

## 2<sup>nd</sup> International Mines Rescue Conference 2005



### Emerging Mine Inertisation Philosophy carried out in the United States of America



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### **Glassport, Pennsylvania USA**

#### **Introduction:**

Historically the process of combating combustion episodes in the United States of America was similar to like approaches throughout the world in the latter part of the 20<sup>th</sup> Century. Events as they occurred saw intervention of water, nitrogen, and carbon dioxide all in varying forms that matched the event.

The early 21<sup>st</sup> Century saw the first successful utilization of a GAG system in combating an event in America. This was a collaborative effort of:-

- CONSOL Energy (Major Coal Producer in the US and owner of the mine)
- Queensland Mines Rescue Service (Custodian & operator of the GAG system)
- MICON (Specialist Mining Contractor)
- MSHA (US Department of Labor Mine Safety & Health Administration)
- West Virginia Office of Miner's Health, Safety and Training. (State Government)
- (NIOSH (The National Institute of Occupational Safety and Health)
- UMW (United Mine Workers union representing the workers)

This single event changed the scene for the combat of combustion events within the United States and set the stage for a multi disciplined approach to the response systems available.

The mine demand for inert atmospheric conditions meant that the GAG system delivered just over 234 million cubic meters of exhaust gases underground over a 21 day period, then 36.27million cubic meters of gaseous nitrogen was delivered over 60 days by Weatherford Membrane Nitrogen Units to maintain an oxygen depleted zone.

#### **Today:**

The result of the event mentioned above saw the birth of a new company (PHOENIX First Response) which initially mirrored the utilization of a GAG system operated in Australia (Queensland Mines Rescue Service) and that of South Africa in the 1980's and Poland as early as the 1970's.

The evolutionary process of the company saw the application of proven concepts throughout the world in a mines rescue sense with a mutual assistance concept being the baseline in conjunction with a risk based logic approach to unplanned events.

The PHOENIX First Response concept illustrates that with one telephone call a mine will receive a multi faceted approach to a combat philosophy that would match the correct system to the need as well as expertise to support the lead combatant agency.

The philosophy is a lead company (***PHOENIX First Response***) activating an entire system not just a Jet engine. The partners within the system currently to date are:- ***WEATHERFORD*** (Nitrogen membrane specialists), ***MICON*** (polyurethane specialists {seals and surface isolation}), ***DRAGER*** (Breathing Apparatus Group), ***Fairmont Supplies*** (support equipment and apparel specialists), ***Industrial Scientific*** (Gas monitoring equipment), ***US Foam*** (nitrogen filled foam).



**GAG System in operational test mode**



**Mine portal seal utilizing PUR  
Note: Yellow Nitrogen hose**

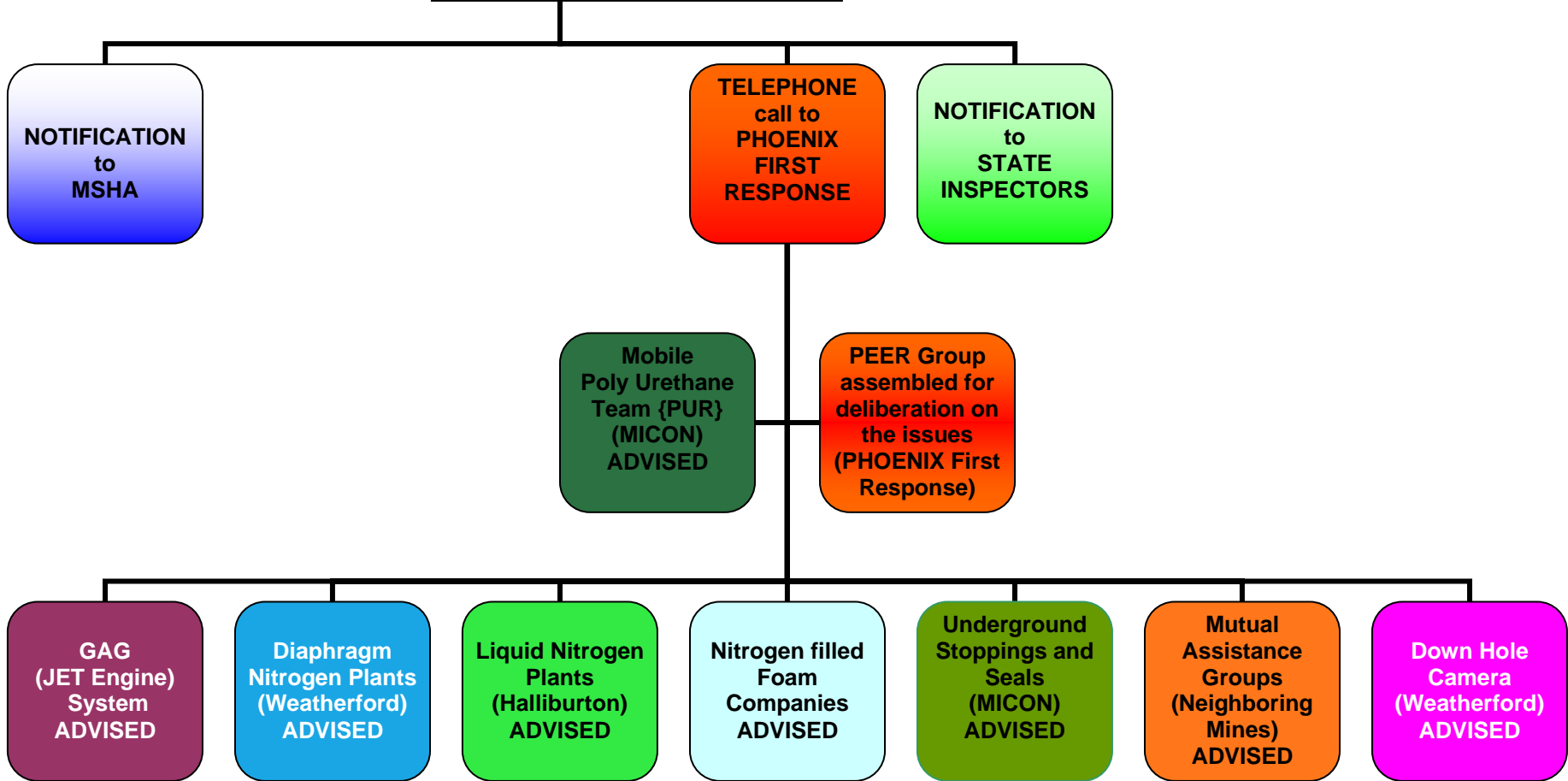
The key for success is echoed in PHOENIX First Response's mission statement to provide timely, rapid intervention to thermal events that impact the mining industry in the United States and to supply a single contact point for response to mines in dire need of assistance 24 hours a day 7 days a week.

The process is a proven approach with several incidents now having utilized the system to achieve a worthwhile resolution.

The five that spring to mind utilized a wide range of agencies including the GAG system, nitrogen separation, liquid nitrogen and nitrogen filled foam. In fact, the most recent event utilized nitrogen membrane technology and, due to the rapid intervention, was back in full production in one week.

The following diagram illustrates how the process and expertise of the partnering companies is upgraded to an active role when required and instructed from the mine after consultation.

