

Upper Big Branch Mine–South Mine ID: 46-08436

April 5, 2010 Accident

Public Briefing

June 29, 2011

Evidence still being collected and analyzed



**On April 5, 2010, at approximately 3:02 PM,
29 miners died and two miners were injured
as a result of a massive explosion at the
Upper Big Branch South Mine.**

| | | |
|--------------------------|----------------------|----------------------|
| Carl C. Acord | Steven J. Harrah | Joshua S. Napper |
| Jason M. Atkins | Edward D. Jones | Howard D. Payne |
| Christopher L. Bell, Sr. | Richard K. Lane | Dillard E. Persinger |
| Gregory S. Brock | William R. Lynch | Joel R. Price |
| Kenneth A. Chapman | Joe Marcum | Gary W. Quarles, Jr. |
| Robert E. Clark | Ronald L. Maynor | Deward A. Scott |
| Charles T. Davis | Nicolas D. McCroskey | Grover D. Skeens |
| Cory T. Davis | James E. Mooney | Benny R. Willingham |
| Michael L. Elswick | Adam K. Morgan | Ricky L. Workman |
| William I. Griffith | Rex L. Mullins | |

Injured: Tim Blake, James Woods

Overview

- MSHA's investigation shows that the explosion at UBB was started by a limited amount of methane/natural gas likely ignited by the longwall (LW) shearer
- The ignition was not prevented
 - Missing and faulty water sprays
- Inadequate rock dust in tailgate of LW
- Methane ignition transitioned into a massive coal dust explosion
- Today, MSHA will present its findings to date:
 - Description of the accident
 - The conditions and practices in the mine preceding the accident
 - The physical causes of the accident
- This explosion could and should have been prevented by the mine operator

General Information

- Mine opened September 1, 1994
- Eagle coal seam
 - High Volatile Bituminous Coal
 - Average coal thickness 54 inches
 - Average mining height 84 inches
- Four producing sections
 - 3 continuous miner (CM) sections
 - 1 LW
 - LW moved to Logan's Fork Mine in 2006, returned to UBB in 2009
- Workforce
 - 234 underground, 2 surface
 - Numerous contractors
- Overlapping and staggered shift schedules
 - Two production shifts, one maintenance shift (midnight)
- Coal production, 1.2 million raw tons in 2009



Description of the Accident

Events Leading Up To The Explosion

Description of the Accident (Personnel in Affected Area)

- UBB shut down Easter Sunday
- Midnight maintenance shift (4/5/2010) was reported as uneventful
- Day shift production crews entered mine
 - Headgate 22 (HG 22), 6:00 AM, Ellis portal
 - LW, 6:04 AM, Ellis portal
 - Tailgate (TG 22), 6:40 AM, UBB portal
- Various Support Personnel
 - Pumping crew, 6:38 AM, Ellis portal
 - Track maintenance crew, 7:30 AM, Ellis Portal
- Managers
- Examiners

