conveyors with a capacity of over 2500 tons per hour. These conveyors are located on the working levels of the mine and transfer the coal directly from the bucket wheel dredger via multiple transfer points to change direction of the coal to the raw coal bunker at the power station. The mine has operated since 1956 and provided Hazelwood's fuel needs from 1964.

Currently the mine employees 200 staff working on various arrangements of shifts and contract other essential activities to various companies. These companies include but are not limited to Alstrom, Belle Banne and Roche Theiss Linfox (RTL). Alstrom are the plant and equipment maintenance contractor, Belle Baine are engaged to maintain conveyors and RTL are a plant and operator hire company who provide earthmoving and other machines for civil works.

Investigation method.

The fire in the Morwell Open-cut occurred on the 12th of October 2006 and was reported to the Morwell CFA watch room by telephone at 1157 hours by the
The fire was under the control of the CFA until the 18th of October when it was formally handed back to International Power at 1800 Hours. On the 19th of October a CFA Fire Investigation Team was requested to attend and conduct an investigation to determine the cause and origin of the fire. Due to the fact that fire scene had been very disturbed from fire suppression activities,
from Morwell CFA had arranged with International Power to canvas all employees and contractors who worked in the mine on the 12th of October 2006. These discussions allowed us to obtain information relevant to the mine activities prior to and during the time of the discovery of the fire. The discussions allowed us to understand and explore the equipment and practices undertaken in the mining operation and associated works. The canvassing of the mine workers commenced on the 22nd of October and concluded on the 24th of October. During this period we were able to talk to 64 people, a summary of the keys point raised is located in the report.

Canvassing of the on site staff who worked on the 12th of October revealed common recollections of activities of the day and work being undertaken, all staff were open and gave freely of relevant information. However there was difficulty in determining accurate times that events occurred, this is most likely due to several factors including:

- The majority of personnel were not in view of the initial fire ignition.
- Most staff on the day of canvassing did not appear to wear watches when working in the mine.
- The time since the fire to the canvassing had been 10 days.
- There was no log of events or record of radio transmissions as they occurred.

During the canvassing process there were several discussions that required us to conduct physical examinations in the mine and at other locations. These were carried out with the assistance of International Power staff and were of high importance in the determination of cause and origin of the fire.

At the conclusion of the canvassing and physical examination process all possible scenarios were explored. They were all tested against the information obtained from the discussions held, physical, photographic, recorded and written evidence obtained. This information allowed us to determine the most probable cause and origin for this fire; this is based on all the available information acquired by and made available to the investigation team. The information obtained from this investigation and the findings into the possible and most probable cause of the fire have been viewed, validated and supported by a subject matter expert in mining operations, [redacted] from the Minerals and Petroleum Branch, Department of Primary Industries.

Country Fire Authority
Fire Investigation Report
Fire & Incident Reporting System (FIRS) Number: 1074299

Owner/Occupier Details

Exposure Type: Coal Mine, Mining Equipment, Power Generation facilities and Equipment.

Type: Owner/Occupier
Name: International Power
Address: P.O Box 195, Morwell. VIC. 3840.
Phone BH: 5135 5702.
Phone MOB 0419 519 491.

Insurance Details

Insurance Company: American Home Assurance Company
Insurance Policy #: 114954.

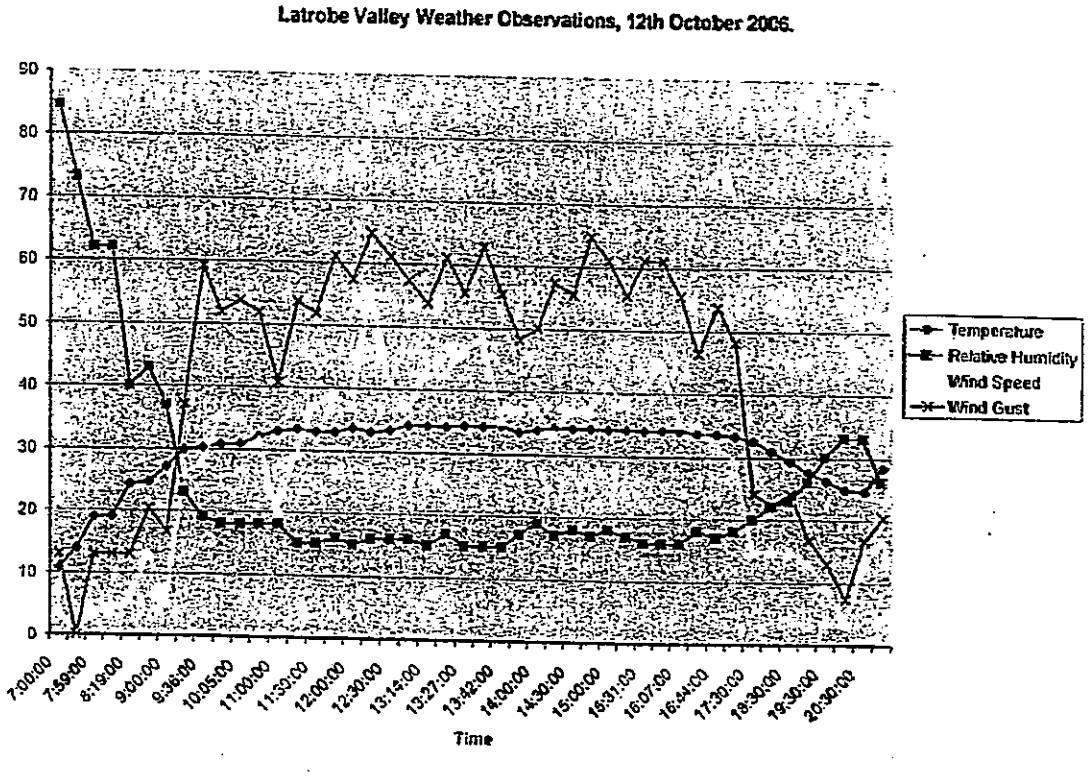
Weather Details

The 12th of October 2006 was an unseasonably hot and windy day. This day saw several large wildfires burn extensive areas of bush land posing moderate suppression difficulties in the Latrobe Valley. Several of these fires were burning prior to daylight and were reported as having extreme fire behavior with-in hours of daybreak. The day was declared a day of Total Fire Ban in all districts except Gippsland.

The weather at the Morwell Open-cut was warm with an increasing wind; in anticipation of a windy day the mine staff were operating their water sprays throughout the mine to suppress dust and to reduce fire danger. The
had issued a "Fire Alert" between 09:45 and 10:00 hours. This is issued when there is a high danger of fire occurring in the mine, and it prevents all hot works and non-urgent maintenance being carried out. The reason it was called was due to the increase in winds and the temperature of the day. Most workers described increasing winds and raised coal dust as the morning progressed.

The above photo was taken by It was taken from the northern side of the mine looking south, note the amount of raised dust and water sprays operating. The photo was taken at 1123 hours on the 12th of October 2006. See the Photographic Timeline for more details.

The investigation team has accessed the Bureau of Meteorology Automatic Weather Station data from Latrobe Valley Aerodrome located 11 Kms northeast from the area of origin. A graphical representation of the temperature, humidity and wind speed is included below. For a table of actual data recorded from observations at Latrobe Valley Aerodrome is included as Attachment 4.



From the data above and the reports from the workers present in the mine on the 12th of October, there was a rapid increase in wind speed and gusts in the hour just before the fire was reported to mine control. . operating the overburden stacker observed wind speed measurements of over 70Kms after the fire was first detected. The stacker was located on the southern side on the floor of the mine.

Weather observations at 1200 hours, possibly 1 hour after ignition. Taken from the Latrobe Valley Airport.

Temperature: 33.7 °C
Wind Speed: 37Kph, Gusting to 57 Km/h, bearing 320.
Humidity: 14.9%,

Weather observations taken at 1100 hours from the Weather link device at the Fire Control Lookout.

Temperature: 31.9°C
Wind Speed: 32.2 Km/h, Gusting to 61.2 Km/h, bearing NNW.
Dew Point: 10.9°C

Data from the Fire Control Room weather station is included as Attachment 5. This is not a calibrated weather instrument, rather a computer operated device.

Mine Operations.

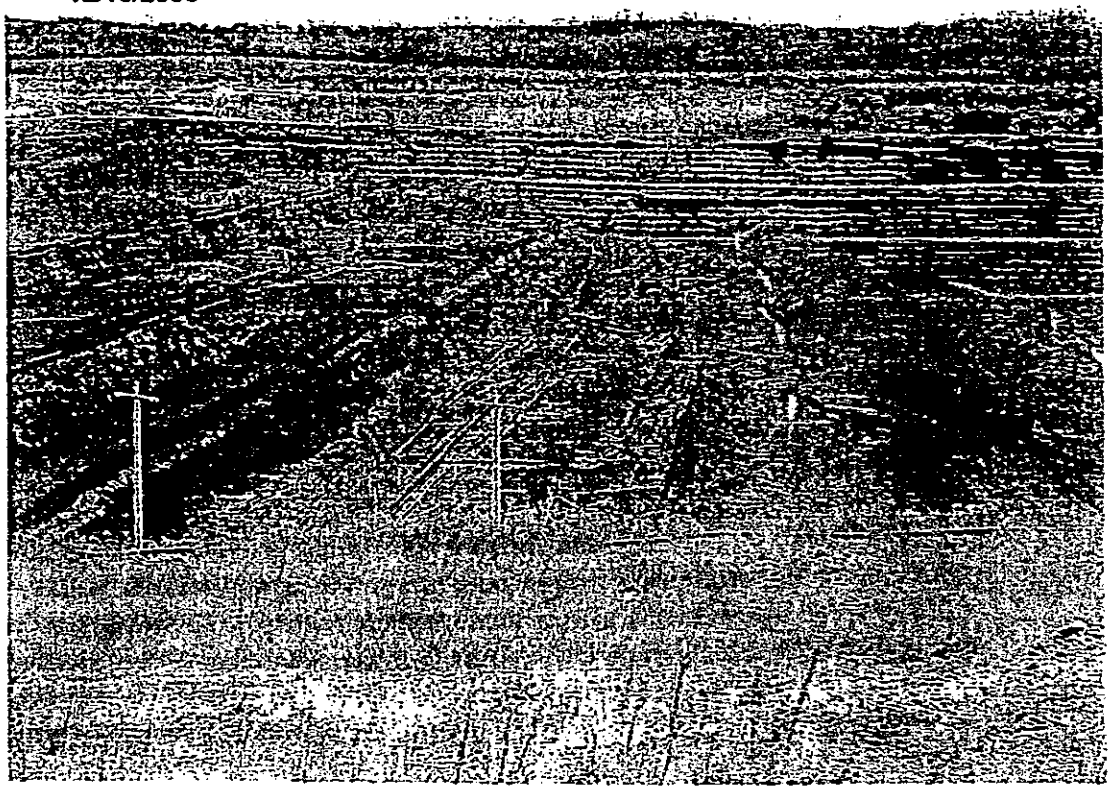
On the 12th of October 2006 the day shift began at 0700 hours. DR11 was scheduled to have a two-day maintenance outage for a crawler pads change and other works. The conveyor that DR11 fed, M620 was scheduled for belt inspections and also required electrical maintenance work to be carried out. At 0700 hours DR11 was taken off line.

. checked the M620 belt for idler replacements until approximately 0745 hours. To complete this task the roadrunners were required to travel between conveyor M620 and the topside fire service pipe. They recalled the topside sprays were operating at the time. Three quarters of the conveyor was inspected and then it was locked out for . contractors at 0800 hours. The work permit was not issued to . because the conveyor was wet due to the fire service water sprays operating, so they requested the belt be positioned to allow them to return at 1000hours to commence work. This was agreed by the

As this occurred workers attended the DR11 and found that it had not been positioned on the appropriate maintenance pad and requested the movement of the dredge to allow work to commence. This movement required DR11 to relocate closer to the headend of M620, as this would take some time the maintenance crew decided they would return after morning brew to start work. A D8R bulldozer was also due for maintenance work and had been moved from the overburden dump to the headend of M620 also.

The maintenance work that was programmed required the delivery of crawler pads to DR11 from the store, a is used to conduct these deliveries. truck arrived at the main gate of the mine at 0910 hours and traveled along the clay roads on the southern batters to reach DR11. With the assistance of one maintenance worker, laid out the crawler pads in front of the dredge to allow them to be replaced. He was then required to pick up some used crawler pads located on the northern batter access road to level M620. He proceeded to drive his International semi-trailer across the coal formation of M620 to reach the tailend and onto the northern clay road. He recalled the sprays were operating at the time of his crossing and he had followed a worn track across the coal. The track was midway between the topside fire service pipe and the coal batter. At one point he was required to divert from the tracks to miss a boggy area of wet coal, he recalled that he might have had to drive through wet area. He reached the crawler pads where he turned around so he could load the pads from the passenger side of the truck. This is visible in the photo below, taken at between 1030 and 1045 hours.

Approx 10:30
12/10/2006



When was loaded he turned around again and then left the mine via the northern batter roads, he exited the main gate at 1115 hours.

While was unloading his truck, at between 0945 and 1000 hours, the had called a "fire alert." The fire alert was communicated to the and the

Fire Activities.

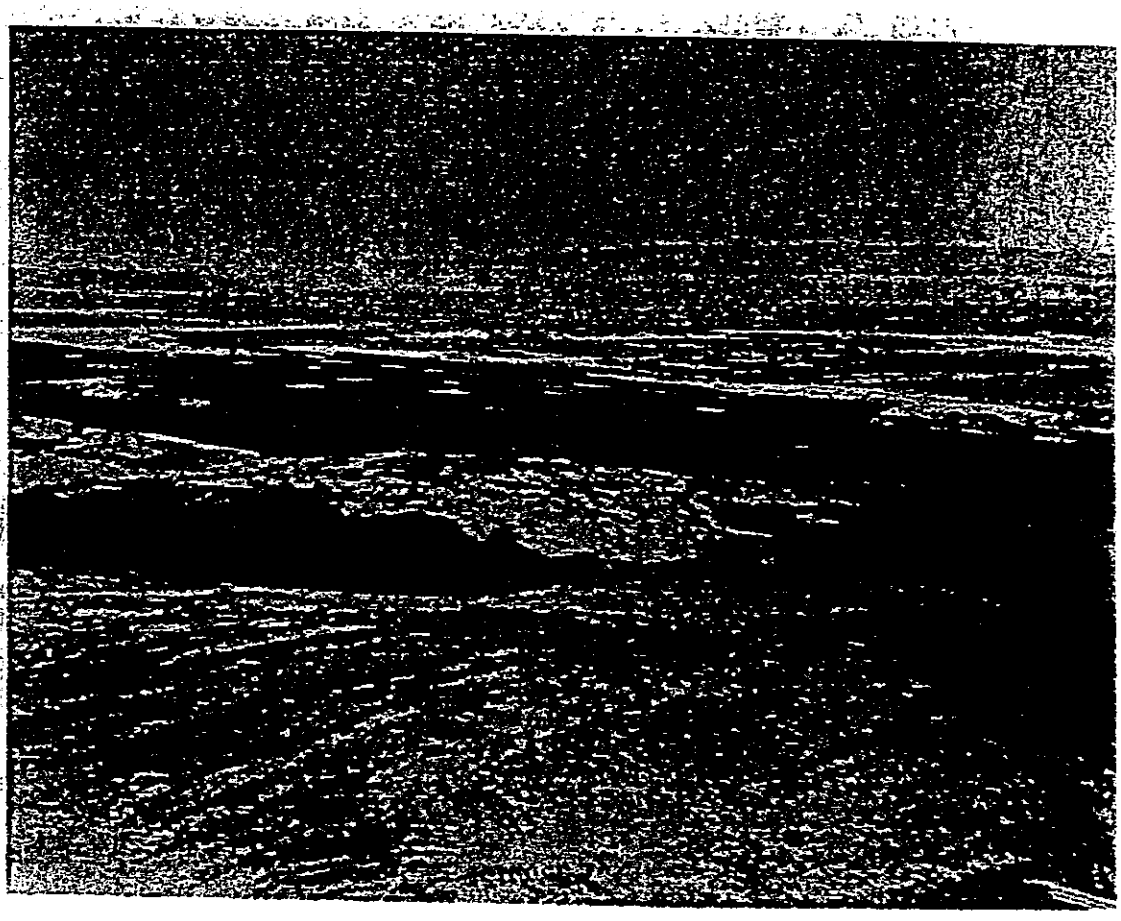
/as notified of a spot fire at the tail end of level M620 between 1045 and 1050 hours, this was confirmed by as he went and conducted a visual check out of his control room and saw smoke from the tail end of M620 only. is employed at the fire service control room; he first saw the fire occurring at approximately 1050 hours and recalled the fire was only at the tail end of M620 also.

was traveling along the top of the mine inline with M620 and reported that he saw several fires on the M620 formation. He recalled the fires were not out far from the topside fire service but there was several of them along the level from the tail end, he believed the time to be 1115 hours when he called the control room. He was told the fire was in hand.