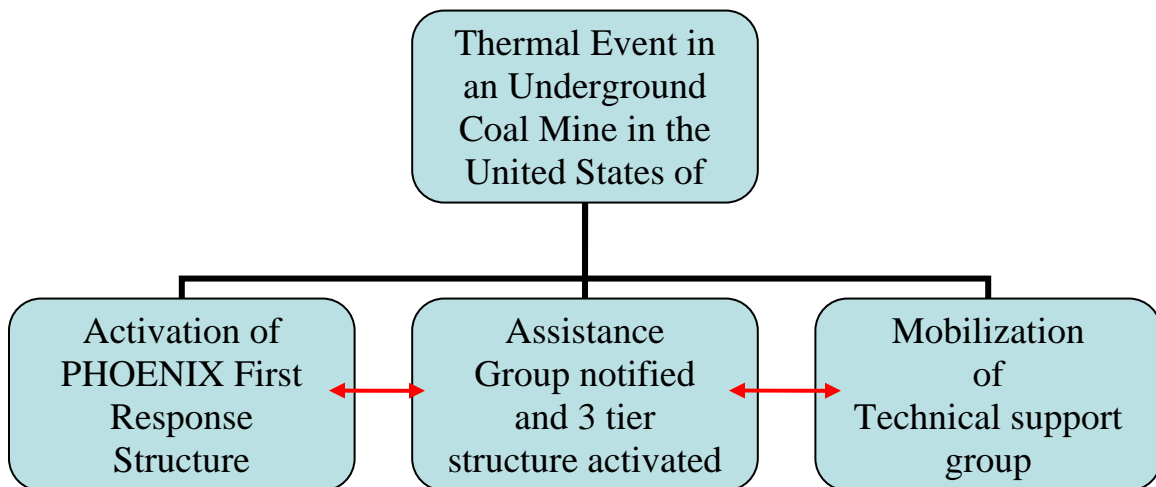
# THERMAL EVENT IN AN UNDERGROUND COAL MINE



## How does this work?

The initial telephone contact to PHOENIX First Response puts all partnering agencies to an alert phase. PHOENIX management interacts with mine management and MSHA as to the identified problems and issues and advises as to the most appropriate level of response recommended after the peer review committee gives its endorsement and risk mitigation principles have been completed.

Singularly PHOENIX First Response has in excess of 90 years of mine fire fighting experience and collectively with the peer group a 200 year knowledge base is available.



The next phase aligns with the actual response and MSHA (the legislator's representative) to formulate a documented plan sequential in style with risk mitigation in mind.

Downstream from the primary event is a stepped support resource base that moves through phases as they are required. For example:-



Weatherford's mining expertise has been utilized on several occasions **PinnOak Pinnacle Mine** Total volume pumped- 3,355,546<sup>3</sup>m. Unit 1 pumped for 56 days at average of 22.65<sup>3</sup>m/min Unit 2 pumped for 87 days at average of 14.16<sup>3</sup>m/min. **Oxbow Mine** Pumped 25.49<sup>3</sup>m/min for two days. **Loveridge Mine** 1<sup>st</sup> Pumped 60 days, total volume 3,369,705<sup>3</sup>m. **Buchanan Mine** Unit 1 pumped 42.47<sup>3</sup>m/min for 8 days and Unit 2 pumped 15.57<sup>3</sup>m/min for 12 days.

This approach will step up to a subsequent event should that be necessary even in a global sense. This process is also applicable to other partner entities such as PHOENIX First Response, MICON, Fairmont Supplies, Drager and Industrial Scientific, etc.

## **CASE STUDY**

### **The Event**

A possible frictional ignition occurred with an associated roof fall that caused an elevated level of methane to be present in the longwall face area. The result was an initial section evacuation with some minor associated issues.

The water supply was isolated to the section as the crew left the affected zone but there was no clear or apparent reason for this action.

The next event was total mine evacuation due to elevated levels of carbon monoxide and the presence of high levels of methane and associated carbon dioxide.

The mine management team reacted quickly to prepare to seal the mine and all plant, equipment and supplies were positioned in place if required at all (9) mine portals. The corporate management infrastructure was assembled to gather and collate information as it became available.

Approximately three hours into the event a telephone call to PHOENIX First Response was made and representation was directed to attend corporate headquarters for further briefings.

All partner companies were notified an incident was being attended to and further information as it became available would be relayed.

The decision to seal the mine was given approximately 26 hours into the event as a controllable condition was unlikely at that stage.

### **The Planning Phase**

Several meetings followed with seven different tasks being allocated:-

1. The Hazard management plan was set up with training certification being established to conform with the expected conditions on site.
2. Underground Mine Condition Monitoring was established to develop a history.
3. A more secure (air tight seal) of the mine was commenced around the clock.
4. Nitrogen Units were called for via the PHOENIX First Response network.
5. Nitrogen filled foam was likewise activated.
6. International contact to Australia and Poland to assist with potential use of multiple GAG units was made.
7. A management structure for the event was established with the appointment of a logistics head person to report through.

Peripheral support was in the area of sustenance (3 meals a day), clothing, oxygen supplies, plant and equipment, security and lighting.

This activated the local State Police, Fairmont Supplies, NIOSH, Halliburton and Nitrogen support plants.

1. *TRAINING:-*

A system for recording all training was set up and involved any person entering mine property to be hazard trained. Further to this training was given to all responding agencies as to the physical location they may find themselves working including but not limited to safety apparel, footwear, hearing protection, fall arrest devices, entry permits and eye protection.

2. *MONITORING:-*

Three separate systems were utilized namely hand held instruments, samples conveyed to a gas chromatograph and fixed systems.



Magnehelic Gauges



TMX 412

Hand held instruments were assigned to mines rescue team members whose role was to ensure a safe atmospheric zone around the portals and act as an escort for all people entering that work area that had been duly trained and authorized to do so.

Samples were taken from lines established by the mines rescue teams and extended to an atmospheric safe zone. The lines had water traps built in and insulation added due to the freezing conditions that were often a feature especially at night.

The person appointed for this task was trained and under constant supervision of the mines rescue person allocated to the site. The samples were bottle samples identified by a tag affixed and were initially taken every half hour on all sites and then evolved to hourly samples at selected sites.

The fixed monitoring points were observed and catalogued initially every half hour then hourly on all sites. After each observation a telephone call to the incident management team was made by the allocated personnel housed in close proximity to the fixed system visual display units.

### 3. PORTAL SEALING:-

The emergency seals of the mine were in essence not substantial enough to resist what eventually recorded almost 10 inches of water gauge pressure exerted by the gas expansion underground.

Further to this a relief valve was fabricated utilizing a plastic conduit pipe with a pre-weighted (ball valve) arrangement and electrically earth bonded.

{see adjacent photograph}.

The application of the initial sealing was a MICON product MPG 550-10 of weighted polyurethane. This was upgraded to a denser RokLok 70 to withstand the extraordinary pressures that eventually settled throughout the mine.

The seals were all built utilizing an agreed planned approach which had pre requisite safety measures inbuilt.

However, even with this in place each task was risk assessed and as required additional hazard controls were added on site as appropriate.

Due to the oxygen deficiency in some areas the trained technicians were instructed to wear appropriate breathing apparatus and were aided by mines rescue team support. The process was carried out initially over a continuous 24 hour cycle that later abated to repairs and maintenance as required.



**From an elevated position**



**Sometimes even in the snow**

The mandatory mine policy with regard to PPE was hard hat, metacarpal gloves, metatarsal boots, safety glasses (if not wearing breathing apparatus) and long sleeves.

#### 4. NITROGEN USE:-

Through the PHOENIX First Response strategy a telephone call was placed to Weatherford to activate the Nitrogen membrane unit to attend the mine site to accelerate the reduction of oxygen underground thus creating an inert atmospheric condition and reducing the risk of continued combustion activity.



To enable rapid installation a foot print for the unit was given to the project coordinator and arrangements to receive the unit took place including delivery pipe line sizes and ground preparation.

A Weatherford contact person was sent to the mine site prior to the installation to answer any questions before the arrival of the systems and to aid in the site preparation to ensure a speedy connection to the coal mine.

Technicians were assigned to each portal site to afford a 24 hour per day operational status and relief of operators and assistants was pre arranged including housing, meals, transport and communications.

#### 5. NITROGEN FILLED FOAM USE:-

PHOENIX First Response arranged for specifications and availability of nitrogen filled foam from two sources to respond to the coal mine and attend to the introductions to the site supervisor for further involvement.