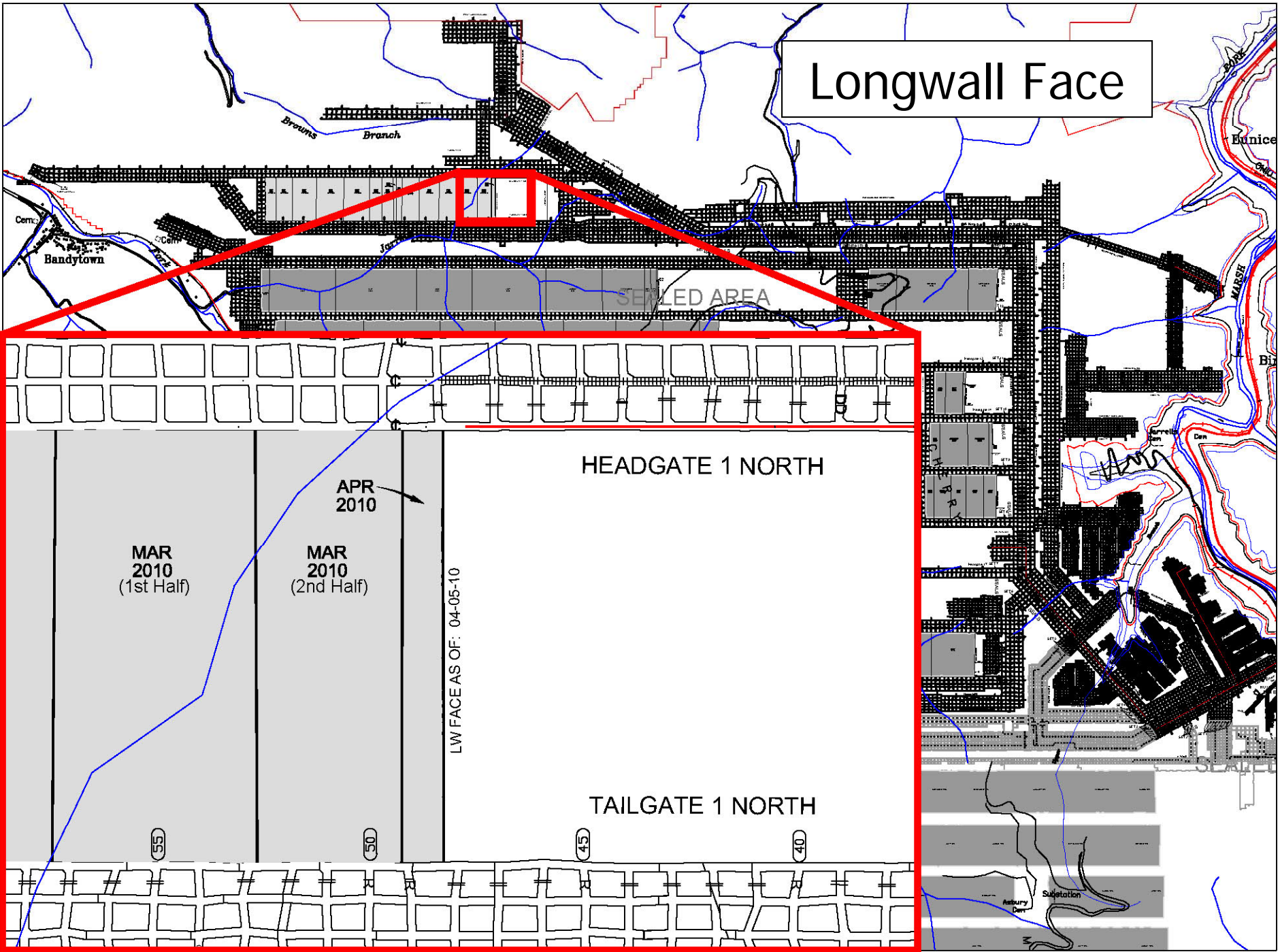
Description of the Accident

UBB Longwall Day Shift Summary

- 30 minute call outs to top Massey managers
- First Call Out 7:30 AM
 - LW ran until 11:00 AM, 2 passes
 - LW was down, 11:00 AM to 2:15 PM
 - Mechanical problems with the shearer
- At least one member of upper management at UBB was at LW
- Last call out at approximately 2:30 PM
 - Shearer at shield 115 cutting to tail

Description of the Accident

- LW
 - Shearer just cutting out on tail, cutting sandstone
 - Shearer shut off by TG side remote control at approximately 3:00 PM
 - Water supply manually shut-off at headgate
 - Shearer high-voltage power manually disconnected
- Face operators traveled 400 feet from tailgate prior to the explosion
 - About 2 minutes
- TG 22 crew in mantrip called out for track clearance
 - 78 crosscut (XC) at 3:00 pm
- HG 22
 - Six miners in mantrip, ready to leave section



Description of the Accident

- At approximately 3:02 PM
 - Electrical power at the Ellis Portal went off
 - Power cable ran through mine
 - Dust and debris blown out of the portals
 - Mine fans at the UBB portal stalled
 - CO monitoring system started alarming
- Several miners near the portals evacuated the mine
- Surface personnel began notifying underground (UG) personnel to evacuate