The first workers who attended the spot fire on M620 tailend, stated the fire was burning in close proximity to the M620 tailbox, and was between the conveyor and the topside and bottomside fire service pipelines. An anchor post for the tailbox was on fire and there was fire burning in loose coal on the bottomside of the conveyor. These workers recalled there were a lot of embers moving around and the wind was quite strong. They stated the fire moved away from them towards the head of M620 as well as progressing down to M720 also. When they arrived at the tailend they did not recall seeing any other fires on the formation. The photo on page 14 shows indicating where the fire was burning between the fire service main and the M620 conveyor tailbox.

Due to the fire alert the decided to remove the new crawler pads from the coal at DR11, he sent the crane to remove them, as the crane was finishing this task the crew at DR11 became aware of smoke and then a fire burning on the north side of DR11. One worker, saw further beyond DR11 and the slewing conveyor S94, and recalled there was smoke and dust coming from further along the formation of M620. The contacted the control centre and advised of the fire at DR11.

Shortly before 1148 hours a call was made over the open radio channel requesting that all available leading hands and roadrunners report to M620 to assist with fire suppression. The operator of the overburden stacker heard the call and slewed his machine around to see smoke issuing from one end of the batter to the other. He took photos of this on his mobile phone. See Below.

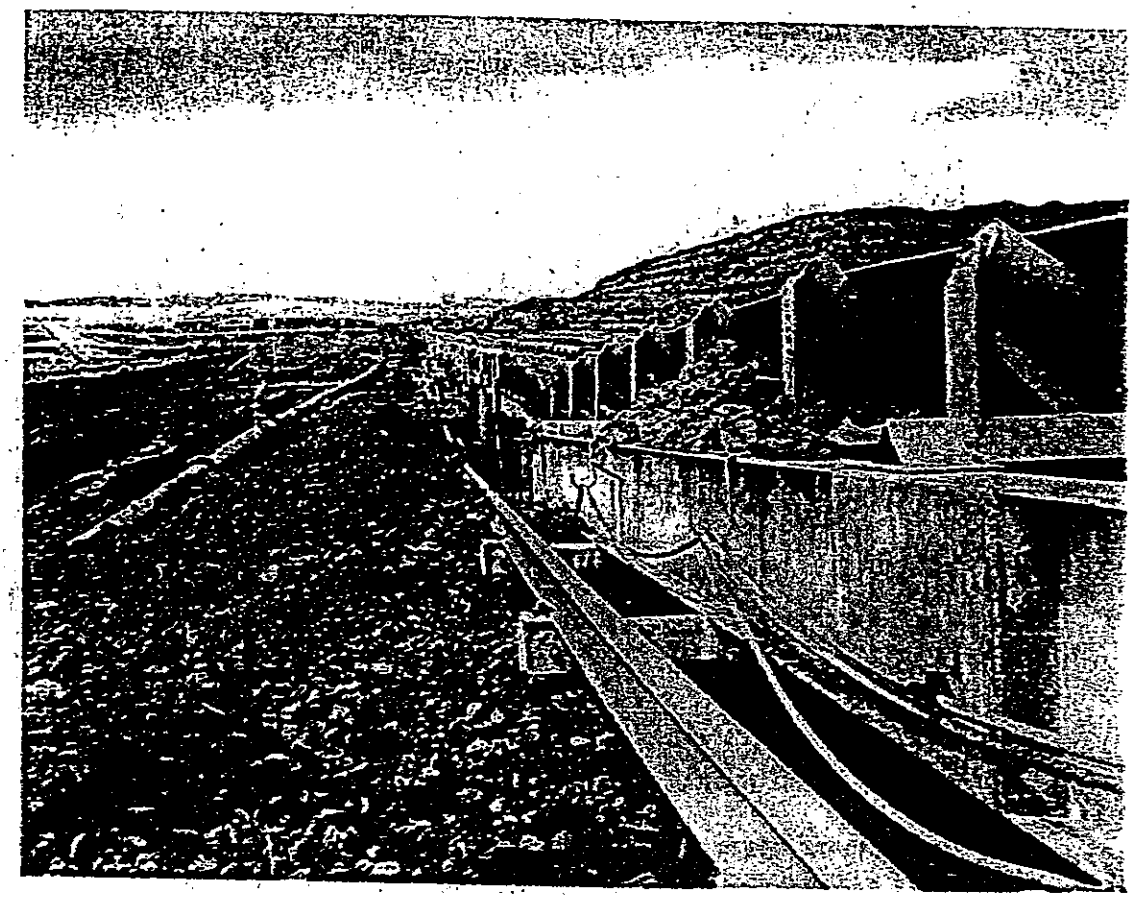


At the same time the was driving down the southern batters towards the main transfer station and then onto DR11. He took several photos that show the fire from the tail end to the head end of the M620 batter, and of the fire burning around DR11 and Slew 94. The first of his photos was taken at 1152 hours. See below.

The logbook from the watchroom at the Country Fire Authority, Morwell Fire Station shows the first call for a fire in the open cut was received at 1157 hours. This call was captured on a radio and phone logger and the fire call was made by The CFA arrived on scene at the Morwell Open-cut mine at 1207. A copy of the logbook is in Attachment 3. When arrived on scene at the Morwell Open Cut, he saw three fires along the length of batter M620. It is most probable the fire was burning for over 1 hour prior to his arrival.

Cause and Origin

Eye witness reports from multiple sources observed the fire only at the tail end of the M620 level. The first workers to the tail end described the fire as being in the vicinity of the M620 conveyor tailbox. The fire was between the bottomside of the M620 conveyor and the bottom side fire service, and also between M620 and the topside fire service. There was also fire around the M620 tailbox. The most probable area of origin was at the tailend of M620 in close vicinity to the conveyor tailbox.



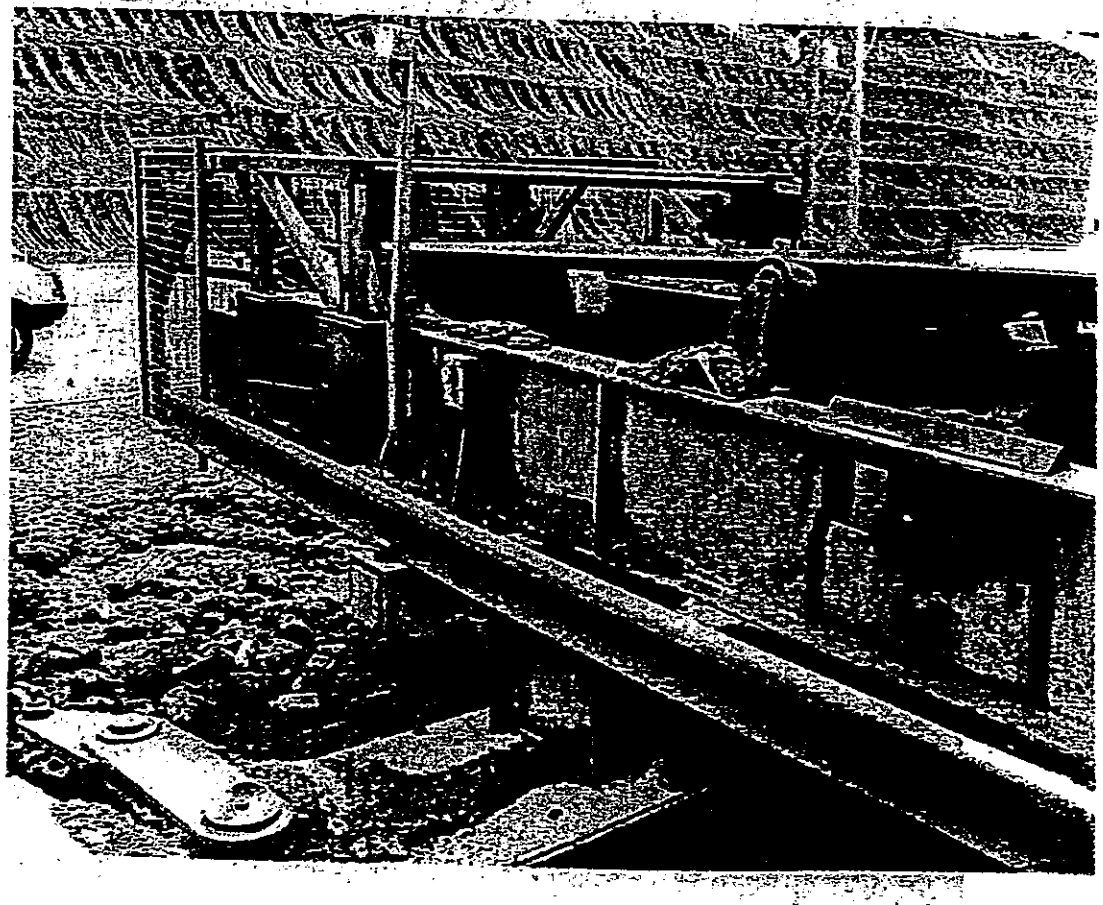
The point of origin was most probably at conveyor unit 157, 852 meters from the head of M620. The remains of the idler assembly that failed were most likely transported on the conveyor to the tailend. The conveyor belt was destroyed to the south of the idler and not north of the belt, it is probable the fire that burnt the belt was a secondary ignition from the same source, see the photo below and note the damage to both the feed and return belts on the left side of the image.

The fire at the tailend, in the vicinity of the tailbox was noticed at the same time the wind speeds had increased. This was several hours after the conveyor was shutdown for maintenance. The point of origin of the actual coal fire was most probably where the heated remains of the idler assembly landed in the built up coal at the tailend of M620, close to the tail box.

Area of Origin

Eye witness reports from multiple sources observed the fire only at the tail end of the M620 level. The first workers to the tail end described the fire as being in the vicinity of the M620 conveyor tailbox. The fire was between the bottomside of the M620 conveyor and the bottom side fire service, and also between M620 and the topside fire service. There was also fire around the M620 tailbox. The most probable area of origin was at the tailend of M620 in close vicinity to the conveyor tailbox.

The following three pictures below and on the next page are of the area that the fire was first seen in this is around the tailend of conveyor M640. Note the build up of coal dust on the tailbox and conveyor. This build up is what is left after the fire and the coal buildup was hosed down to extinguish it.



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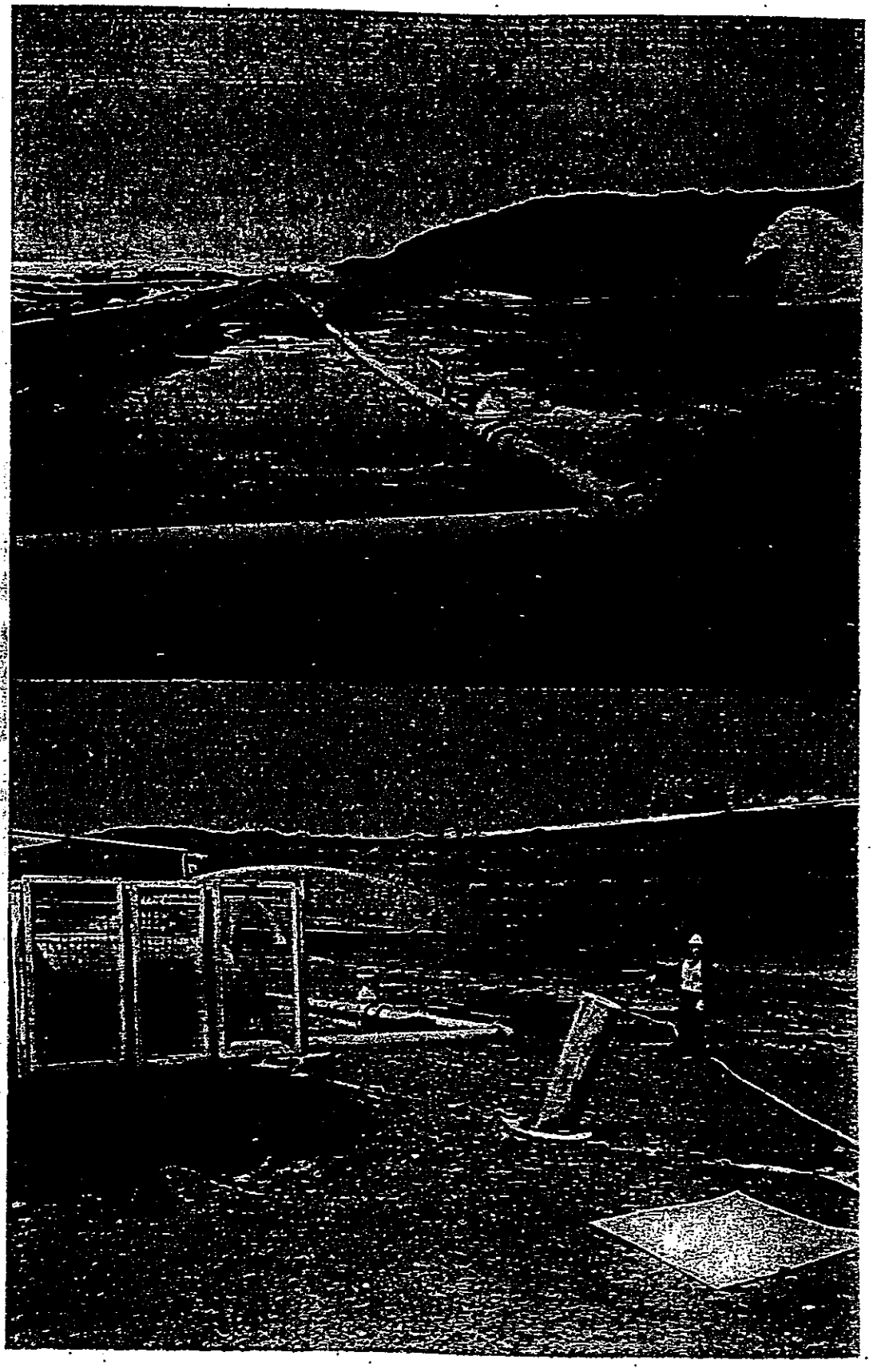
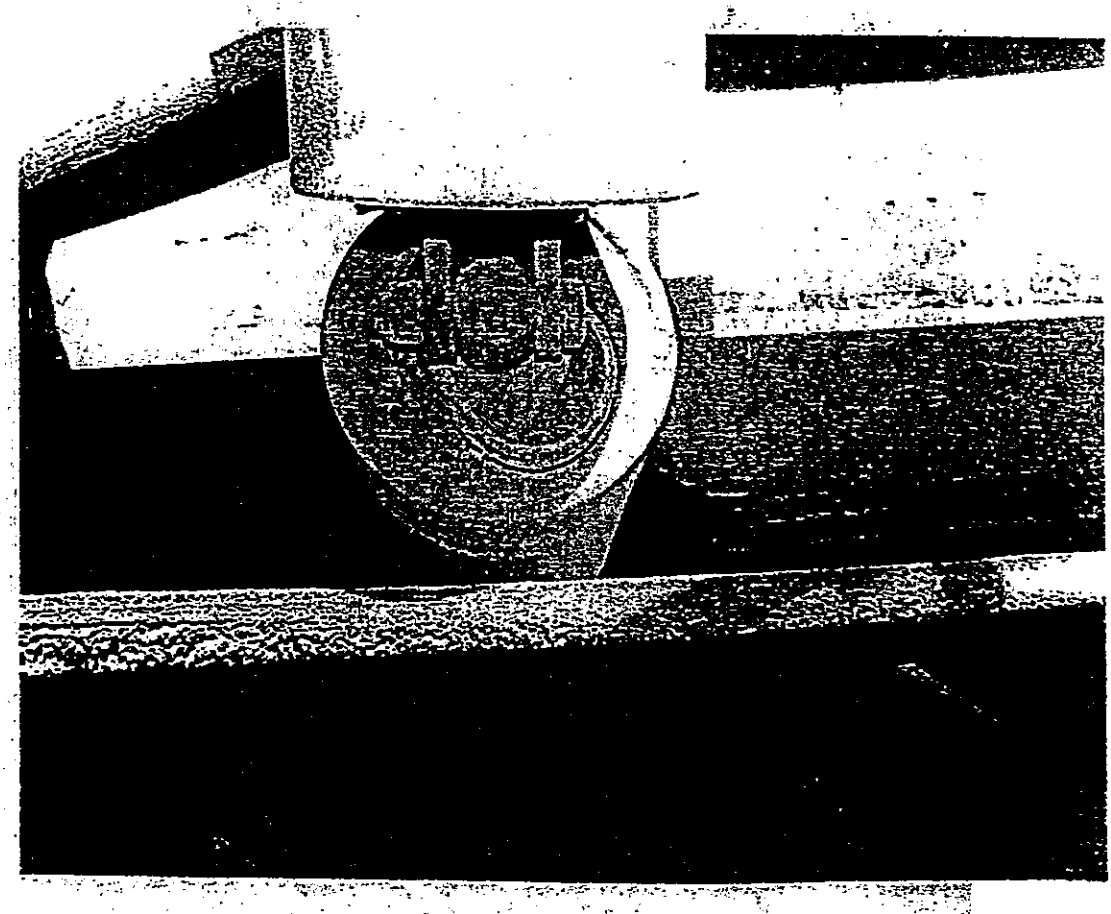


Point/s of Origin

The point of origin was most probably at conveyor unit 157, 852 meters from the head of M620. The remains of the idler assembly that failed were most likely transported on the conveyor to the tailend. The conveyor belt was destroyed to the south of the idler and not north of the belt, it is probable the fire that burnt the belt was a secondary ignition from the same source. The fire at the tailend, in the vicinity of the tailbox was noticed at the same time the wind speeds had increased. This was several hours after the conveyor was shutdown for maintenance. The point of origin of the actual coal fire was most probably where the heated remains of the idler assembly landed in the built up coal at the tailend of M620, close to the tail box.