The process has been tested by NIOSH and is currently undergoing upgrades to add additional controls to better respond to events underground in the United States of America. The process was utilized for a combustion event in the latter part of 2004 with good effect as was discovered upon re-entry.

The application of nitrogen filled foam working with the injection of gaseous nitrogen was assessed as being a desirable two attack method being controllable and predictable. Flow patterns of foam using underground seam horizons could be steered to the event site and void space filling utilizing the gaseous product would only enhance this activity.

## 6. INTERNATIONAL RESPONSE:-

Two GAG systems were prepared for application should the need arise at two separate mine portal locations.

A preliminary risk assessment identified the potential need for additional manning support. This led to requests with regard initially as to the availability of both The Polish Central Mines Rescue Station and The Queensland Mines Rescue Service if required for response. Both organizations have had extensive experience with the GAG application to mine fires.

Two portal site locations were identified and prepared to receive the systems.



Conditions underground were ever changing and the coal mine owners requested that the support manning be summoned.

The result was that in early March the Australian contingent was on their way to the United States with their team leader arriving a day early to assist with the preliminary risk assessments. The team arrived the next day and at the mine owners direction were housed in Pittsburgh due to the shortage of accommodation in the nearby region.

The plan was to bring them forward as required and relocate other mine staff to vacate accommodation for the team.

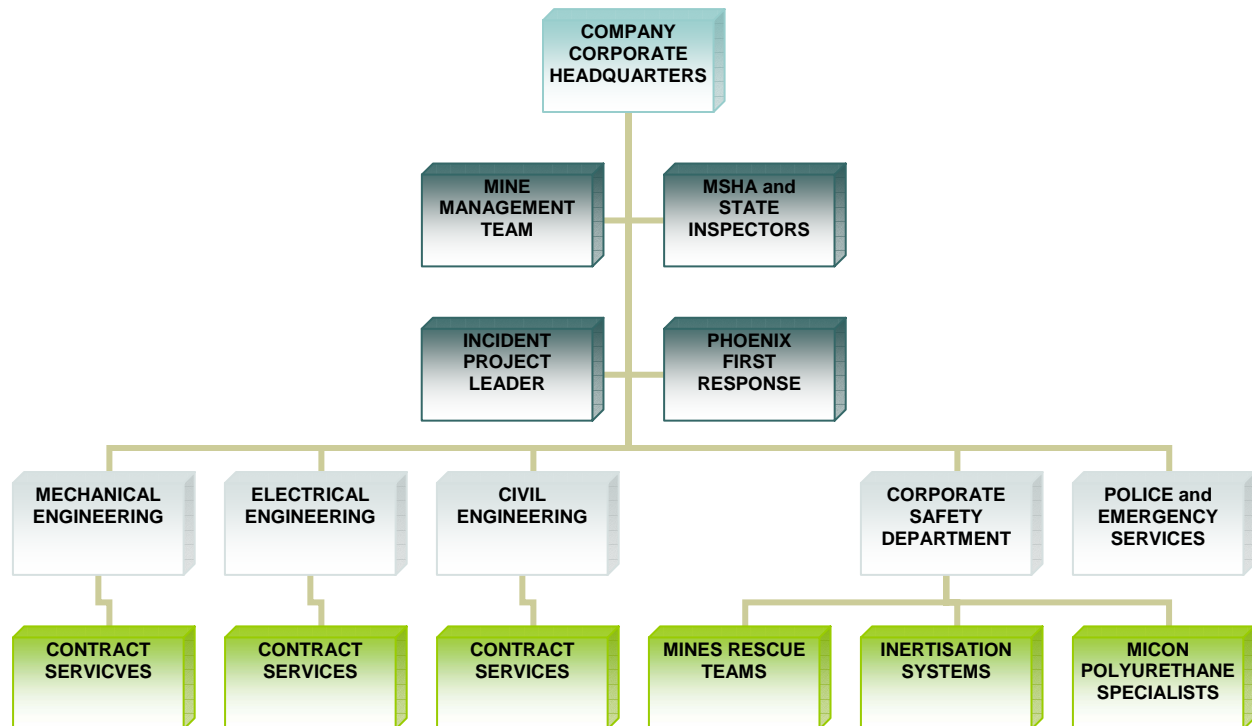
On week later the Polish crew was due to arrive so that an overlap could be created and afford rest cycles for both teams due to the changing weather conditions which would have some impact on both teams.

While the Polish crew was still in transit conditions underground improved and the mine issued a stand down order. This permitted a return to Australia for that team and a standby mode for one week for the Polish Team. March 22<sup>nd</sup> 2005 was the date that notification that the GAG would **NOT** be utilized was issued and demobilization commenced.

## 7. THE MANAGEMENT STRUCTURE:-

A project leader was appointed to set up an infrastructure so logistics would be organized in a planned manner and avoid replication which did arise early in the event.

The best example is that two weeks into the event a mobile electrical generator failed in the latter part of the day and next morning there were six mobile generators on site to replace the inoperative unit.



Setting this line management structure for the size of this event was intrinsic to its ultimate success which came together in an under time estimate. The process also kept costing to a minimum level due to the non replication of issues.

Forward command posts were set up for the major responding agencies which permitted communications to their respective agencies without interfering with the coal mine's need for communication and security.



## The Response Phase

1. MSHA notification.
2. State notification.
3. Emergency Sealing.
4. Final Sealing and Maintenance.

The response has been divided into four sections to highlight significant activities which took place with some being very much outside the normal scope of expectations in a coal mine fire event.

To illustrate each point photographs have been included for the purpose of pictorially representing what is difficult to put into words.

### 1. *MSHA NOTIFICATION:-*



Unplanned events in American coal mines require notification to the legislator's representative to ensure the Safety and Health of coal miners.

The reactivity depends solely on the magnitude of the event from an inspection of the site with a potential fine following to a "K" order which essentially closes the mine with re-entry process being a protracted exercise.

A mine thermal event in the magnitude of this case study is by its very nature a "K" order incident.

MSHA Technical Services acts as an adjudicator for the re-entry ensuring that plans are developed and adhered to at all times with in field inspectors monitoring the activities.

These plans are generally a written agreement with the mine and MSHA after extensive verbal negotiations are carried out. With risk mitigation in mind constantly the control measures installed and agreed to minimize the potential for harm or injury.

An example of a control is that excursions into oxygen deficient zones are restricted to a maximum of 1,000 feet.

### 2. *STATE GOVERNMENT NOTIFICATION:-*



An incident in a coal mine also must be reported to the state government agency as well as the federal agency.

The state government inspectors work with the incident management team to ensure that state legislation is also adhered to in regard to the reclamation of a coal mine. In fact the state legislation could be more prescriptive on an incident site than the federal regulations.

### 3. *EMERGENCY SEALING:-*

The call for mines rescue teams came when it was discovered there was a potential for oxygen deficient atmospheric conditions at or near the portals depending in some cases on barometric changes.

The task was to quickly fabricate emergency seals to fit to a wide variety of shaft diameters and unique problematic issues such as the production and equipment haulage systems that were located in these shafts.



The seals were fabricated with timber, brattice cloth and commercially available light foam packs with an underlying steel bracing.

This proved to have a limited effect due to the expansion of gases underground which led the incident management team contacting MICON to install a much more durable material to these sites.



### 4. *FINAL SEALING and MAINTENANCE:-*

This involved a specialist approach with MICON technicians applying PUR material at varying strength levels. This was carried out only after conducting a risk analysis for each different portal location as all had their own unique characteristics.

This process indicated that due to the nature of the event that any and/or all of the sites could in fact have the potential to be oxygen deficient at any time. This may be dependent on atmospheric influences which were not readily identifiable and meant wearing breathing apparatus was seen as a prerequisite for this emergency application.