Description of the Accident

- Tim Blake (1 of 2 survivors of the TG 22 crew) recounted that
 - Felt the wind pick up
 - Immediately blinded by dust
 - Held his breath
 - Immediately donned his self-contained, self-rescuer (SCSR)
- Blake sat for a couple of minutes in the dark and dust
- When wind and the dust decreased
 - He placed SCSRs on crew members
 - Removed some of crew from mantrip
- Approximately 45 minutes later
 - Blake realized SCSR was almost depleted
 - He reluctantly began walking out of mine
- The mantrip was found at XC 67

Description of the Accident

- Approximately 20 to 30 minutes after the explosion, several managers started into the mine from both the Ellis and UBB portals
- Mr. Blake walked out about 20 XCs when his cap lamp was spotted by the incoming managers
- Patrick Hilbert stayed with Mr. Blake and the other managers proceeded further into the mine on foot
- Approximately 5 to 10 minutes later, Jack Roles yelled that a mantrip was needed

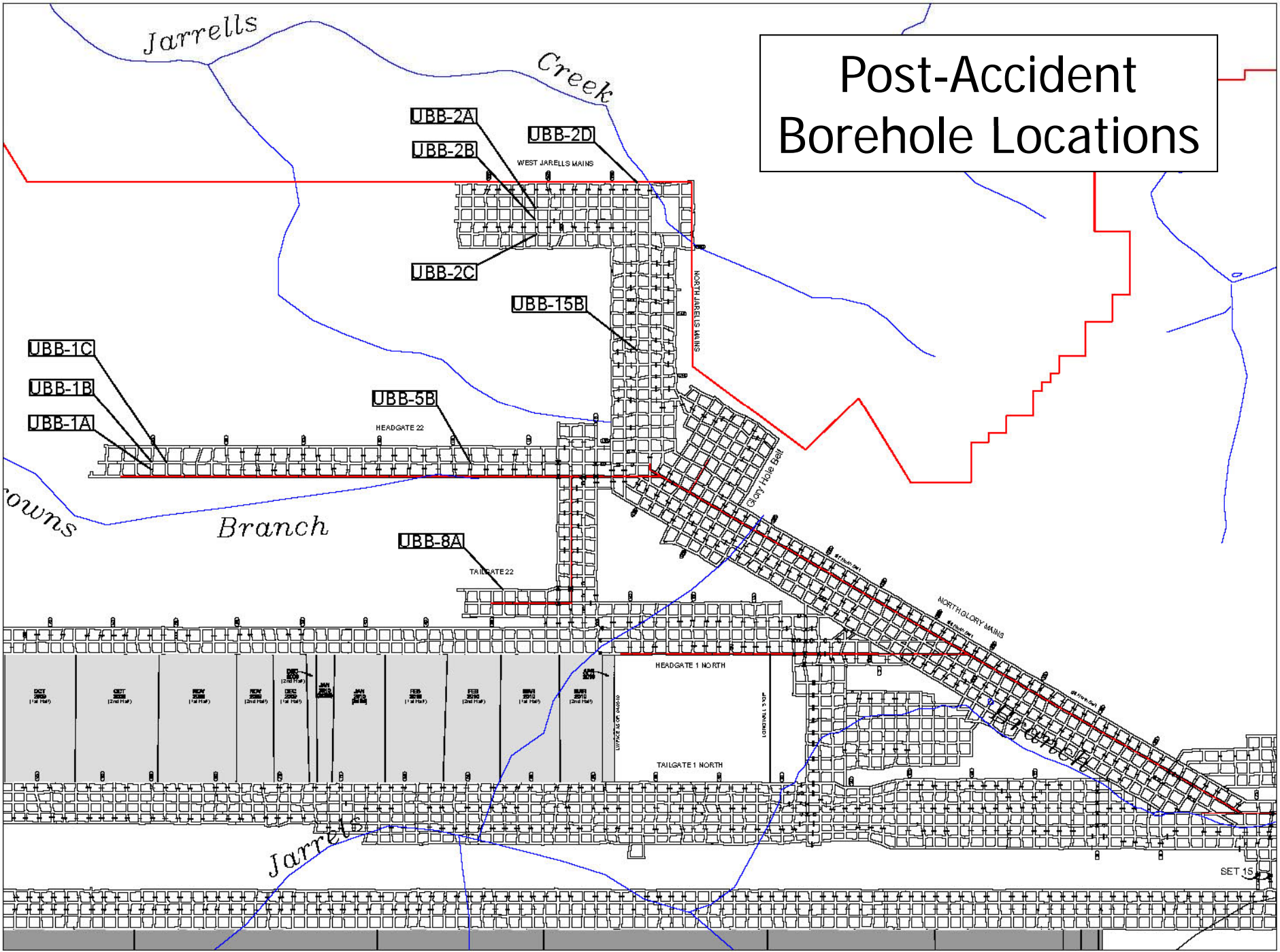
Notification of Accident

- Accident notification
 - Jonah Bowles, Safety Director, Marfork Mine
 - Called MSHA's hotline at 3:30 PM
 - Reported an air reversal on beltline at the Ellis Portal
 - Concentrations of 50 to 100 PPM of carbon monoxide (CO)
 - Reported mine was being evacuated
 - No one trapped or injured
- Hotline operator finished the call with Bowles and called District 4 at 3:42 PM
- Immediately, MSHA contacted the mine operator
 - Determined that a serious event had occurred
 - Issued a 103(j) control order
 - Began its emergency response

Rescue and Recovery Operations

- UBB managers transported TG 22 crew out of mine
 - Chris Blanchard and Jason Whitehead traveled further into the mine on foot
 - Bare-faced with SCSRs
- Mine Rescue Teams (MRTs) explored LW face and found HG 22 mantrip
- Evacuated mine at 12:45 AM due to explosive gas and smoke
 - 18 victims found by MRTs