The following photos show the destroyed idler bearing and the conveyor looking towards the tailend.



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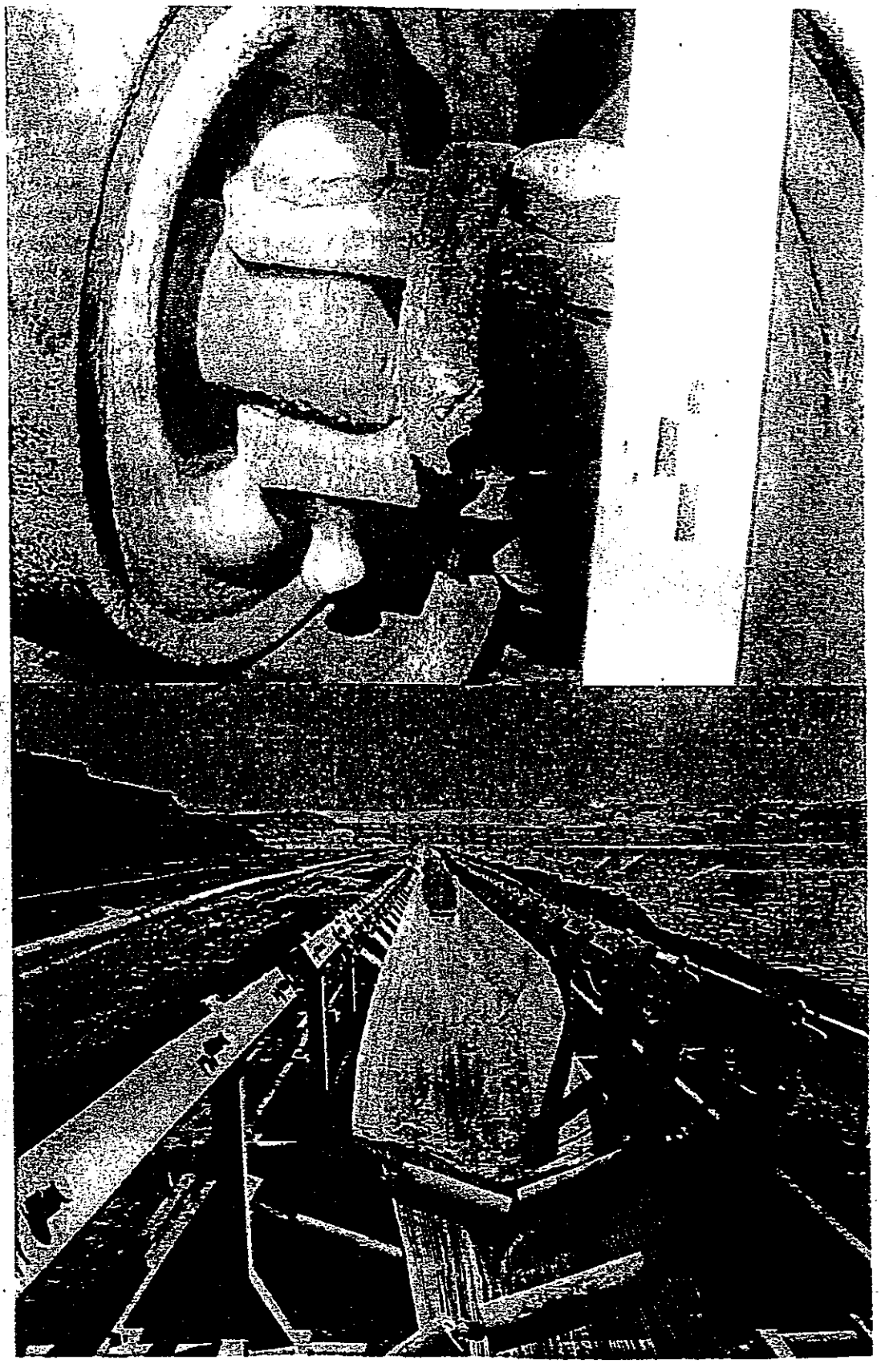

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Cause of Fire

Cause of Fire: Accident

Ignition Factor: Part failure.

Type of Material Ignited First: Coal or coal dust.

Form of Material Ignited First: Form of material not applicable

Equipment Involved in Ignition: Conveyor Idler Bearing,

Comments
First Idler Bearing Set, on conveyor unit 157. The lower bearing collapsed in the bottomside, feed idler, the roller had ground away the nut and bolt below it. There was evidence the conveyor had run for a period of time after the failure as the idler had destructed and the only remains of the bearing was a molten bearing cover.

The most probable area of origin of this fire was checked against the CFA's Fire Incident Reporting System (FIRS) and the query matched 31 other fires in Region 10 Gippsland that occurred since 1998. In 25 of these cases the material first ignited was listed as Coal. And in all 31 cases the Ignition Equipment was determined as either a conveyor or a bearing. A copy of this FIRS query in Attachment 6.

The other possible causes that can not be categorically ruled out, but are less likely to have caused the fire are:

1. The movement of a mine maintenance vehicle along M620 conducting a conveyor inspection. This vehicle traveled between the topside fire service and the M620 conveyor. It was required to complete a U-turn and return along the same track. The water sprays were on at the time of this activity. It is not determine whether the vehicle contacted with coal or caused wet coal to contact its exhaust. This is less likely to have caused the fire because it traveled along the level at approximately 07:30 hours and it only went 3/4 of the entire length.

2. The movement of a transport contractor's semi-trailer across the coal face on level M620. The vehicle was required to drop maintenance parts at the head end of M620 and then proceeded along the coal face to the tail end where it picked up other equipment and then left the mine. It traveled in the center of the formation to avoid wet and boggy coal; this is a less likely cause because the fire was first identified between the fire service pipe and the conveyor.

Plant and Losses estimates.

The following is a list of estimated losses that were provided by International Power.

CS2 (M720, M740, M760 conveyor systems)		
• Extensive belt damage. (approximately 630 meters replaced)		$ 200,000.
• Extensive electrical damage. (M720 head end and M740)		$ 200,000.
• Mechanical & structural damage. (pulleys, impact curtains, 200 idler sets replaced, painting)		$ 300,000.
• High Voltage supply cable repairs.		$ 100,000.
CS1 (M620, M640, M660 conveyor systems)		
• Extensive belt damage. (approximately 2430 meters to replace)		$ 800,000.
• Extensive electrical damage. (M620 head end and M640)		$ 300,000.
• Mechanical & structural damage. (pulleys, impact curtains, 1200 idler sets replaced, painting)		$ 500,000.
• Hopper H1828 rebuild.		$ 250,000.
• High voltage supply cable repairs.		$ 100,000.
Dredger 11 Estimate only.		
• Extent of damage currently being assessed by IPRH and independent.		
• Some structural damage evident.		
• Electrical wiring damage evident.		
• Pulleys, idlers, belts require replacement.		
• Extensive painting works required.	(assuming repairable)	$6,800,000.
Slewing Conveyor 94		
• Extensive electrical damage.		$ 500,000.
Bulldozer		
• Caterpillar D8R		$ 750,000.
Production Losses		
• Approximate costs.		$1,000,000.
Preliminary total cost of plant and lost production.		**$11,800,000**

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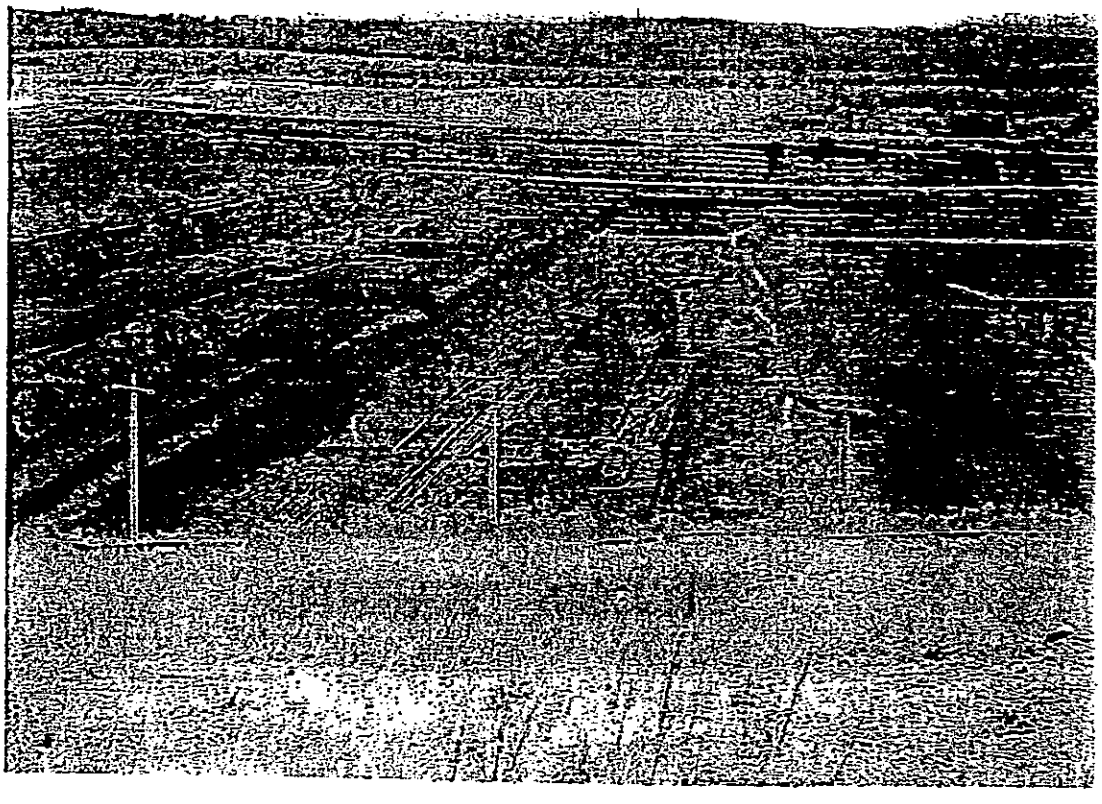
Photographic Timeline.

Approx 10:30
12/10/2006



The above image was taken by an unknown person, the image was presented to the CFA investigators to show the mine's fire sprays were operating prior to the fire. The caption on the image states it was taken at approximately 1030 hours on the 12/10/2006, however the time stamp is for 1150 hours on the 12/10/2006. The truck located in the middle of this photo belongs to . His gate pass recorded that he entered the mine at 0910 hours and left at 1115 hours. Discussions held with revealed that it took him 30 minutes to exit the mine to the gatehouse. He stated that he took approximately 1 hour to load at the location in the picture. The possible timeframe for the capture of this image is between 1015 and 1045 hours, however closer inspection of the photo shows ; truck is loaded. This would make the likely time probably **1030 to 1045 Hours.**
This image was taken from the south end of the mine and shows the tail end of levels M620 on the left at the top through to level M820 on the far right. This photo shows that not all sprays were operating, and that the sprays at the tail end of M620 were turned off. Close inspection of this image shows no sign of fire in the mine.

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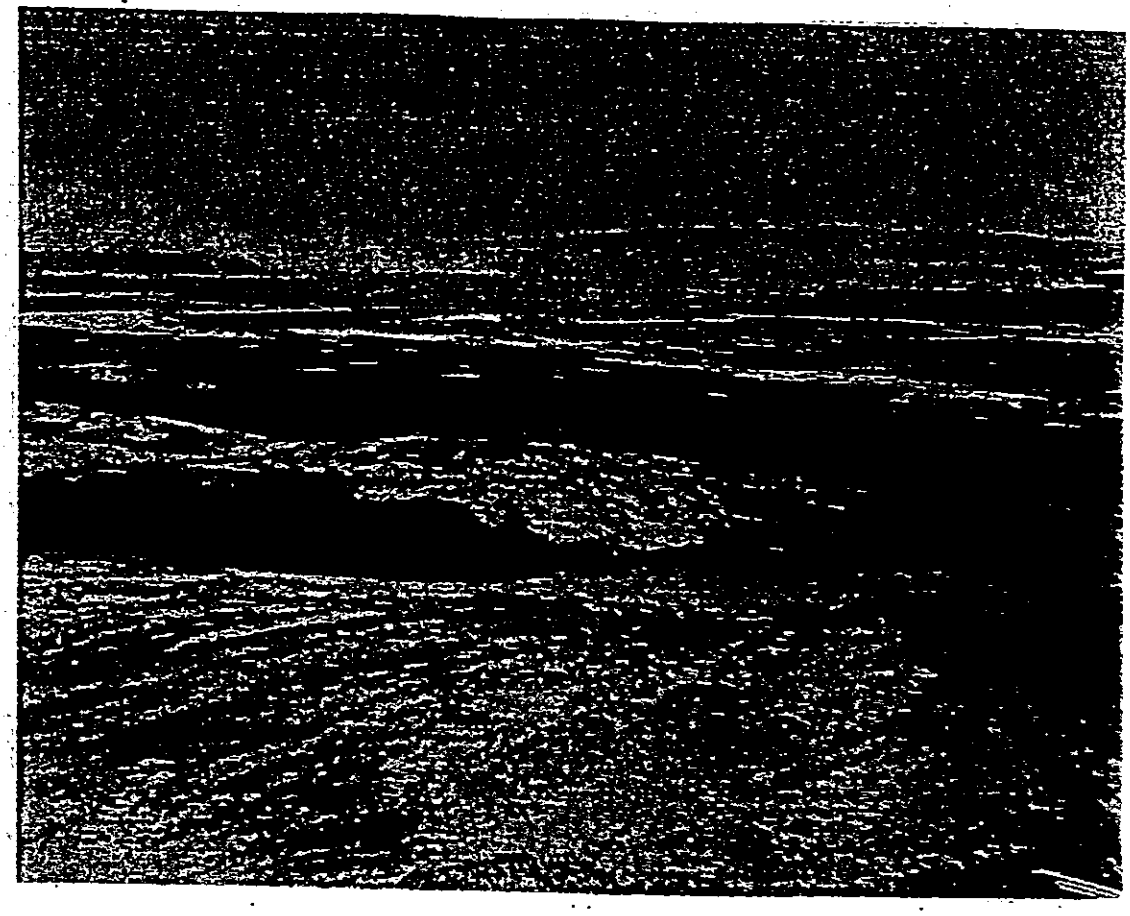
The above photo was taken by . It was taken from the northern side of the mine looking south. The time stamp on the camera was 1213 Hrs on the 12/10/2006. Inspection of camera revealed the time stamp is approximately 50 minutes fast, the actual time of this image is **1123hours**. Batter and formation M620 is visible in the right of the picture, the sprays to the right of the image are operating on M620. The heads of all of the conveyors are not visible due to raised dust. From the left of the picture, Dredgers 10 and 9 are visible. The Dredge on the far right is DR25, DR 11 is sited on the far end of M620, and it is not visible due to the amount of raised coal dust. The tail end of M620 is on the far right of this image and not in view, this shows the topside sprays operating and shows the limited coverage of the sprays due to the wind. As this image does not show the tail box, it is not possible to determine if there is an active fire at the time of the photo.