The risk analysis process further identified that mines rescue teams would need to be deployed to aid and assist with this activity. It was further established that a minimal amount of people should be inside a radius of 30 foot from any shaft and utilization of a “SLAM” (**S**top **L**ook **A**nalyze **M**anage) philosophy with all excursions into that zone.

This resolve expedited the sealing due to the fact logistics could be set up prior to approach which enabled the process to come in under time expectations.



The planned activities were reviewed daily and signed agreements with the Mine and Federal and State representatives ensured that all potential risks were mitigated.

Mines rescue teams manned a 24 hours a day 7 days a week regime to monitor the effectiveness of the seals by utilizing hand held monitors to detect any leakage. A visual examination also took place on a regular basis observing any signs of degradation of seal material.

As an added feature pressure relief devices were fitted to all seals to guard against over pressure damage and reduce the amount of repairs required. These relief units were self closing as the pressure dropped to prevent ingress of oxygen.

## The Re-entry Phase

This by far was the most delicate but at the same time interesting part of the event.

The learning experience had no precedent insofar as the whole concept of surface sealing utilizing polyurethane was in itself quite innovative. Now it had to be removed and there was no pre tried method.

Approximately a week prior to the removal, research and testing produced a low risk method of achieving the result desired. Dry ice applied through a cutting tip under pressure was found to be the most safe and expeditious method to remove the polyurethane from the surface portals.

A risk mitigation process was applied to the concept and identified that the residue being carbon dioxide would render the immediate zone of operations oxygen deficient. This knowledge applied to a re-entry plan would put mine rescue trained operators at the cutting edge so to speak and with their breathing apparatus would reduce at least this risk factor to an acceptable level.

Further control measures were also added:-

1. Fall arrest devices for all personnel within a 30 foot radius of a mine opening plus lifeline attached.
2. Constant atmospheric monitoring.
3. Limit number of people within the immediate area to those only associated with the task at hand.
4. Communications to Incident management team at all times.
5. Backup resources including standby team/s.
6. Sequential removal to be observed at all times and written agreement between mine operators, MSHA and State Inspectors.



Proceeding underground was a pre-planned, documented sequential arrangement which involved a maximum 1,000 foot excursion into oxygen reduced atmosphere. The purpose of the agreed journey was to re-establish ventilation underground 1,000 feet at a time and therefore permitting Fresh Air Base to always be close at hand.

This advanced fresh air, equipment and other resources rapidly to the effected area of the coal mine.

Upon arrival at the effected zone, damage was found to be not extensive but rather broad in nature which did require a significant amount of rehabilitation. Resolution however did come rapidly due to the diligent work of the rescue teams tasked with the problem.

When all ventilation fans were re-commissioned a sense of achievement was felt and this sign of a job well done is worthy of praise to the diligence and selfless approach of all rescue people involved. They truly are special individuals who become an awe inspiring team in emergency events.

## **CONCLUSION**

The formalization of a concept that has its roots in history within the mining industry regarding reaction to emergencies underground does have a sound basis.

To this end knowing that a response to a thermal event in any subterranean area may and generally does involve broad disciplines it is wise to contemplate an expeditious means to bring all parties together. This in essence is the PHOENIX First Response philosophy and has merit in the fact that to provide timely, rapid intervention to thermal events a single contact point for response to mines in dire need of assistance 24 hours a day 7 days a week is at the very least worthy of consideration.

The adjunct of an experienced review panel to advise the most prudent response medium has also shown great worth in these episodes.

The mines rescue involvement is intrinsic to the ultimate and timely success to an emergency event in the coal industry. The dedication and diligent approach of trained mines rescue operators is always going to be in high demand well into the foreseeable future. The gratitude of many in this industry goes to the few who are the mining industry's elite in every way.

APPENDIX

REQUEST for ASSISTANCE

to

PHOENIX FIRST RESPONSE



a

DIARY OF EVENTS AS THEY UNFOLDED

## Mine Fire February 14<sup>th</sup> 2005 (16 hours)

### Information from witnesses:-

1. The shearer was operating as normal approaching the tail wedge to begin to remove it and prepare to change direction.
2. There was a bump on the longwall panel (most likely the 60 foot sandstone overburden collapsing and breaking off.)  
{***This would most likely raise dust into suspension and cause a significant wind blast***}
3. Sparks were observed coming off the cutting drums with some reports of blue methane flame being present.
4. It had appeared that there had been an ignition of expelled methane as eye witnesses reported an 8 foot flame and the shearer operator had singed hair on the back of his head.

### Important points:-

1. The ignition occurred approximately at 5:00 pm. Combustion was most likely a combination of coal dust and methane.
2. PHOENIX First Response consultancy group representatives were on site by 9:00 pm.
3. PHOENIX First Response consultancy group remained until 8:45 am the next morning and returned at 8:45 pm for another 12 hours.
4. In charge mine personnel were identified by the V.P. Mining Operations.
5. After some preliminary analysis it was decided to utilize Nitrogen and Foam in attempt to extinguish the fire.
6. PHOENIX First Response supplied the contact telephone numbers for:-  
**WEATHERFORD** {Nitrogen Membrane Units}  
**HALLIBURTON and US Foam** {Nitrogen filled foam}
7. Weatherford membrane units were being utilized by the company at other locations, however, PHOENIX First Response was able to inform that a down hole camera could also be obtained from Weatherford for the purpose of viewing the suspect site.
8. Drillers will be on site in the morning of the 15<sup>th</sup> to commence the 3 day job to drill into the mine. (Horn Drilling is the local drilling company on site.)

9. It was reported that the flame on the face was now either Red or Yellow in color, not blue as previously reported.
10. MSHA, Acting District Manager informed the company that he will be waiting on MSHA Technical Support to make a decision on entry to the mine.
11. Observations were made on a Gob gas well vent pipe with readings as follows Q35B, @ 10:30 was 238ppm then at 2:35 207ppm with a further observation of 121 ppm. This was some cause of concern for the decision group. PHOENIX First Response consultative group offered a theory on this which after due consideration was deemed as the most plausible reason for the strange readings.
12. Barometric pressure was reported at 30.2" to 30.4".
13. Borehole readings continued throughout the night and observations and deliberations continued.

February 15<sup>th</sup> 2005 (11 hours progressive total 27 hours)

1. It appears that stoppings, and or regulators on the right hand stopping line were blown out when the bump occurred and this in turn would cause a reverse on the longwall face, or neutral air zone on the longwall face.

The reversal of ventilation was reported by people working in the longwall face area after being interviewed which confirmed the ventilation disruption suspected by a drop in water gauge as determined by the incident management team.

2. It was also reported that the dust from the bump made it hard to see coming off the face and also that dust made it outby the longwall headgate to outby to the power center.

This further confirmed the suspicion of ventilation disturbance and short circuiting.

3. There is a surface road enabling access above the tailgate area to drill hole from surface to underground to pump nitrogen filled foam, to flood the tailgate entryies, and surround all the wood cribs. This in turn will help to cool any wood cribs that were heated from the ignition, and or cribs that were burning. One of the big problems with getting a hole from the surface is the overburden, which is approximately 2600 ft. and had an approximate drilling time of about 3 days. This hole will permit the ability to send down a camera to take a look.

4. At this point PHOENIX First Response consultancy reaffirmed the **WEATHERFORD** contact as a possibility for the camera capable of a 10,000 foot depth also, fibre optics and foam
5. These same holes (minimum 6" diameter) may also be used for injection of foam charged with nitrogen, and/or nitrogen only to cool the fire.
6. The incident management team discussed transportation issue for plant, equipment and materials and agreed that a responsible person would be appointed for developing a program and to report back to incident management team.
7. There was a need to make contact with US Foam to get equipment and materials in motion. The incident management group determined that information be sought from US Foam to make sure we get information on fittings and connections to hook up to nitrogen tankers as they can then be prepared for the arrival of the system.
8. The incident management team advised that **MICON** may need to set up PUR (polyurethane) pumping equipment to help seal off metal shaft doors to make seals on ventilation seals.
9. MICON advised that there may be a need to make arrangements to acquire sample lines to get gas samples down at mine level.
10. **(Standby condition) (PHOENIX First Response) NOTE:-**

This job highlighted the need to contact Weatherford on portable Nitrogen Generators and prompted a check on available nitrogen plants in close proximity to any coal fields in continental USA.