 - Massey did not have an accurate count of missing miners until 1:40 AM on Tuesday, April 6
- Gas monitoring, boreholes drilled into mine, nitrogen injection and seismic monitoring
- MRTs made several attempts to find 4 missing miners
 - The final missing miner was found at 11:20 PM on Friday, April 9
- Recovery of victims was completed at 12:57 a.m. on Tuesday, April 13

Post-Accident Borehole Locations



Investigation of the Accident

- Accident Investigation began April 12, 2010
 - UG investigation delayed until June 25, 2010
 - Continued hazardous conditions in the mine:
 - Higher concentration of carbon monoxide than expected
 - Water accumulation
- Interviews
 - 266 individuals have been interviewed
 - 34 call back interviews
 - 18 Performance Coal and Massey managers declined to be interviewed
 - Exercised 5th Amendment Rights

MSHA Personnel Involved

- 105 MSHA Investigation Personnel have been utilized during the on-site investigation
 - Type and Number of Teams Utilized
 - Mine Dust Survey Teams – 10 teams per day
 - Mapping Teams – up to 10 teams per day
 - Electrical Teams – up to 3 teams per day
 - Ventilation Team – 33 teams over 10 days
 - Geology Team – 1 team
 - Flames and Forces Team – 1 team
 - Evidence Collection Team – 1 team
 - Inspection Activities Team – consisted of numerous inspectors
- An additional 45 Technical Support Personnel have been utilized to perform testing and other technical activities
- Also other MSHA Personnel were utilized to guard the three portals during the investigation

Other Parties Involved

- State of West Virginia
- Governor's Independent Investigative Panel
- United Mine Workers of America (UMWA)
- Moreland & Moreland
- Massey Energy
- Internal Review

Evidence Collected to Date

- More than 84,000 pages of documents
- 954 separate maps have been logged into evidence
- 23,405 photos have been taken along with 18 separate videos
- 1060 separate pieces of physical evidence have been collected