The above image is the second in a series of two taken by from the northern end of the mine; it was taken shortly after the previous image.



This image was captured by on his mobile phone when he overheard a radio call for roadrunners and leading hands to attend a fire over the open channel.

was operating the TS2 Overburden Stacker on the south side of the mine, on hearing the call he slewed his machine around and took a series of photos. The first photo was recorded at 1149 hours. This image is from the east looking at the fire on the M620 formation and batter. The tail end is to the right and the dredge is just visible through the smoke on the left side of the mine.

This photo was taken by at **1152 hours as he traveled towards the** head end of the mine. This photo was retaken by to see if the 11DR and S94 would have been visible from this point. As you can see in the next photo they would have both been in the picture, but appear to have been obscured by smoke. They would have also had fire around them.

The direction of the smoke travel and lack of height in the smoke column indicates the wind was blowing from the north and with a reasonable strength.

This photo shows the view of the 11DR and where S94 would have been. Taken by

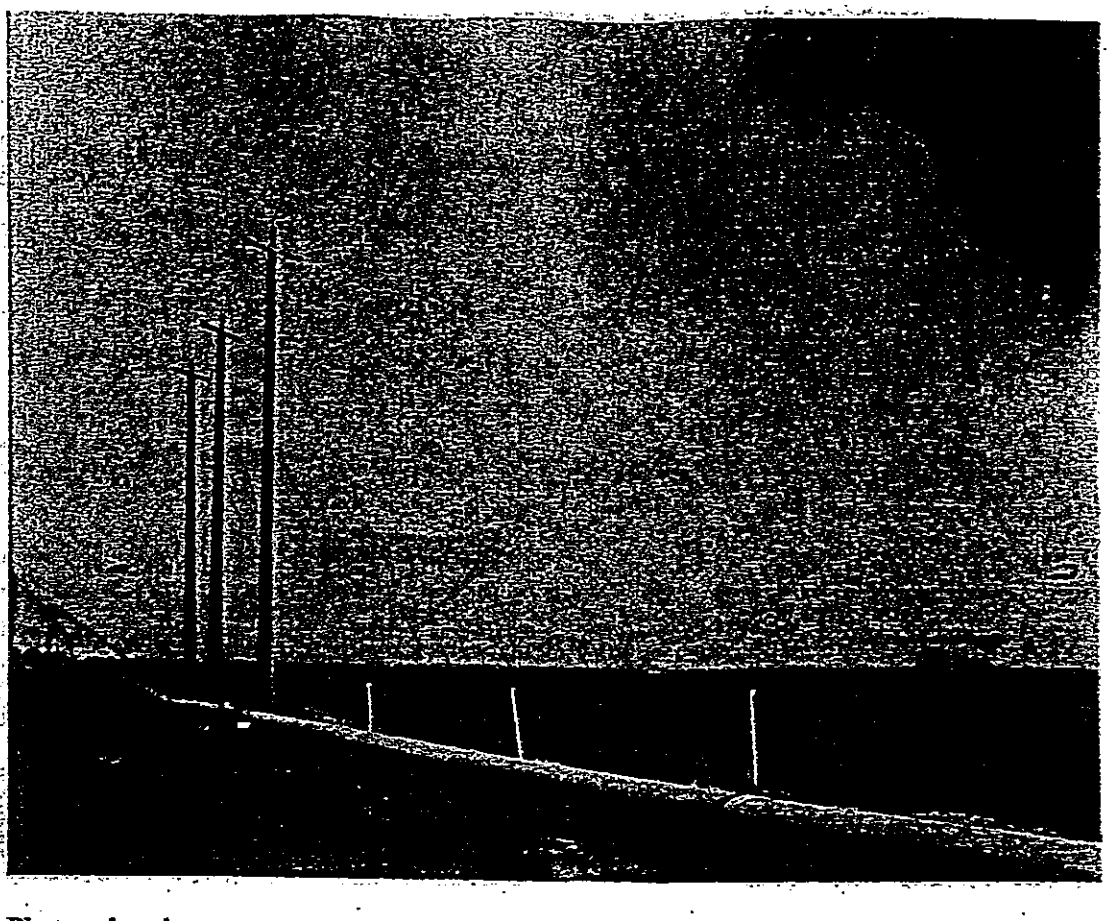


Photo taken by while approaching the fire from the headend at 1229 hours. DR 11 and S94 both in view.

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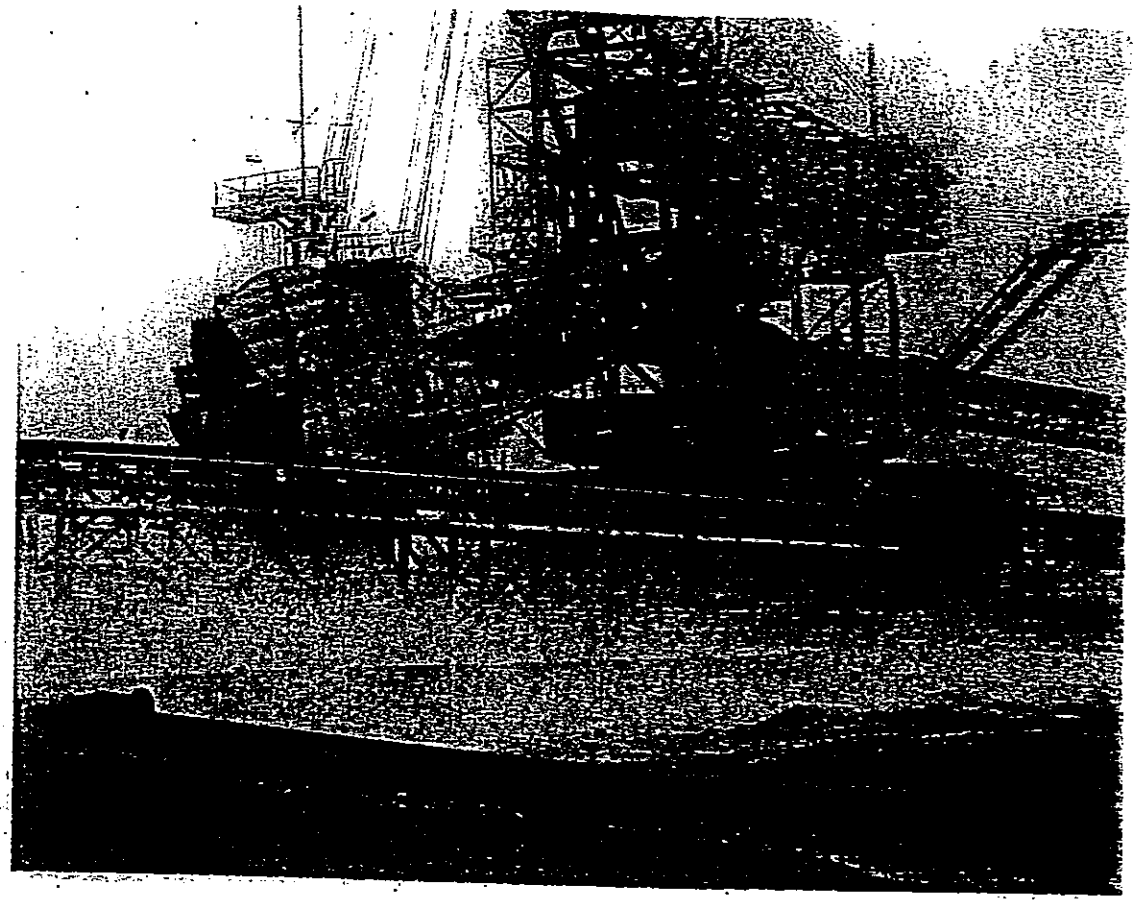

Photo taken by **while approaching the fire from the headend at 1229 hours.**

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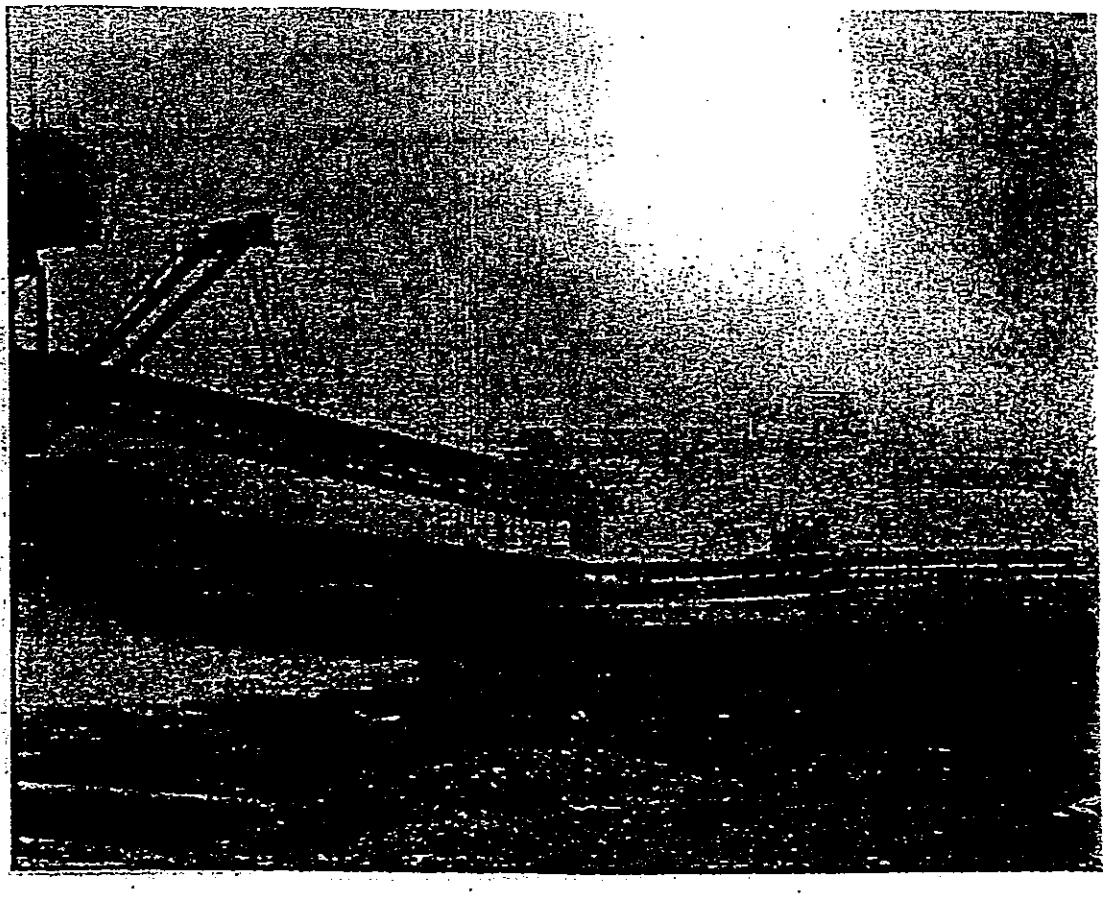


Photo taken by while approaching the fire from the headend at 1229 hours.

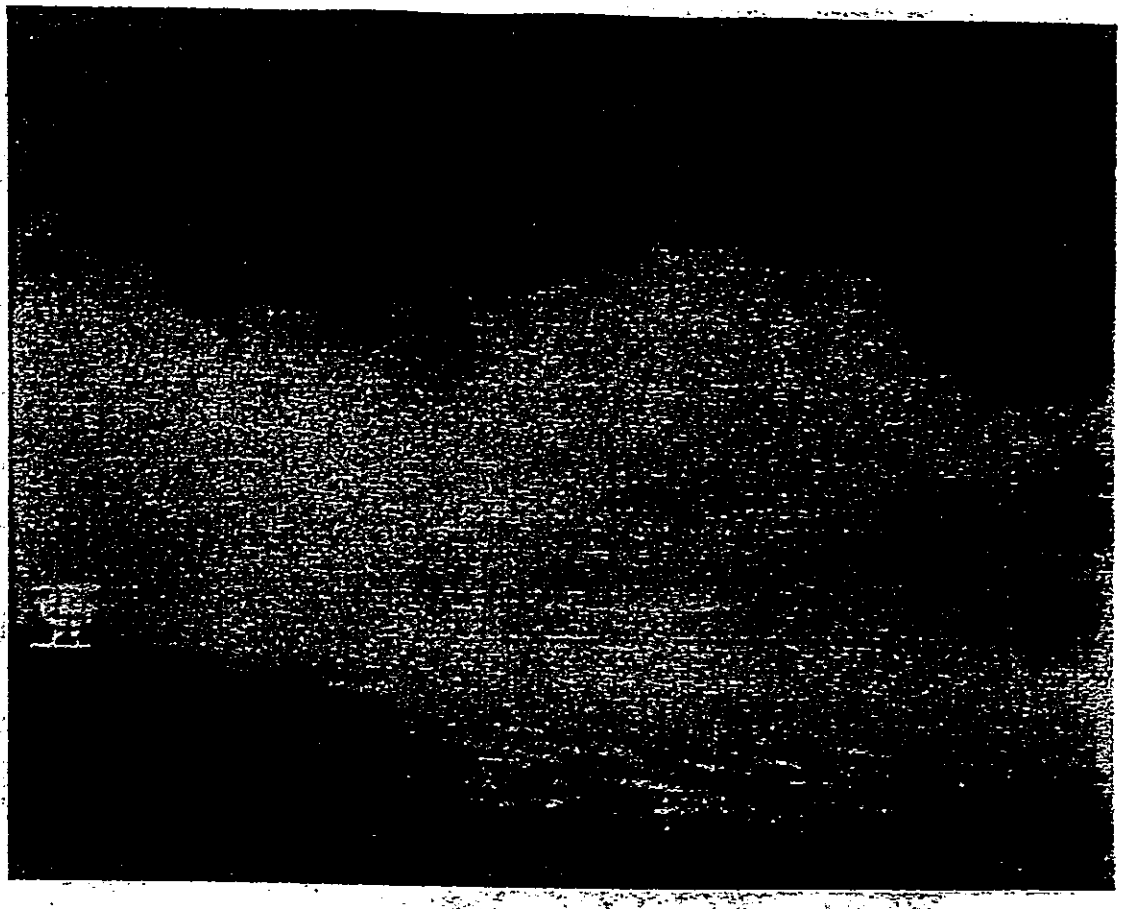
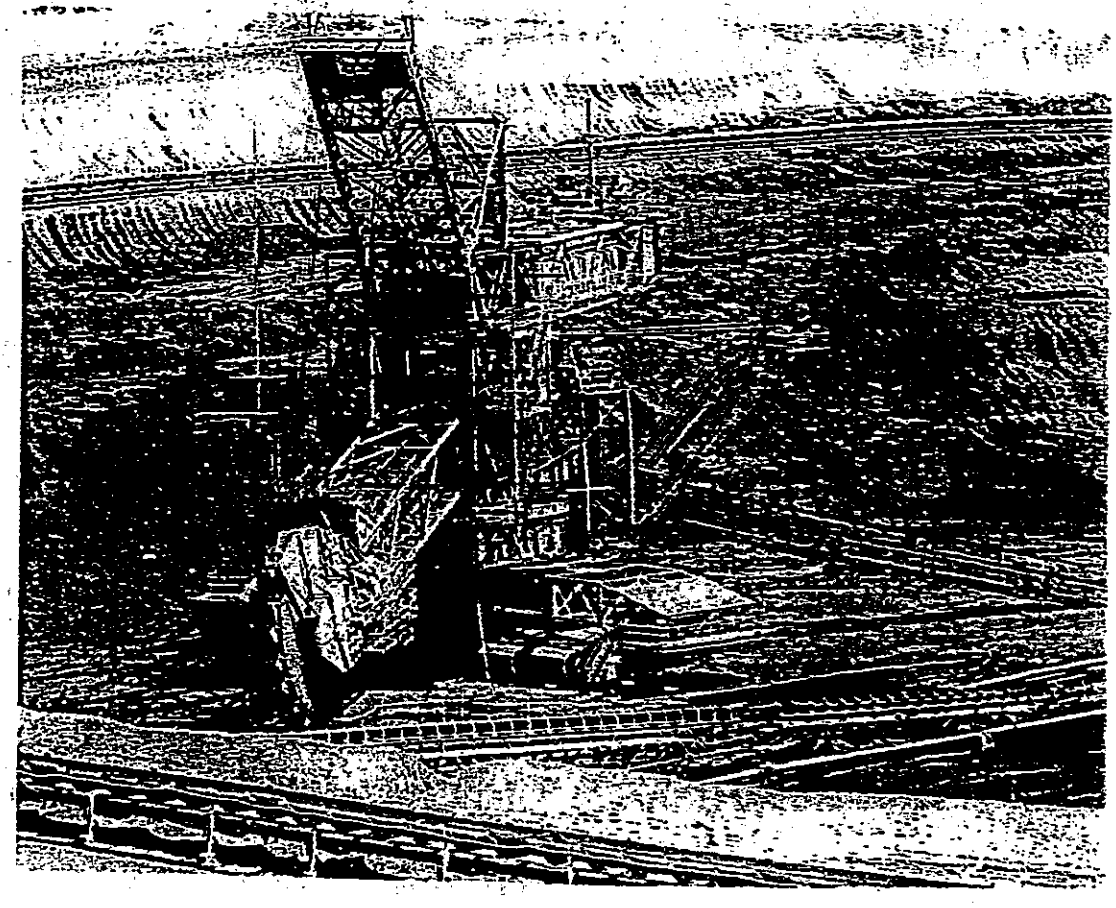