February 16<sup>th</sup> 2005 (12 hours progressive total 39 hours)

1. Preparatory arrangements to shut down mine fans and seal off utilizing beams and planks, using PUR Foam packs to seal tight against leakage.  
  
This will be part of the plan submitted to MSHA by on site mine management team with consultation with incident management team.
2. A call to PHOENIX First Response was made to get prepared to use the GAG system at short notice as well as PHOENIX First Response Consultancy team to advise on any issue that they be of assistance with.
3. After considering all factors it became apparent that the best combination at this point would probably be Foam and Nitrogen to combat the combustion incident. It

would be the most expeditious method currently available for the conditions in this incident in particular due to the location geographically of the problem.

4. MICON was called to alert them that the mine is ready to start sealing all of the shafts, fans and mine openings. At this time it looks like a shut down of the mine ventilation was imminent.
5. Service and Production shaft intakes are ready to lay down canvas and foam pak for final sealing. Sealing is due to start at approx. 5:00 am.
6. Further advice was given that a relocation of the mine management team would follow the sealing due to the 300 foot radius on the portals being imposed by MSHA under their "K Order"

**NEW CONTACT NUMBERS ADVISED and noted:-**

7. Advice received that the Fans were shut down 5:30 am.
8. Further advised that there was now two drill rigs in place and ready to start drilling, estimated at about 10:00 am.
9. Progress update that the Service and Production shafts are sealed. This was effected at 6:00 am and appeared to be satisfactory.
10. Advise received that throttle down No.8 fan was achievable due to fan being fitted with hydraulic adjustable blades.

February 18<sup>th</sup> 2005 (8 hours progressive total 47 hours)

1. A call was received by MICON to respond to the mine fire incident and to utilize MICON technologies and grout or seal off shaft caps on all of the portals sealed on this past Tuesday February 15<sup>th</sup> 2005 as suggested by PHOENIX First Response.
2. Direction was given to mobilize all the grout equipment that would be required to foam the tops of all the shafts including:-  
The freight of 2000 lbs of MPG 550-10 and 2000 lbs. of RokLok 70.
3. The decision to adjust reaction time of the MPG 550 -10 was made and arrangements were made prior to shipping to expedite the process when the equipment arrived on site.

## February 19<sup>th</sup> 2005 (14 hours progressive total 61 hours)

1. Upon arrival on site the first allocation was to recoat No. 7 shaft. {The original method of sealing was accomplished by the use of foam pak.} It had become quite apparent that a denser material was required to achieve a positive seal on the vent caps that were fitted.
2. The intake side of No. 4 shaft was the next to be addressed and it was started with a half drum of 550 grout and finished off with RokLok 70.
3. A process decision was made to abandon the use of 550 as it does not appear to be as effective as RokLok 70 mixed with 1 gallon of water.
4. Advice today suggested that this project will involve MICON up to Tuesday 22<sup>nd</sup> February 2005.

## February 20<sup>th</sup> 2005 (14 hours progressive total 75 hours)

1. Today the first task was to grout the supply shaft where the Technician was required to wear a body safety harness as well as all the appropriate safety equipment as directed in the site specific induction.
2. The intake side of No. 4 shaft was the next to be addressed and it was started with a half drum of 550 grout and finished off with RokLok 70.
3. This shaft had a very little foam pack solid and was leaking quite considerably which dictated the 2000 lbs used to effect the seal. An extremely good RokLok base was established by the time this task reached conclusion.
4. The next task was to seal an abandoned air shaft that was utilized as a downcast shaft. This shaft cap was a very difficult task and once again consumed 2000 lbs of foam. Two inputting factors contributed. It wasn't under cover and had some stagnant water on top. This water was removed as much as possible prior to the foam application and the end result was a good seal preventing ingress of atmospheric air.
5. The MICON team was then relocated to the new current bath house and man elevator shaft. This was the most difficult shaft to grout as we had a lot of beams to work around. The MICON Technician had a difficult time with movement with all of the gear on plus a safety rope hooked to him. A total of 1500 lbs was used to grout this shaft.
6. The Technician with considerable experience indicated that this particular task was some of the most difficult grouting he had ever done.

7. The mine incident management team indicated that there are a possible 4 shafts left to complete this project.

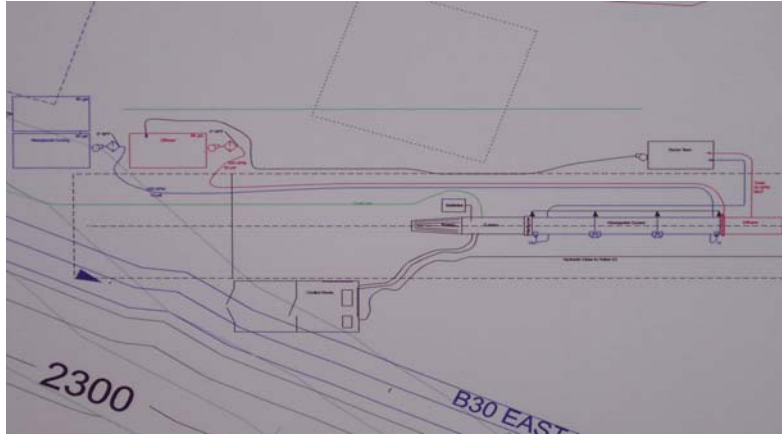
February 21<sup>st</sup> 2005 (10 hours progressive total 85 hours)

1. No. 6 shaft was today's first target and had similar problems to the other sites already complete with the necessity to remove some of the outer skin so re-foaming would be to a high standard.
2. The Technician was required to wear all safety gear identified in the site specific induction as well as a full body harness that was secured by rope to a stable structure to conform to the MSHA approved plan.
3. The complete top of the shaft was grouted and the ground level was grouted. They were then joined so a complete bond to the ground was achieved and consumed 1500 lbs of material.
4. The complete system was relocated to the production skip shaft which required a different approach as identified below:-
  - a. Jam rod utilized to force grout completely around the skip shaft cables to seal them.
  - b. Existing seal cap perimeter was also sealed utilizing this same method.
  - c. Changed to a mixer gun and coated top to approximately 3 inches thick which had previously been done by a foam pak as a temporary measure.
5. This task consumed 1500 lbs of material and concluded at approximately 5:00 pm.
6. Dispatched a truck to a nearby mine that had excess MICON material to pick up more RokLok 70, approximately 8000 lbs. The extra supply should ensure that we will **not** run out of material prior to finalization of project.
7. Instruction was given to transfer material and reload the Box Truck for next round of injection and to get all of the PUR in the Box Truck heated.