Photo taken by at 1235 hours from the tailend of M620. Note the batter is also now involved in fire.

Post Fire, Fire Investigation Images.



Type: Digital.

Direction: North-West

Taken By:

Description: Dredge 11, post fire.

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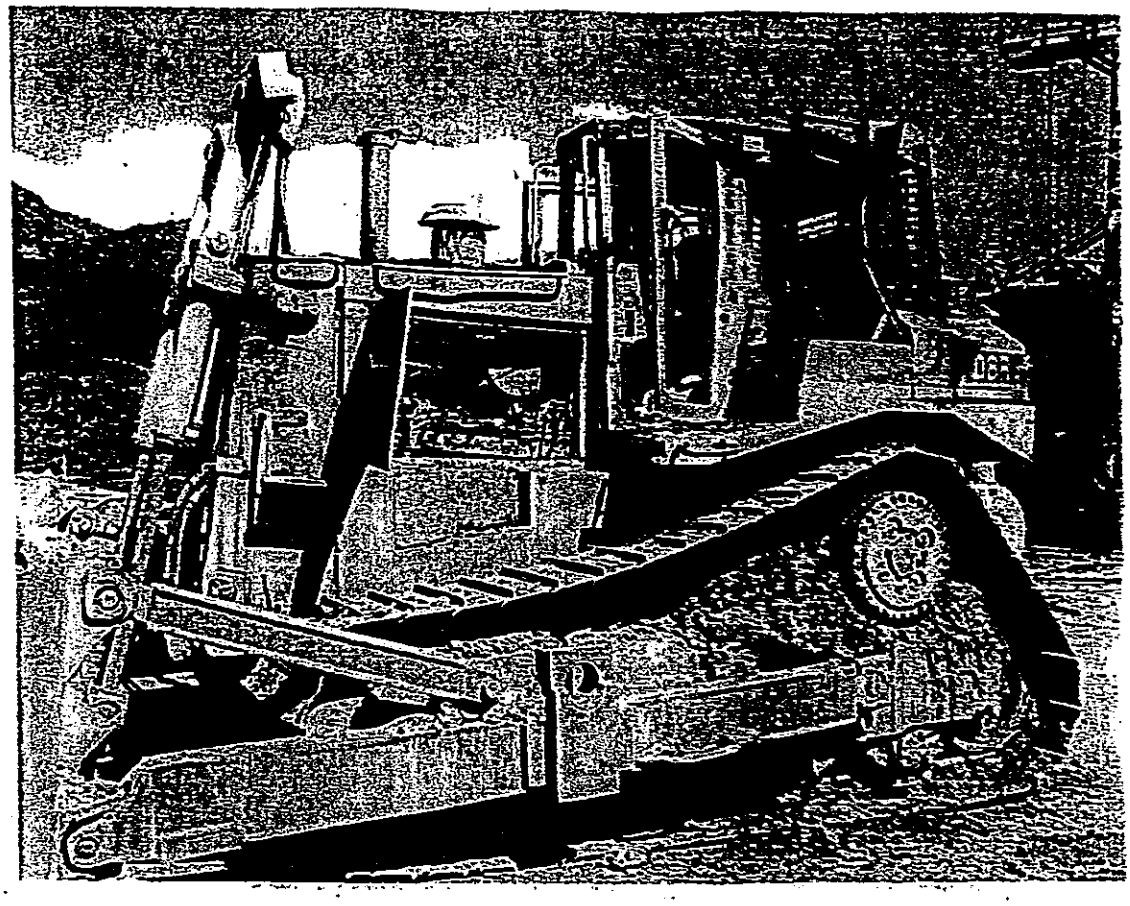

Type: Digital

Direction: West

Taken By:

Description: Destroyed Bulldozer at head of M620.

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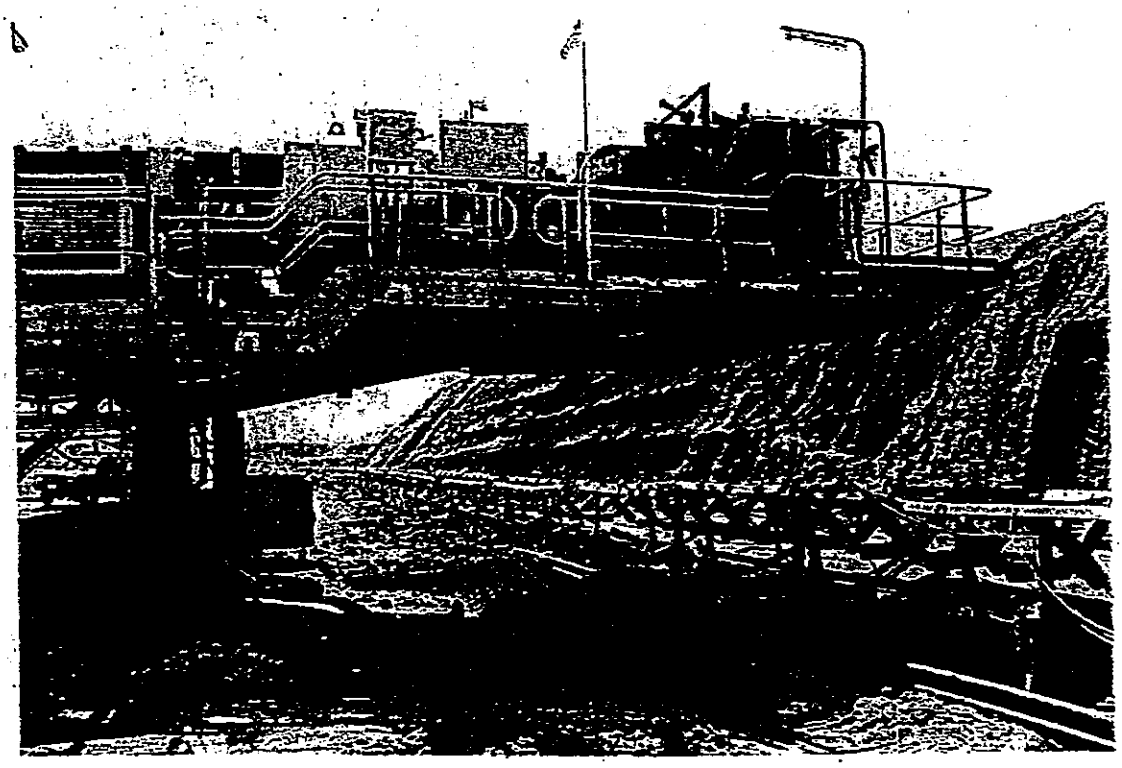

Type: Digital

Direction: East

Taken By:

Description: Destroyed head unit from the M620 conveyor and the M640 conveyor underneath it.

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Type: Digital

Direction: North East

Taken By:

Description: Destroyed head unit from the M620 conveyor.

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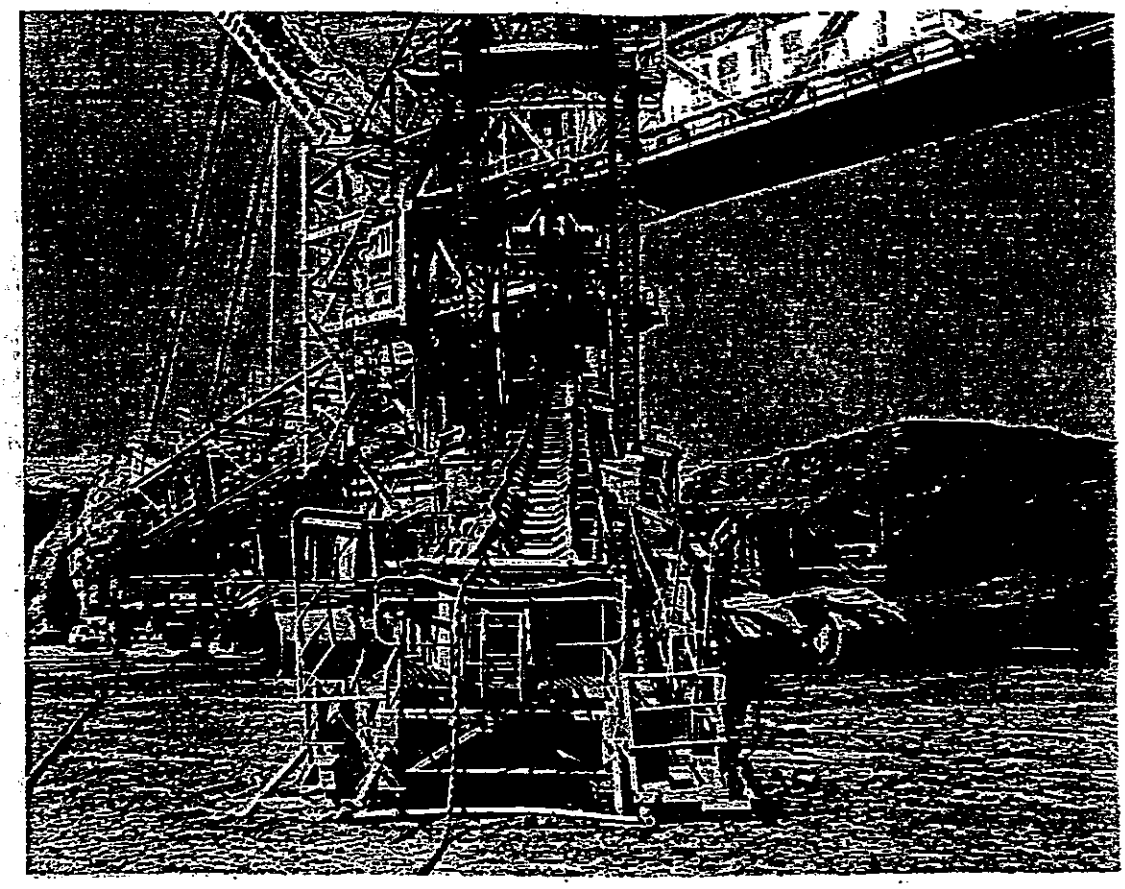

Type: Digital

Direction: South West

Taken By:

Description: North end of the damaged DR 11. This photo shows the conveyor that exits the rear of the unit.

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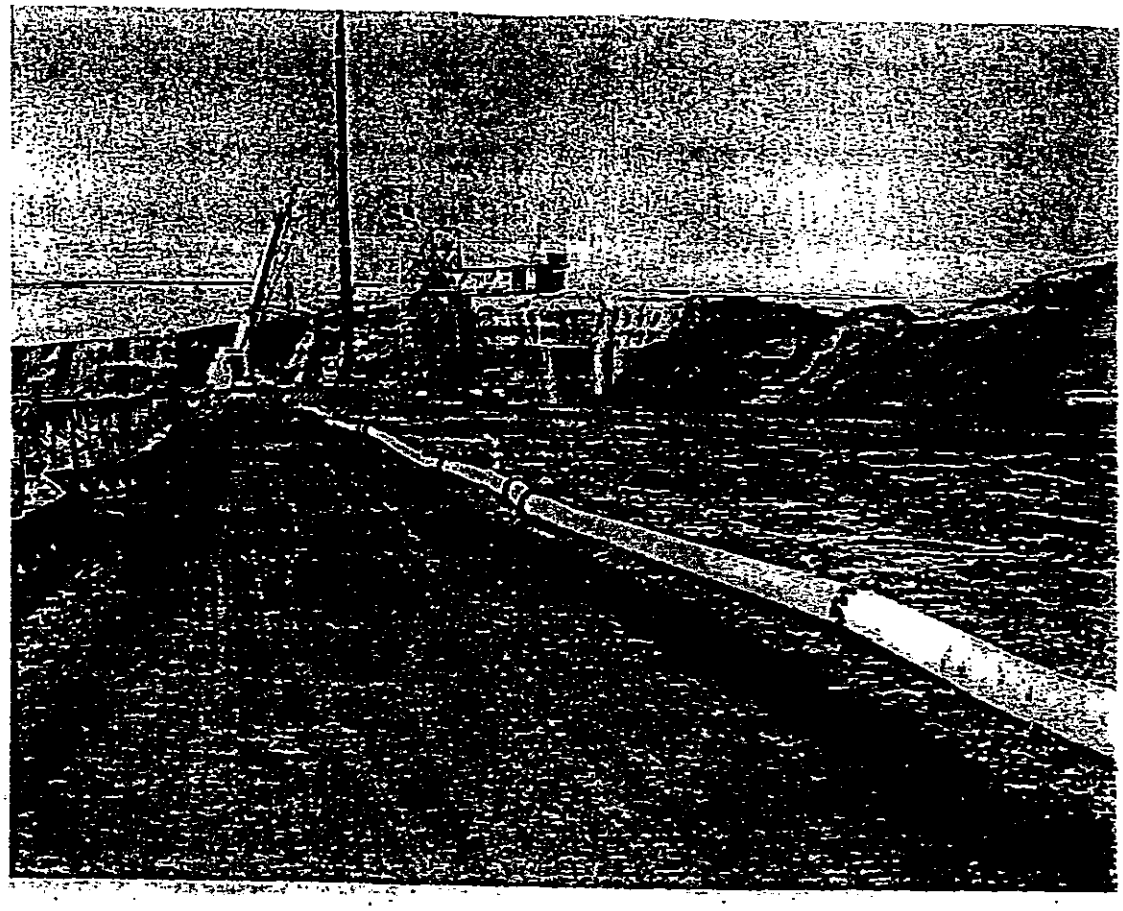
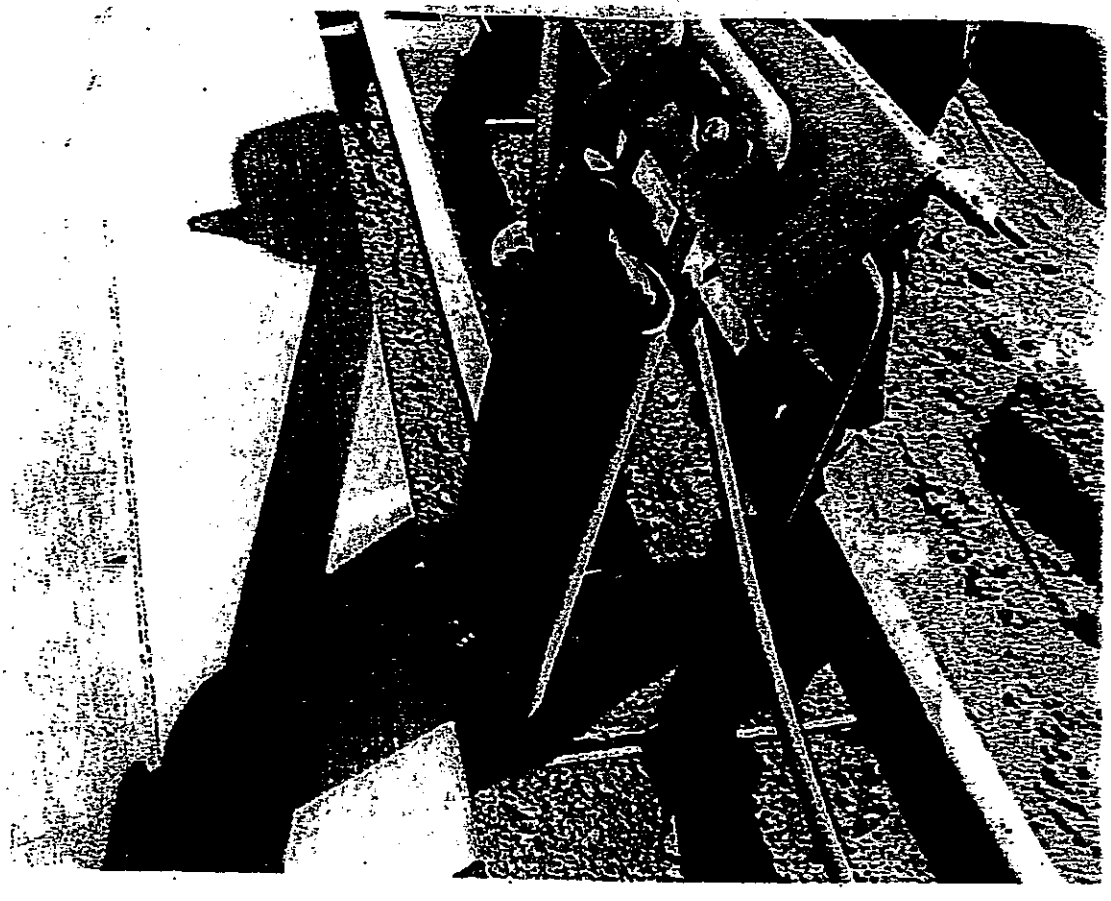


Type: Digital

Direction: South

Taken By:

Description: View of the M620 profile and batter, repair work was underway prior to our arrival on site.



Type: Digital

Direction: South West

Taken By:

Description: Damaged idler on conveyor unit # 157, 852 meters from the head of conveyor M620.

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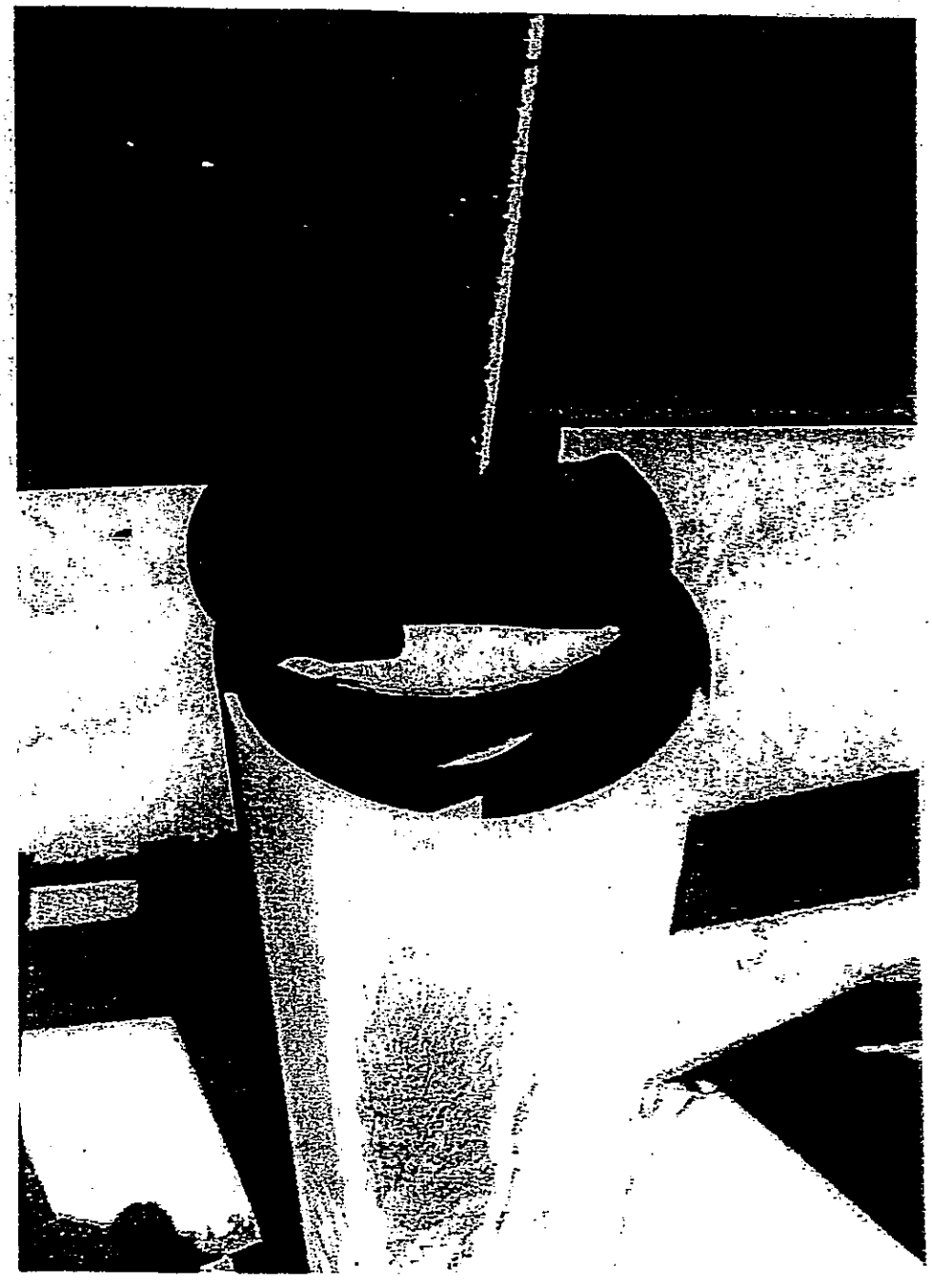
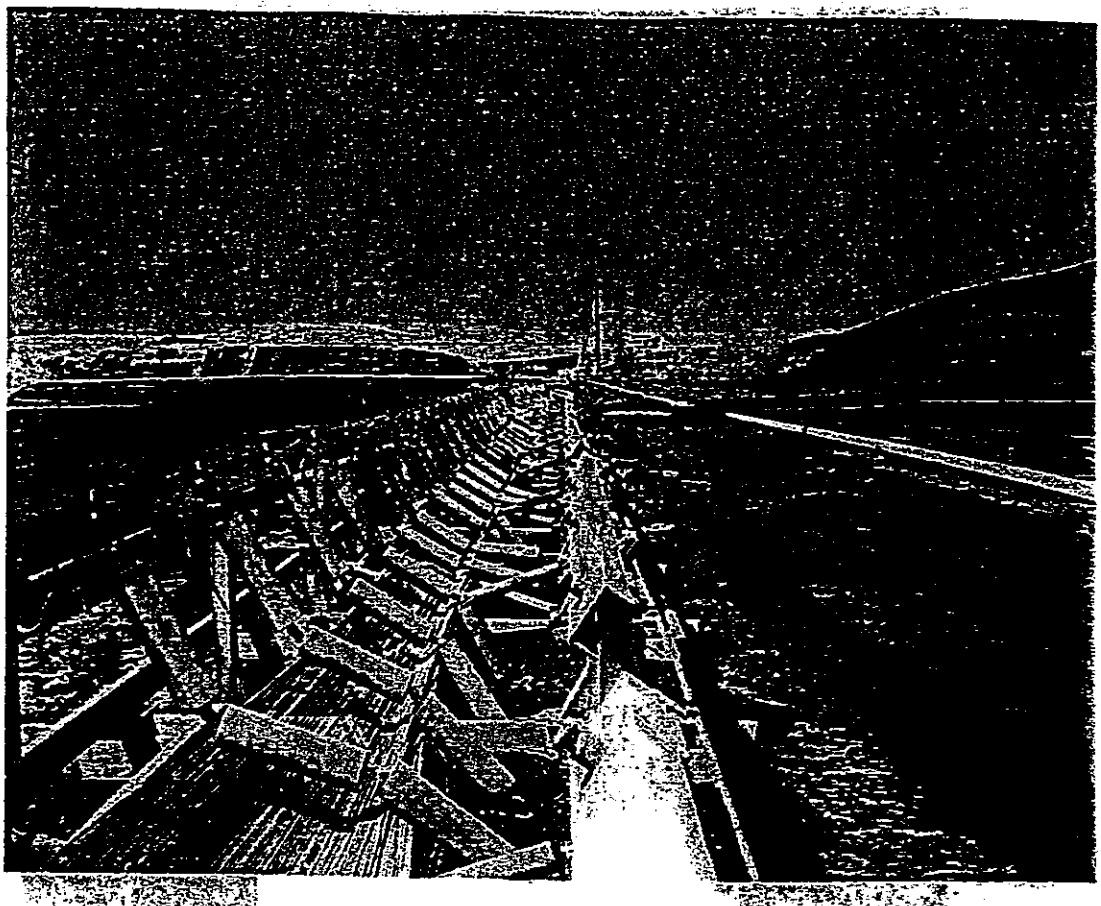


Type: Digital

Direction: South West

Taken By:

Description: Damaged idler on conveyor unit # 157, 852 meters from the head of conveyor M620.



Type: Digital

Direction: South

Taken By:

Description: View of the M620 conveyor, profile and batter, repair work was underway prior to our arrival on site. The feed belt had been removed and topside idlers already released. This picture was taken from the conveyor unit 157 with the damaged idler bearing.

Country Fire Authority
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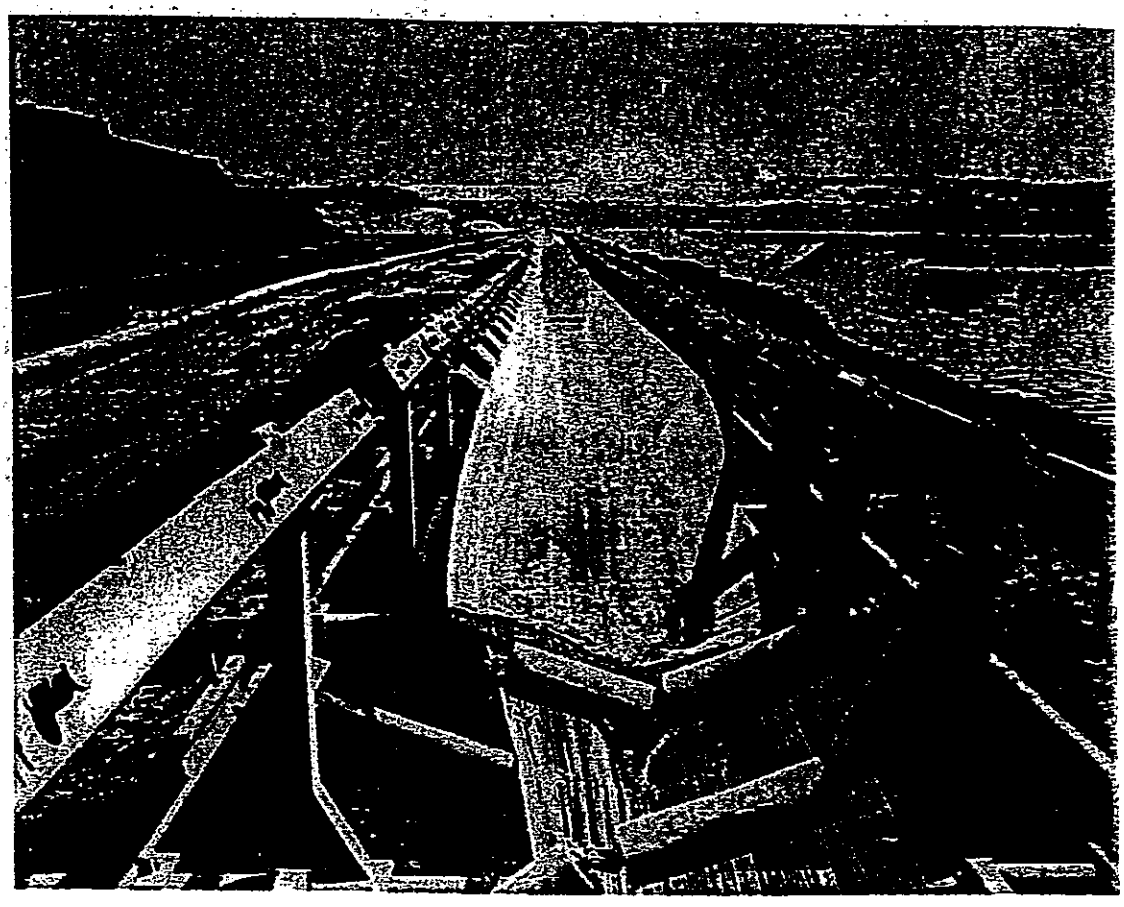
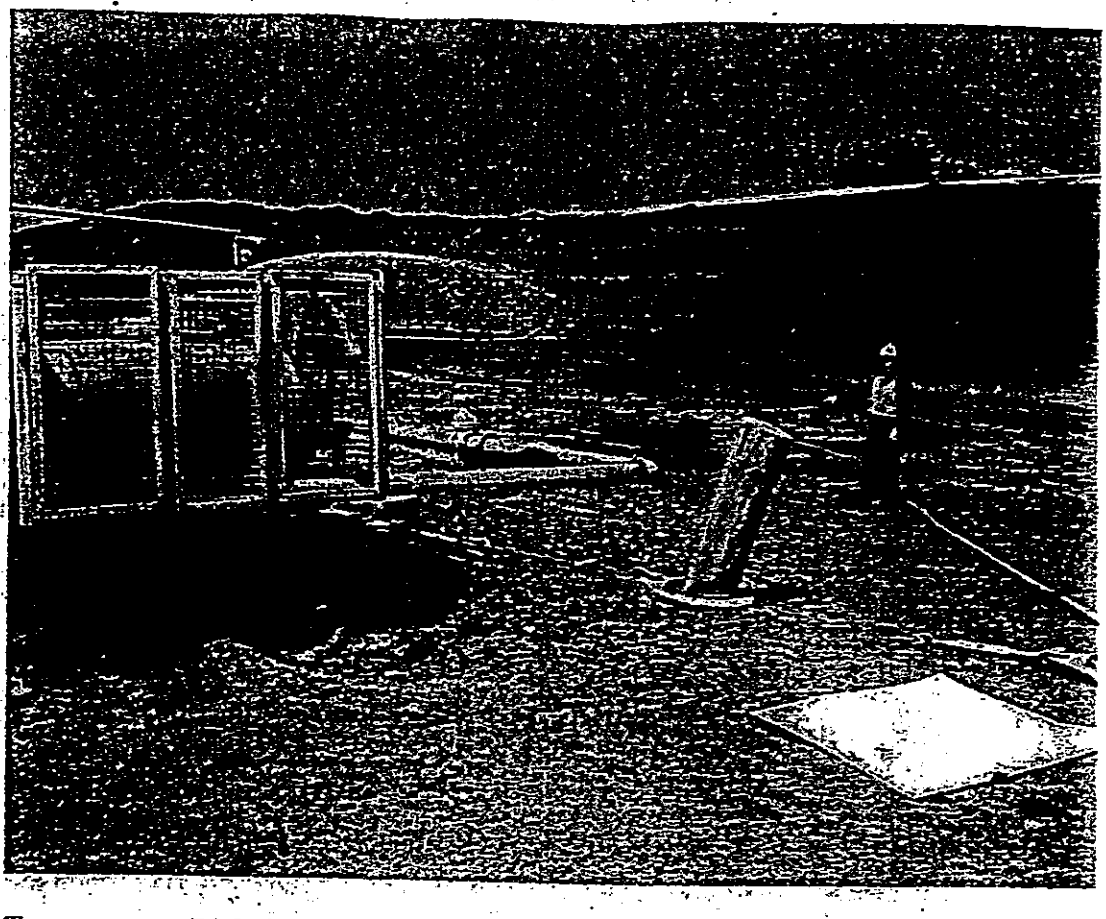


Type: Digital

Direction: North

Taken By:

Description: View of the M620 conveyor, looking towards the tailend of the system. Note where the damaged belts finish, the third idler on the right hand side of the image is the damaged one.