February 22<sup>nd</sup> 2005 (12 hours progressive total 97 hours)

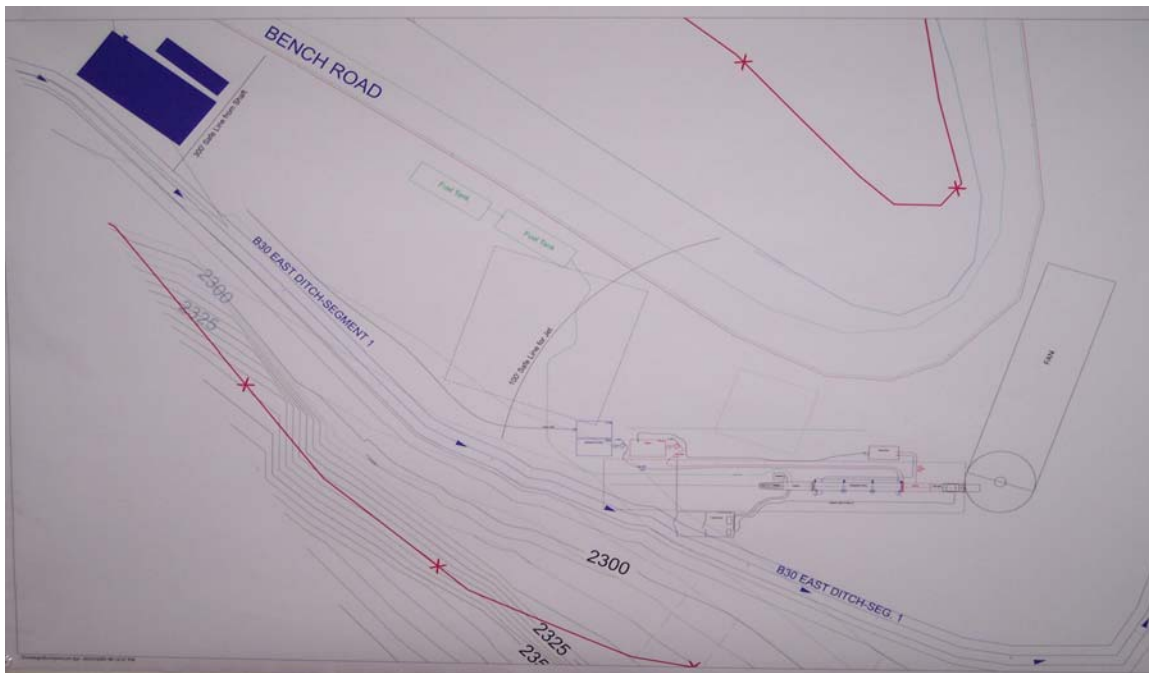
1. Meetings all day setting up for the change of the No. 9 Ventilation Shaft cap, logistics of setting up the GAG Jet engine and any assistance that may be offered by the coal mine personnel.

2. Consultation with various departments establishing tasking and assisting with technical support information.



3. Tasking was identified in various areas and teams set up to achieve resolution of the following issues:-

- a. Access road construction to No. 9 Shaft
- b. Jet A1 Fuel Supply
- c. Water Supply including dam construction
- d. Additional water supply by truck support
- e. Control room for operator (fabrication)
- f. Transport of by pass gate to site



## February 23<sup>rd</sup> 2005 (10hours progressive total 107 hours)

1. Instruction was given to organize the Box Truck ready for expected continuous operation and also cleaning equipment and heating PUR.
2. The second task was to load up the stake bed with used and discarded equipment and/or supply drums and at the completion of the on site tasks and commence the transport journey back to Glassport.
3. Most of the day for MICON safety department and PHOENIX First Response was consumed with establishing logistics for manning, water, fuel, supply systems, site construction in preparation to establish the GAG system on site.
4. Returned to No. 9 shaft for inspection and direction of the driver to locate the elbow and slide gate he brought from Glassport where they were unloaded and he was then dispatched for the return trip.
5. Contacted Glassport office with update of activities and requested the 900 gallon tank be dispatched to the proposed GAG location for use in the future. Further advised that PHOENIX First Response and Weatherford would be at the mine office the following morning after 8:00 am.

## February 24<sup>th</sup> 2005 (13 hours progressive total 120 hours)

1. Instructions were given to prepare all the gear required for application of PUR and to get as much of the material up to temperature so application time and environmental exposure to the mine conditions was minimized.
2. The morning meetings were set to address two issues:-
  - a. Potential GAG operation & positioning.
  - b. The sealing of No. 9 Shaft utilizing PUR.
3. At approximately noon the command center requested a relocation to No. 9 shaft and witness the installation of the steel cap so preparation could be made for sealing with PUR. The new steel cap (designed to withstand a 10" water gauge pressure) incorporated a swivel GAG adaption elbow fitted with monitoring tubes which gave the ability to adjust the angle to match the inclined pad that is to be built.
4. This particular seal had been more unique than the others as it required the Technician to periodically wear an oxygen regenerative breathing apparatus (BG174) for a 4 hour period concluding at 9:00 pm.



**No. 9 Shaft Return Side**



**No. 9 Shaft Intake Side**

5. The equipment was cleaned and re-packed and a debriefing of this task plus an update for tomorrow's activities took place with the incident management team.
6. There was an agreement to meet in the morning with the incident management team to formulate a plan for the No. 2 shaft seal job (the final seal).

February 25<sup>th</sup> 2005 (14.5 hours progressive total **134.5 hours**)

1. Instruction was given to heat the PUR to the required temperature in preparation for application at the seal site.
2. The first task was back at No. 4 shaft where a recoat of a few places was in order, and then a coating of the explosion doors that had a light Foam Pak PUR. The light 1.75 lb. density foam was not holding under pressure. After the RokLok PUR was applied there appeared to be no further problem.



**No. 4 Return side**



**No. 4 Intake side**

500 lbs in total on No. 4 Shaft was applied.

3. MICON management team attended two meetings in the morning
  - a. With incident management team in regard to the plan approved for the shaft sealing activities and:-
  - b. With the Mines Rescue Team to design the temporary bulk head for the return portal in No. 9 shaft.

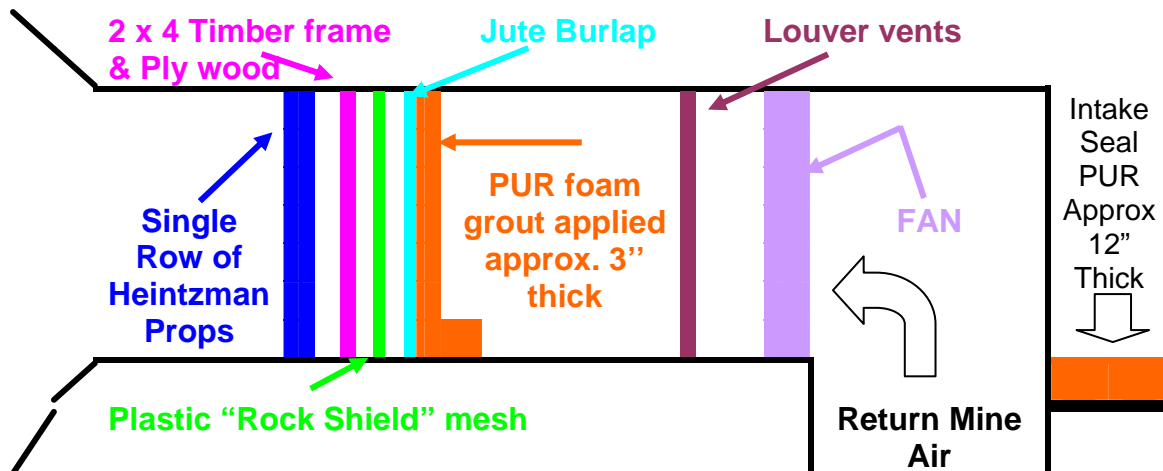
consisting of:- Single row of "Heintzman props" 80 ton rated  
 2" x 4" timber framing  
 Plywood wall  
 Plastic "Rockshield mesh"  
 Jute Burlap

**All coverings were nailed down using brass nails**

Then approximately 3" of PUR foam applied {500 lbs}  
 RokLok 70

**This was done using breathing apparatus**

**"40% Methane, 8% Oxygen Balance Nitrogen".**



4. Also at No. 9 shaft on the intake side we touched up the metal covering foamed previously the day before to seal all leaks.
5. Also went up on top and sealed the explosion doors on No. 9 that were originally sprayed with 1.75 lb. foam. Sealing with the RokLok 70 fixed the leaks. Total for the touch up work was 1000 lbs of RokLok 70.
6. As soon as No. 9 was tightened up, the water gauge went from 2.5 inches to over 5 inches almost immediately. This did have a significant affect on the underground environment.