Type: Digital

Direction: West

Taken By:

Description: The initial fire was also on the topside of the M620 conveyor when crews arrived. It was burning between the conveyor and the topside fire service pipe work, as pointed out by

Country Fire Authority
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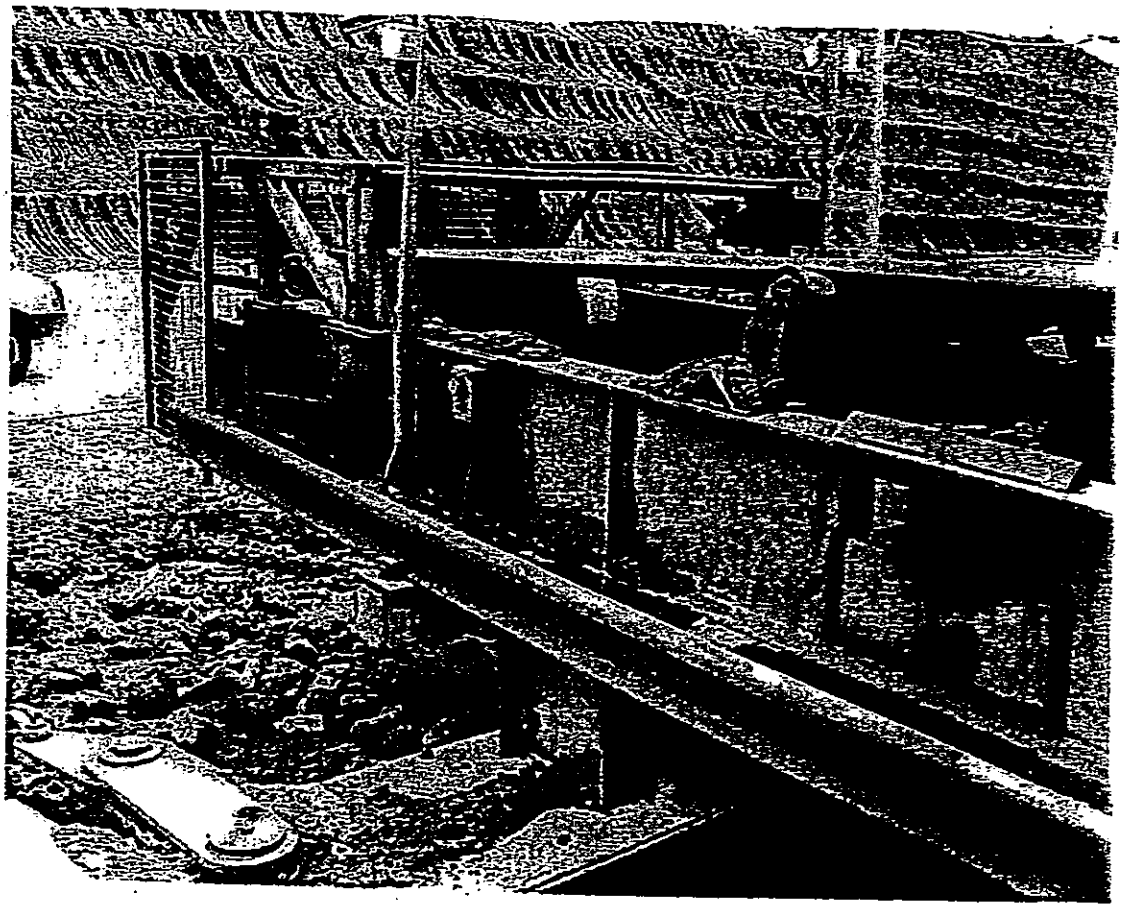

Type: Digital

Direction: North-East

Taken By:

Description: Tailbox of conveyor M620, note the coal build up on the unit. The fire was in the vicinity of this unit when the first crews arrived.

Country Fire Authority
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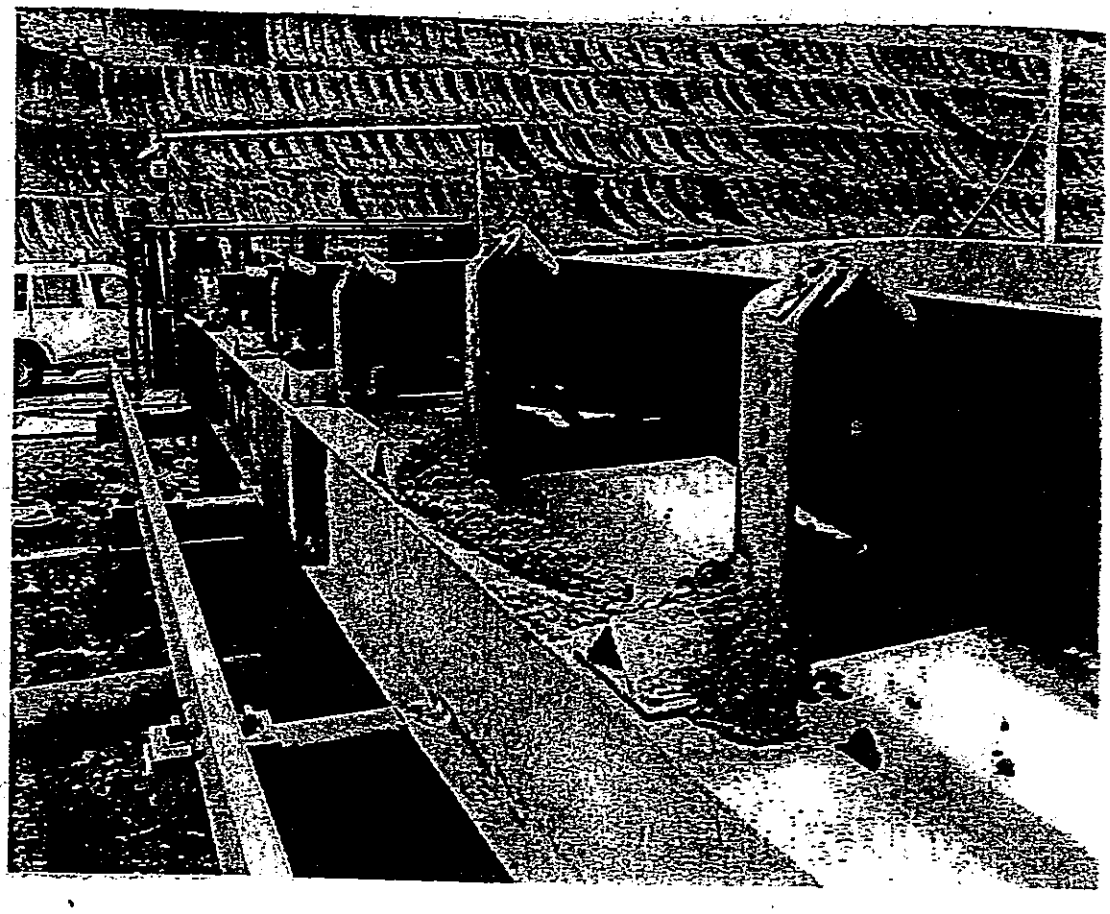

Type: Digital

Direction: North-East

Taken By:

Description: Tailbox of conveyor M620, note the coal build up on the unit.

Country Fire Authority
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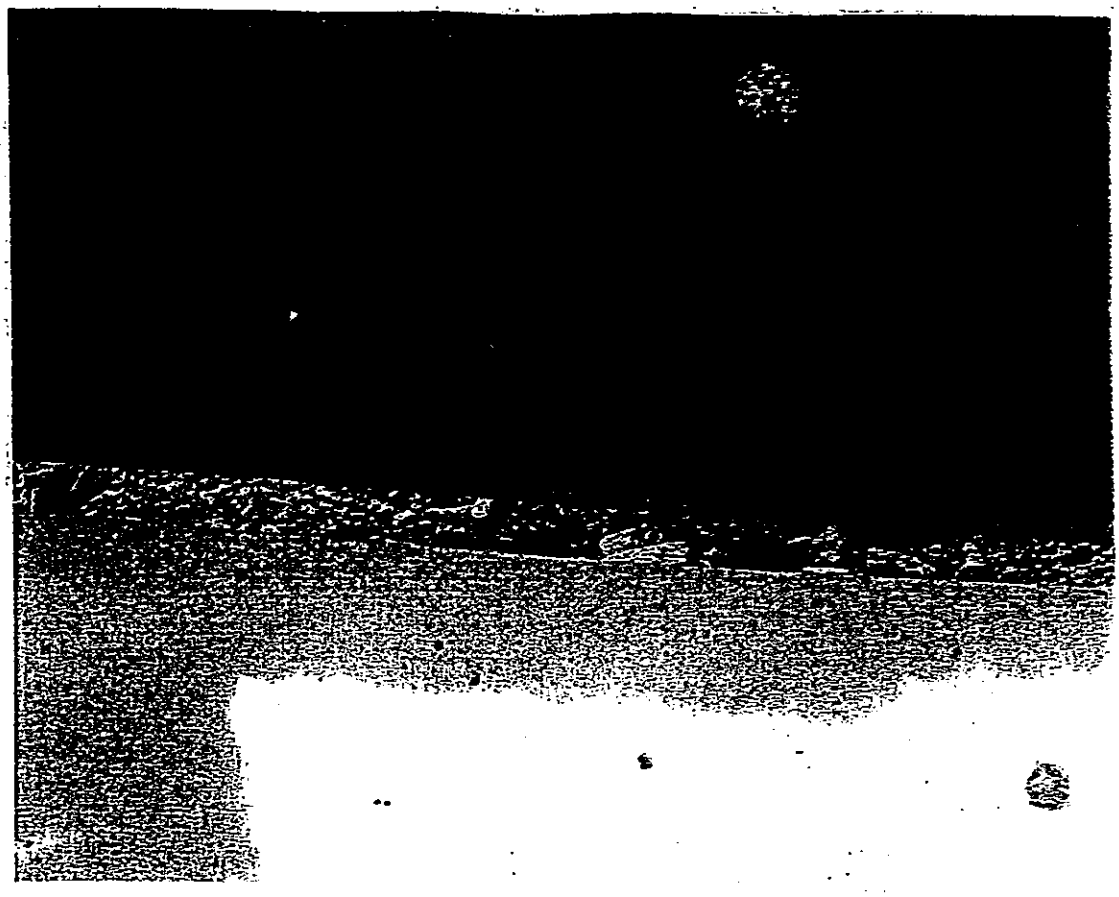
Fire & Incident Reporting System (FIRS) Number: 1074299



Type: Digital

Direction: East

Taken By:

Description: Tailbox of conveyor M620, note the coal build up on the unit.

Country Fire Authority
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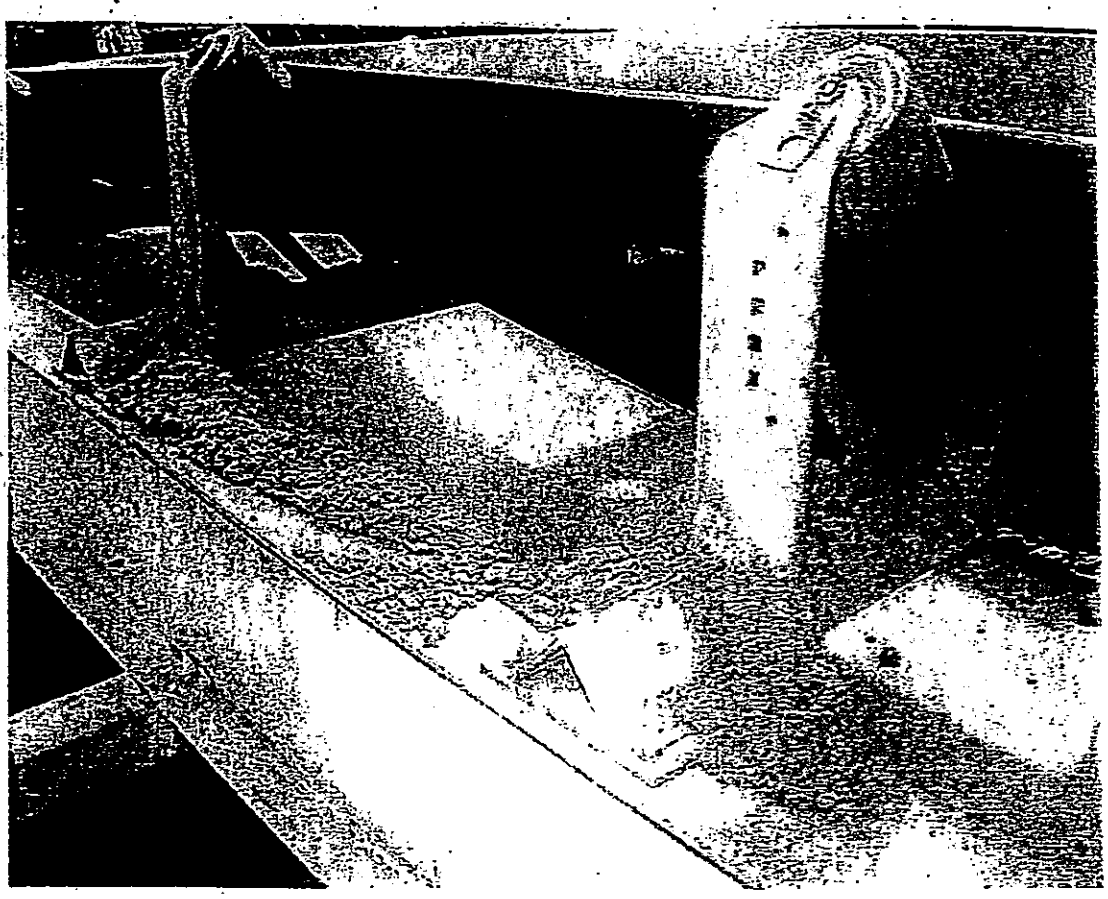

Type: Digital

Direction: North

Taken By:

Description: Tailbox of conveyor M620, note the coal build up on the unit.