## February 26<sup>th</sup> 2005 (8 hours progressive total 142.5 hours)

We were at the ready mode all day and a meeting to plan the foam capping which is yet to be installed at No. 2 shaft took place.

The incident management team indicated they would be closer to making a decision on the issue in the morning. If all went well over night MICON technicians would be able to complete the task on No. 2 Shaft.

## February 27<sup>th</sup> 2005 (8 hours progressive total 150.5 hours)

Once again today we were at the ready and MICON management made an appointment to meet with Incident management team later in the day to discuss whether there was a chance that No. 2 could be sealed at all and should we still remain on site to do the job.

The answer to the meeting was that the Incident management team could not say at this time whether MICON would be required later on today or tomorrow. However, a request was made to stay close for the day in preparation to move at short notice.

## February 28<sup>th</sup> 2005 (13 hours progressive total 163.5 hours)

Today was a difficult situation as the barometer had fallen due to an approaching severe winter alert.

This permitted No. 2 Shaft to enter back into an explosive range.

A decision to pump nitrogen foam into No. 2 Shaft was made at 2:30 in the morning and is still currently being injected with the view of bringing the site into an inert zone.

This was decided with the view of permitting a **safe** approach to the site as well as achieving a risk mitigation for the area in which work was to be performed.

## March 1<sup>st</sup> 2005 (0 hours progressive total 163.5 hours)

Assisted with leak detection and resealing in the early morning.

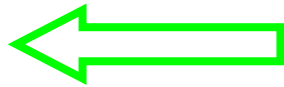
Asked to attend a meeting regarding going back to Pittsburgh and deployment of GAG system and suggested arrival time for setup.

Traveled back to Pittsburgh to check and load GAG system first thing in the morning.

## March 2<sup>nd</sup> 2005 (0 hours progressive total 163.5 hours)

Loading plan for GAG onto a 43 foot tractor trailer combination was developed including weights and sizes.

Checks carried out on all equipment to be transported to Virginia (estimate travel time 8 hours). The complete system will need to be loaded by 9<sup>th</sup> March to arrive on time.



Direction of Travel

Jet Engine 1		Box 2		Box 3		Box 4		Stainless Steel Tank		Site Box1
Box 9a	Oil Pallets	Hose Pallets	Box 5		Box 6	Box 7	Boxes 8 & 9b	Battery Trolley	Site Box 2	Hydraulic Power Pack

## March 3<sup>rd</sup> 2005 (0 hours progressive total 163.5 hours)

The morning was utilized to continue with checks on all GAG equipment to be transported to Virginia.

The afternoon was spent checking support material (clothing, boots, PPE, etc.).

Discussion was had with regard to the process and who would lead for meeting and greeting overseas responders. PHOENIX First Response with a mine company representative was decided upon.

## March 4<sup>th</sup> 2005 (0 hours progressive total 163.5 hours)

The day was a routine office and safety day with quotes, telephone calls and discussions regarding the mobilization of any equipment necessary for the incident.

The morning was utilized to continue with checks on all GAG equipment to be transported to Virginia.

The afternoon was spent loading the support material (clothing, boots, PPE, etc.).

March 5<sup>th</sup> 2005 (1 hours progressive total **164.5 hours**)

Spent time today discussing response for 0400 tomorrow and items and materials to be loaded for the response and who is going to respond to the thermal incident.

March 6<sup>th</sup> 2005 (16 hours progressive total **180.5 hours**)

The day was utilized resealing particularly No. 8 shaft with RokLok 70 to seal material applied by another PUR company that had reacted poorly.



**Observed poor application at No 8**



**Material applied at southern side**



**Technician preparing to re-seal site**



**Close inspection prior to sealing**

## March 7<sup>th</sup> 2005 (14 hours progressive total 194.5 hours)

Continued with risk analysis with sealing jobs and set criteria for ongoing instruction and safety support including but not limited to:- atmospheric analysis, Breathing Apparatus, Safety Apparel, exclusion zones and permit to enter requirements.

Left in the afternoon to travel back to prepare GAG system for transport as per the pre arranged plan.

## March 8<sup>th</sup> 2005 (10hours progressive total 204.5 hours)

The entire system was cross checked and repacked for transport as the road haulage will require some materials and equipment to be stowed with protective devices fitted.

Arrangements were made for additional supplies of oil, fuel line and additional stores for utilization of two complete systems.

Verbal and written communication was petitioned to Queensland Mines Rescue Service to hire an additional unit.

Backup of a complete system from Poland for either hire or purchase was also commenced.

Third source was from (All Metal Solutions) a recently commissioned GAG system from Australia also under investigation.

## March 9<sup>th</sup> 2005 (19hours progressive total 223.5 hours)

The overseeing of loading the entire system took all morning with securing in correct positions and stowage to plan being directed.

Left Pittsburgh to travel to Bristol Tennessee Tri City Airport to collect the Australian team leader (Mick Farrag) then drove back to mine site for accommodation that night.

## March 10<sup>th</sup> 2005 (10hours progressive total 233.5 hours)

The morning was utilized to prepare the site at No. 9 Intake Shaft to receive the GAG system upon arrival on site. All tubes were attached to the slide gate and coated with high temperature sealant on the joints prior to bolting together.

The rest of the GAG system was unloaded from the tractor trailer and positioned in the correct location as well as the spares being stowed and proofed against the weather.

The control box and hydraulic system were both located in the control room that was purpose built for this location including lighting, windows, heating when required and rest area.



**Tubes connected at No. 9 Shaft**



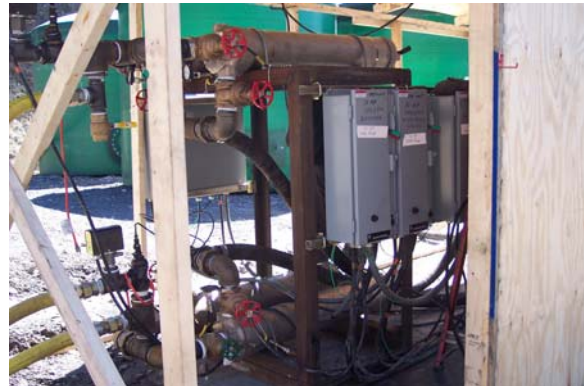
**Control Stations in purpose built container**

Still left to be done are the connection of the water supplies to the re-circulation tanks and the hydraulic pump to the control station then to the slide gate.

The main water supply from the dam that was purpose built needs connection to the feed pump and then connection to the supply pipe to raise the water 360 vertical linear feet to the holding tanks.



**Water Supply Pump from Dam  
Blue Pipe is line to tanks**



**Water re-circulation filters with  
holding tanks in the background**

**March 11<sup>th</sup> 2005 (9 hours progressive total 242.5 hours)**

Manufactured extension tubes were attached to the system already in place to extend location of engine 20 feet further away from the No. 9 Shaft intake side where the docking facility was attached.

Took the Australian team leader on a surface tour of all portals of the Mine and identified the two portals that had been set up to receive the two systems I.E. No. 9 Shaft (proposed to be operated by Polish Teams) and No. 7 entry (proposed to be operated by Australian Teams).

The portals that should be effected initially are Number 9, 8, 7 and 6 then progressively 4, production, 1, supply and lastly 2.



**No. 7 Shaft Preparation**



**No. 9 Shaft Preparation**

**March 12<sup>th</sup> 2005 ( 8 hours progressive total 250.5 hours )**

This morning both No. 9 Shaft and No. 7 Shaft were visited with the Australian team leader to conduct a site survey to formulate some preliminary work prior to a complete Risk Assessment.