Country Fire Authority
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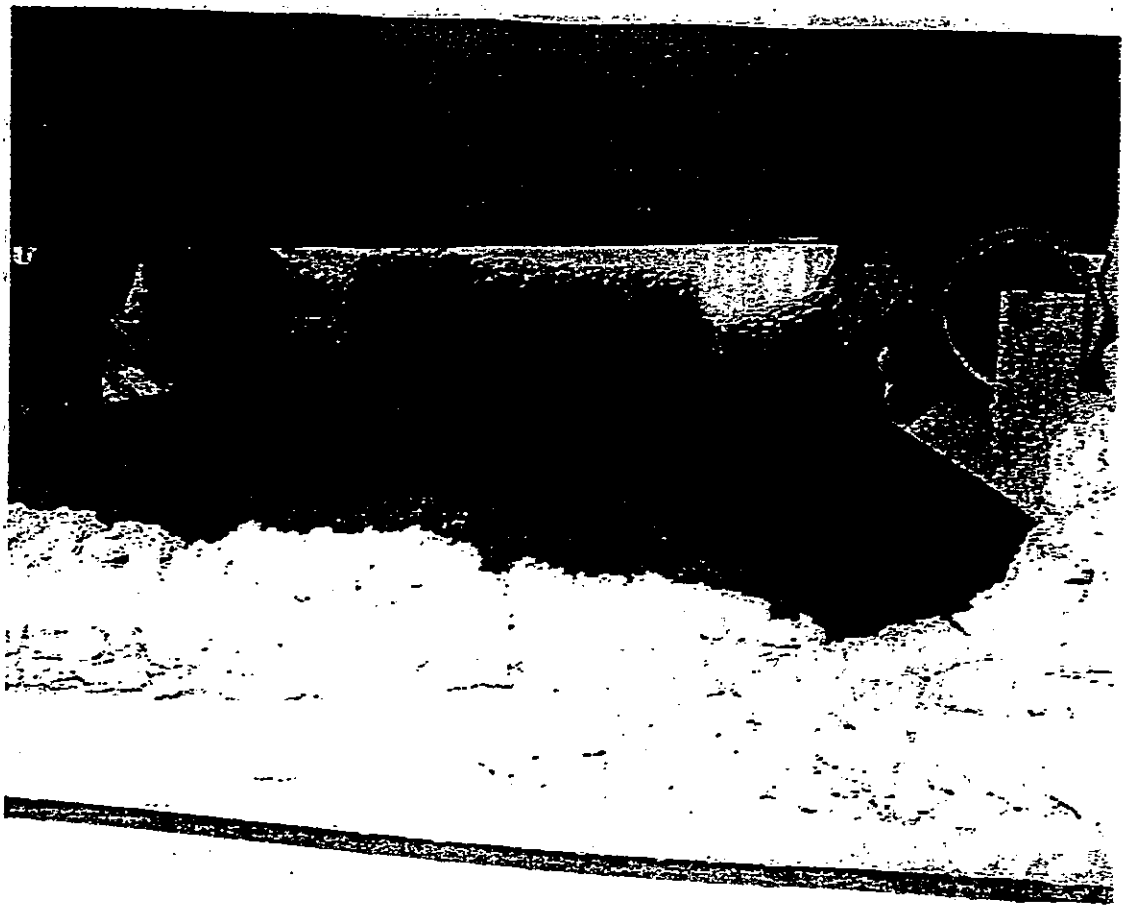

Type: Digital

Direction: North-East

Taken By:

Description: Tailbox of conveyor M620, note the coal build up on the unit.

Country Fire Authority
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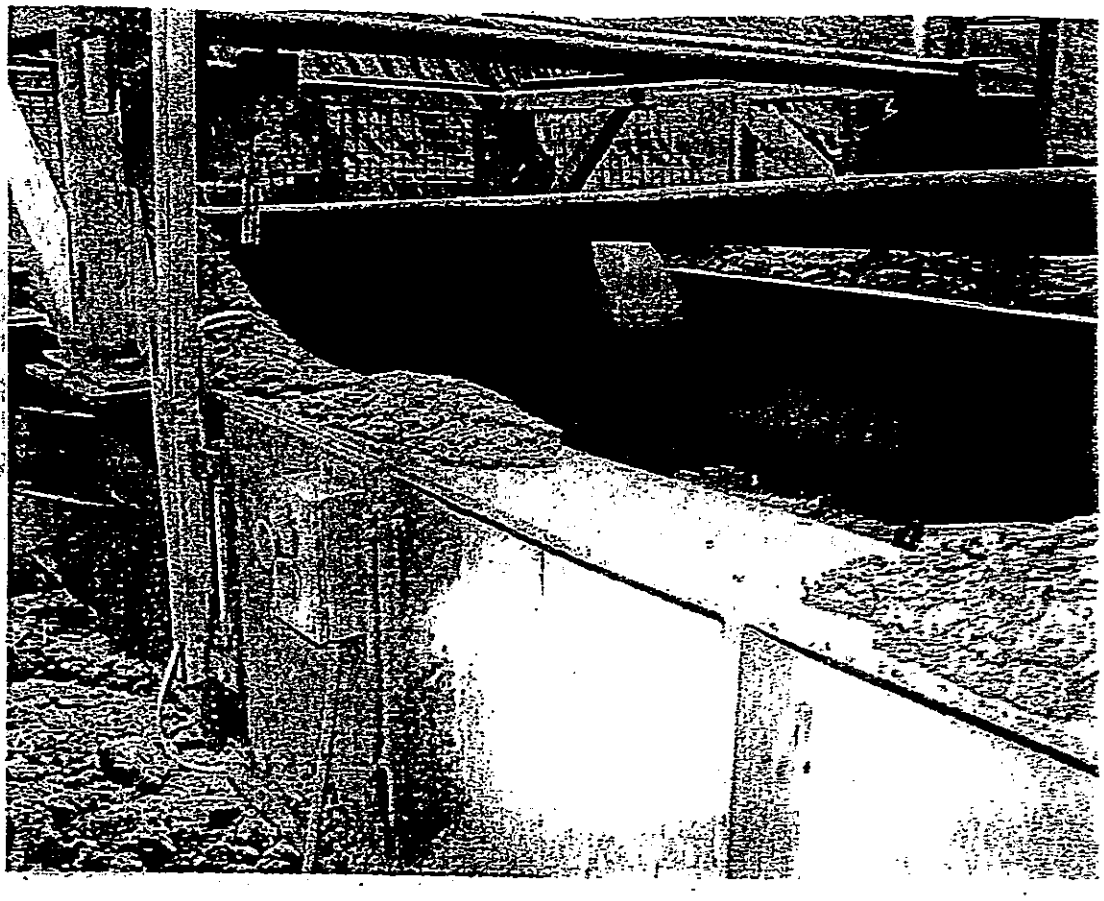

Type: Digital

Direction: North-East

Taken By:

Description: Tailbox of conveyor M620, note the coal build up on the unit.

Country Fire Authority
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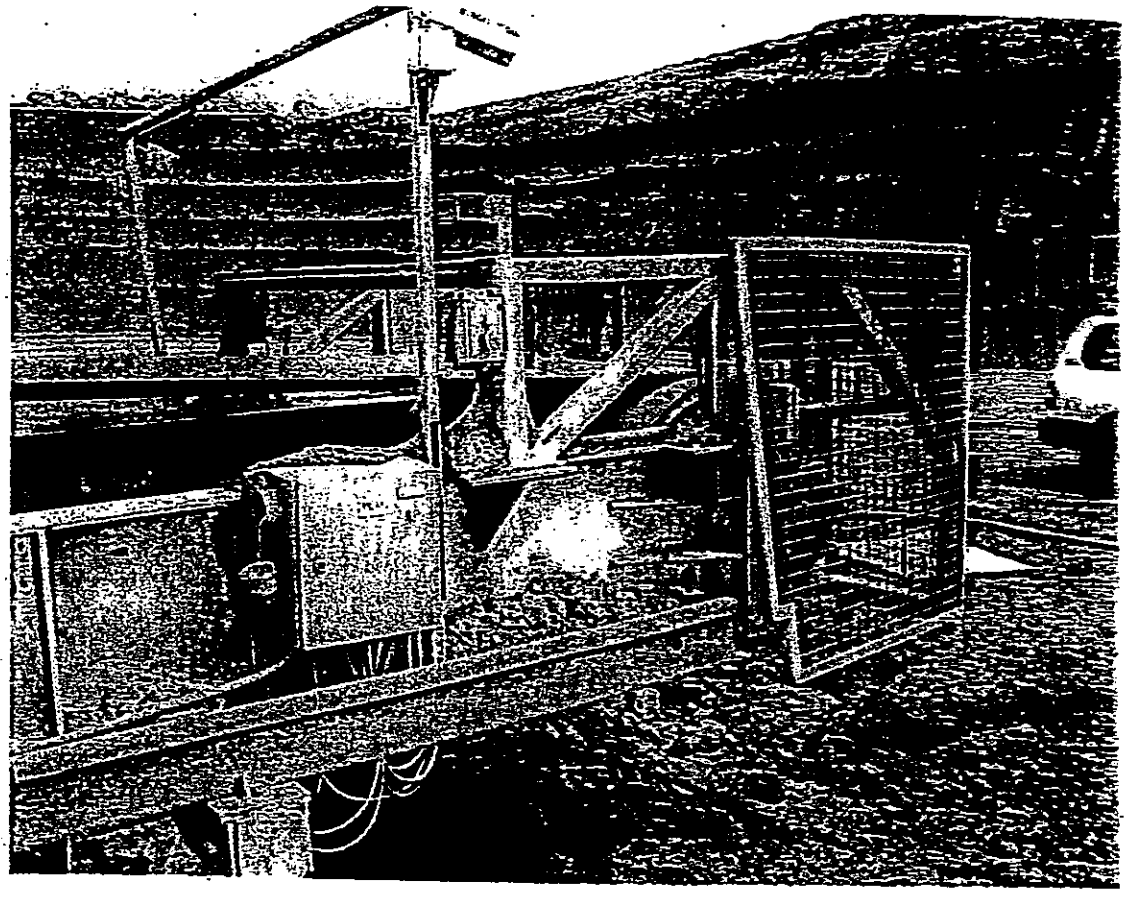

Type: Digital

Direction: North-West

Taken By:

Description: Tailbox of conveyor M620, note the coal build up on the unit.

Country Fire Authority
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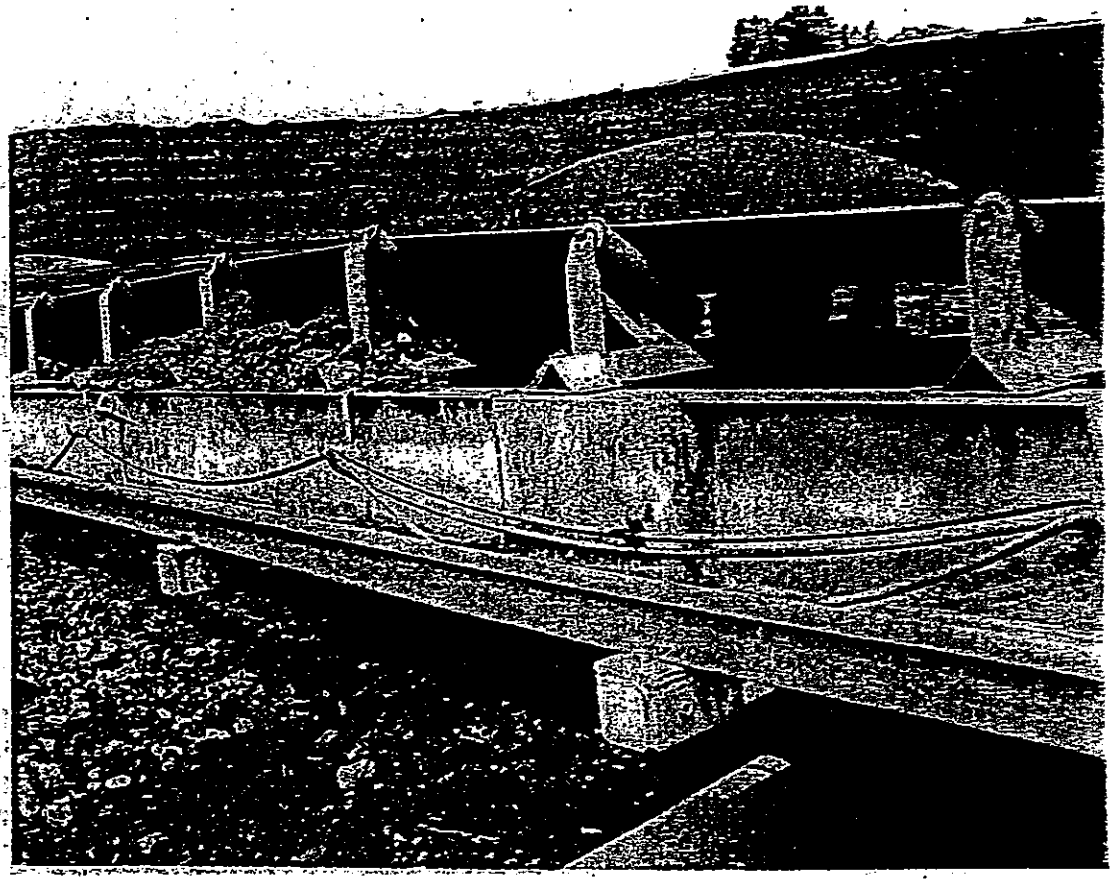


Type: Digital

Direction: West

Taken By:

Description: Tailbox of conveyor M620, note the coal build up on the unit. The fire was in the vicinity of this unit when the first crews arrived.

Country Fire Authority
Fire Investigation Report
Fire & Incident Reporting System (FIRS) Number: 1974299

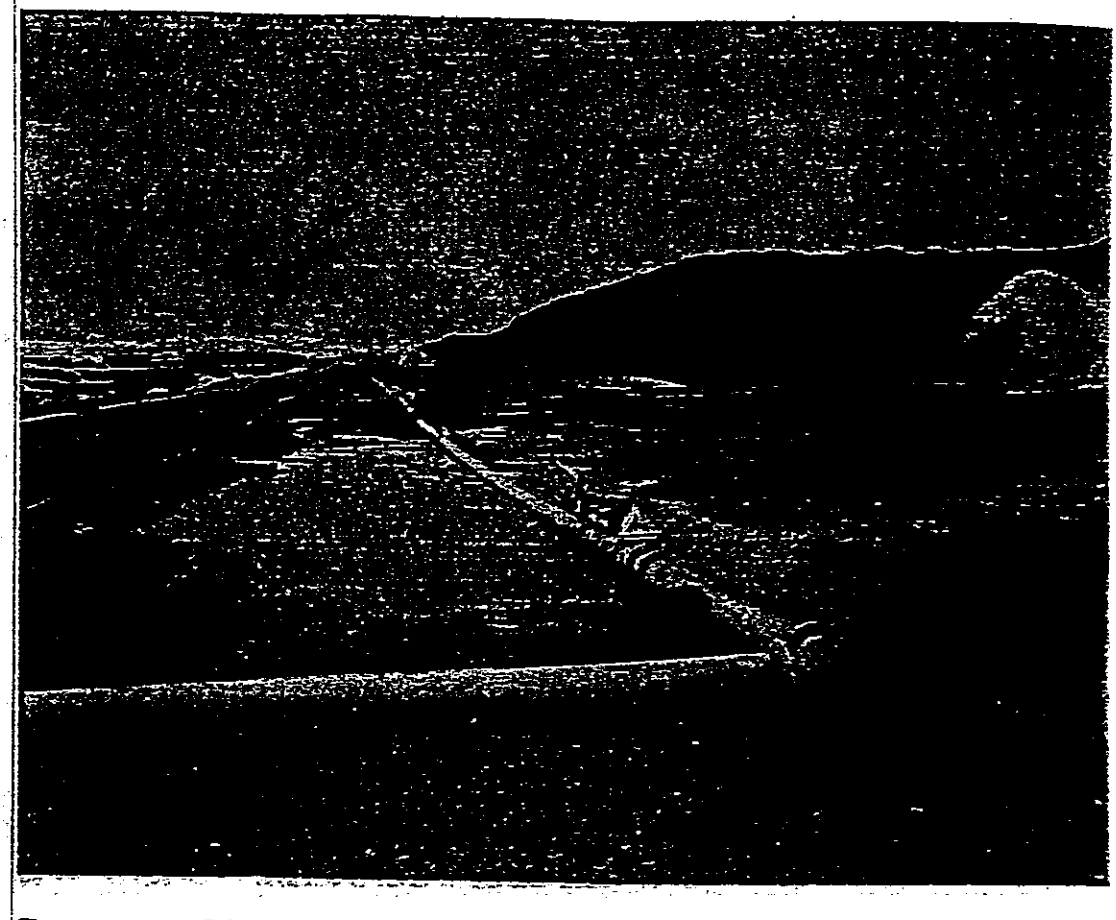
Type: Digital

Direction: South

Taken By:

Description: Tailbox of M620 looking towards the head.(south) There was loose coal on fire on this side of the conveyor when crews arrived. Once again note the build up of coal debris on the plant.

Country Fire Authority
Fire Investigation Report
Fire & Incident Reporting System (FIRS) Number: 1874299



Type: Digital

Direction: South

Taken By:

Description: The initial fire was also on the topside of the M620 conveyor when crews arrived. It was burning between the conveyor and the topside fire service pipe work.