Contributions were solicited with some major input to the location of the recirculation tanks positioning on the highwall side of No. 7 site as well as the drainage system that was yet to be installed to take away waste water.

The afternoon was utilized to go over preliminary requirements for teams to function in the environment.

The major difference is that at No. 9 shaft there was located a trailer for team rest and comfort where No. 7 didn't have that in place. (Possibly Phoenix RV could be located at this site for the purpose of rest and comfort.)

**March 13<sup>th</sup> 2005 ( 10 hours progressive total 260.5 hours )**

This morning the Australian Team leader left to meet up with Australian Team in Pittsburgh (the Australian team was housed at this location due to the accommodation

shortage). The plan was when required to bring the team forward and house one of two locations one about an hour away and the other about 35 minutes away.

MICON crew continued with ongoing sealing of leakages in shaft caps and assessing operations in breathing apparatus (BG 174) for MSHA Certification (Form 5000)

1. No. 4 Shaft applied coat of RokLok 70.
2. No. 4 Vent shaft waited and added a coat of foam.
3. Service shaft was given a complete coat of foam as instructed.
4. No. 2 Shaft applied coat of RokLok 70.
5. No. 2 Vent shaft waited and added a coat of foam as instructed.



**Service Shaft  
(9 feet below ground level)**



**RokLok 70 coating at No. 2  
Intake & Return**

March 14<sup>th</sup> 2005 ( 10 hours progressive total 270.5 hours)

Today was similar to yesterday with the MICON crew conducting ongoing sealing of leakages in shaft caps and assessing operations in breathing apparatus (BG174) for MSHA Certification (Form 5000).

1. Started at No. 1 shaft to also put a coat of RokLok 70 as instructed.
2. Touched up leaks on Service Shaft found earlier in the morning by the Mines Rescue Team during routine inspections when the shaft was at positive pressure.
3. Went back to Vent 8 once again to touch up leaks again detected by the Mines Rescue Team during routine inspections when the shaft was at positive pressure early in the morning.



**No 1 Shaft (easy access all round)**



**Service Shaft (approximate seal level)**

March 15<sup>th</sup> 2005 ( 10 hours progressive total 280.5 hours)

The morning was consumed touring the seal site and inspecting GAG system installations with MICON Company President.

The appraisal was good and some further suggestions were offered by the President to the MICON technicians for any further applications to the seal sites.

The early part of the afternoon was dedicated to a meeting with senior staff from Weatherford with regard to the application of Nitrogen through diaphragm technology.

The latter part of the afternoon was meeting with the Polish Team to appraise them of the situation which by now had developed into a standby situation rather than a definitive response due to the MSHA directive given.



**MICON President with Weatherford Manager Polish Team looking on**



**Polish Team with a Weatherford Plant in the background**

March 16<sup>th</sup> 2005 ( 8 hours progressive total **288.5 hours** )

This morning was similar to that spent with the Australian Team leader as today a meeting with Polish Team leaders and interpreters at No. 9 Shaft was convened and discussion took place as to the requirements or expectations should they be required to operate the system at this location.

The afternoon was spent with MICON technicians as a different application was to be utilized and a risk assessment was to be conducted prior to commencing work.

1. Went to No. 4 Shaft and fixed up leaks around fan housing.
2. **Lanced around the base of the intake shaft.**
3. Fixed up small leaks on production shaft on the flat surface.
4. Went back to No. 1 Ventilation shaft; fixed up leaks.
5. **Started to lance around base.**
6. **Went back to No. 7 Ventilation shaft and lanced around the base where leaks had been detected earlier.**



**No. 4 Shaft aerial foam application**



**No. 7 Shaft with pressure relief fitted**

March 17<sup>th</sup> 2005 ( 10 hours progressive total 298.5 hours)

The entire day MICON technicians continued with sealing operations as follows.

1. Advised to return and finish lance job on No. 1 Ventilation Shaft.
2. Went back to No. 7 Ventilation Shaft and repaired leak at base.
3. No. 8 Ventilation Shaft required some additional work.  
Accompanied Mines Rescue Team as they were tasked to remove a leaking flange and replace with a new one.  
The pressure was building well at this location and any leaks were laden with high levels of Carbon Monoxide and Methane so the following tasks had to be completed utilizing the Drager BG 174 closed circuit breathing apparatus.
  - 3.1 Wall inside Return Fan Housing re-sprayed with foam.
  - 3.2 Waited 1 hour and coated foam with RokLok 70.
  - 3.3 Leaks around replacement flange.
  - 3.4 Leaks on wall next to cage.
  - 3.5 Minor leaks at ground level.



**No. 8 Shaft Intake & Return**



**No. 1 Intake Shaft Seal Repairs**

## March 18<sup>th</sup> 2005 ( 8 hours progressive total 306.5 hours )

Standby with GAG system and spent the day with MICON technicians and sealing operations as follows.

1. Sealing required keeping drums of product at elevated temperature for the day as no apparent leaks were found today.
2. Training on breathing apparatus continued and moved into servicing, testing and rebuilds of (BG 174).
3. Checks were carried out on GAG equipment in the field to ensure that all was OK with weather proofing and functionality of exposed equipment.
4. Meetings with the Mine superintendent and mine engineer occurred today with reports on status of equipment and projected potential decommissioning when the time comes.

## March 19<sup>th</sup> 2005 ( 8 hours progressive total 314.5 hours )

Standby the same as yesterday with GAG system but with MICON technicians sealing operations were as follows.

1. Leak repairs at No. 8 Vent shaft around liquid nitrogen injection point (possibly due to freezing).
2. No. 9 vent shaft along return fan structure where it meets concrete base required sealing (higher pressure 8.9" water gauge).
3. Leaks repaired around airlock door on No. 2 shaft.
4. Called to No. 4 with a reported door open. This was a false alarm as it had nothing to do with the ventilation circuits.

## March 20<sup>th</sup> 2005 ( 8 hours progressive total 322.5 hours )

Standby the same as yesterday with GAG system but held at motel at the mine's request where reports were worked on and discussion with MICON technicians with regard to strategy for withdrawing all plant and equipment.

Arranged for pickup of excess used drums, hoses, and equipment requiring shop repair.

Checks were carried out on Jet A1 fuel on site for any water ingress and fuel filters for gelling with the result that none was apparent in either location.

Packed away any equipment not immediately essential for use if the GAG system were to be utilized.

March 21<sup>st</sup> 2005 ( 9 hours progressive total 331.5 hours )

Met with Mine management who requested that GAG system stay on site until re-entry of mine was indeed effected in case it would be required if anything untoward were to happen.

This was agreed to if the Jet could be housed in a climate controlled building with lubrication oil pallets and any polyurethane drums that were also to remain with the pump system so security could be attended to.

Re-packed Jet into transport container and secured into position ready for relocation as agreed to. The lubrication oil pallets were also positioned ready for pickup.

A PHOENIX First Response representative was to be present for the loading and relocation of all this equipment as directed by the Mine management as part of their in house protocols.

March 22<sup>nd</sup> 2005 ( 8 hours progressive total 339.5 hours )

Met with Polish Team to formally demobilize and arranged for transport to airport to leave the country.

Met with MICON technicians for their exit from the site on possibly Thursday and tasked them with assisting in relocation of plant and equipment from No. 9 shaft area as agreed to with the Mine Management.

Traveled back to Pittsburgh to write reports and arrange future meetings with the mine for scheduling.

Commenced procedural document for removal of seals when required including recommendations, required PPE, disposal recommendations and offer to remove particularly No. 8 seal by MICON technicians.

## Footnote:-

A cap was fitted to No. 9 shaft return to take pressure off the internal MICON seal wall so it can remain intact for as long as possible or at least until removal.



**Arrival of No. 9 Shaft Seal**



**Joining of No. 9 Shaft Seal**



**Rotation of No. 9 Shaft Seal**



**No. 9 Return Shaft Seal Rotated**