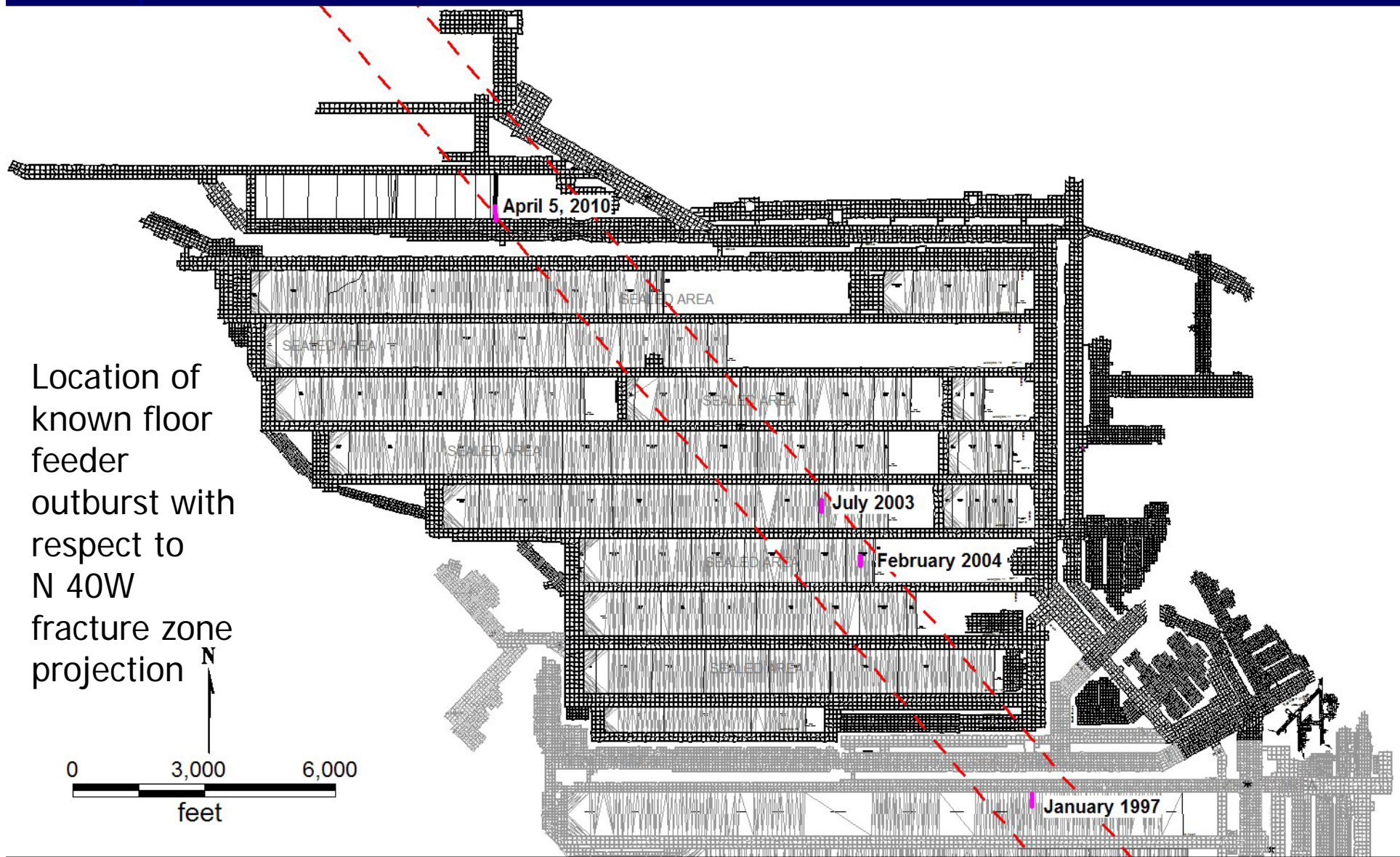


Conditions and Practices at UBB Prior to the Explosion

Geology

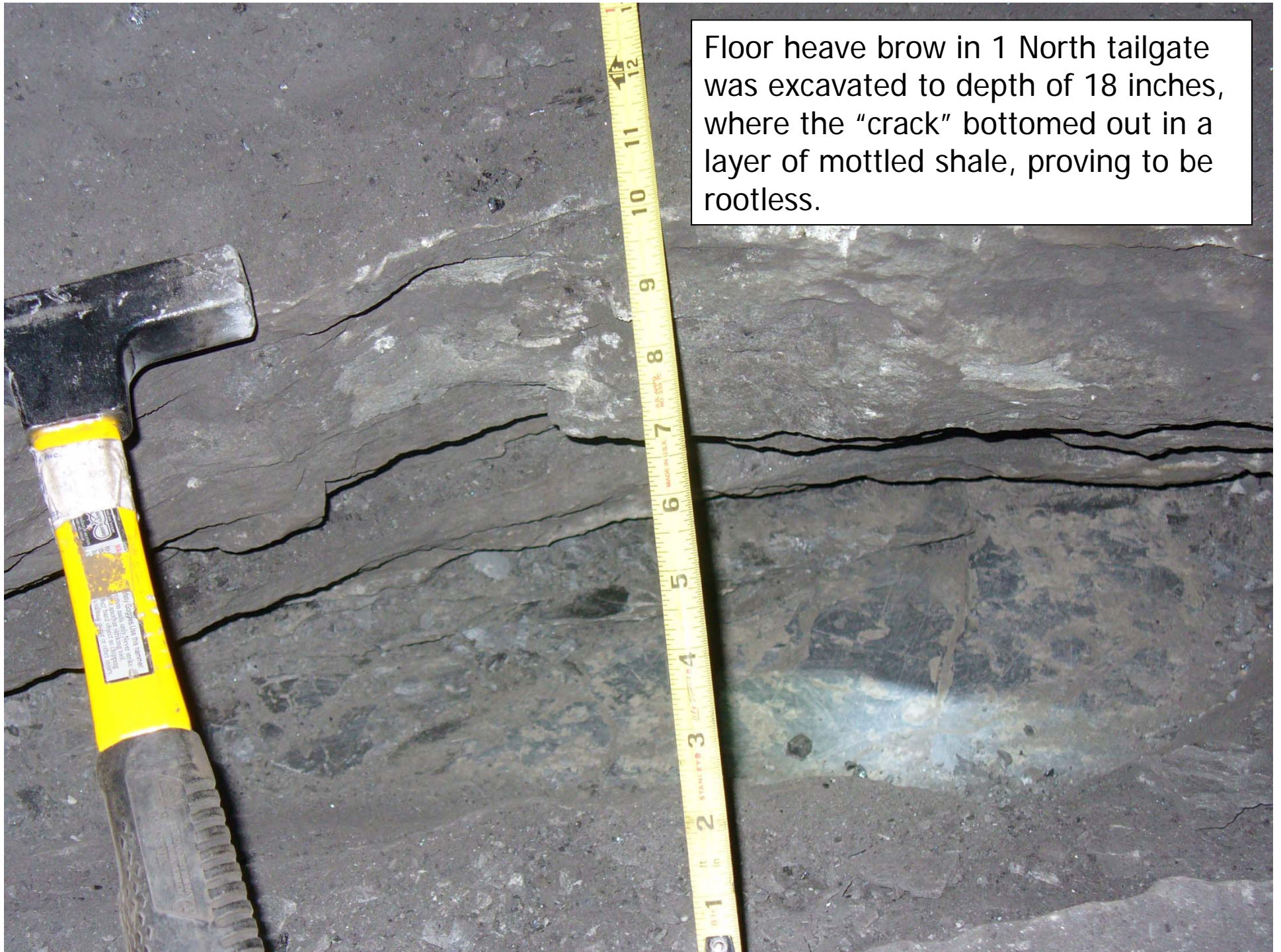
- Eagle coal seam
 - Up to 1,200 feet deep
 - Extensive overmining
 - History of floor heaving
 - Long history of inundations
- Explosion in gob of LW 2 West panel in 1997
 - Attributed to roof fall
- UBB inundations in 2003 and 2004
 - Floor cracks, regional faulting
 - MSHA Tech Support investigated
 - Massey was aware of inundations
 - Recommendations given to UBB
 - No evidence of implementation

Locations and Dates of Known Gas Outbursts Relative to Fault Zone



Examples of Floor Heaving





Floor heave brow in 1 North tailgate was excavated to depth of 18 inches, where the "crack" bottomed out in a layer of mottled shale, proving to be rootless.

Ventilation

- Push-pull system: 2 blowing fans, 1 exhaust fan
- Bandytown fan ventilated area of explosion
- Vent plan required 15,000 cfm in the last open XC (LOC) for CM sections
 - Did not maintain minimum air quantity at HG 22
- Vent plan required 30,000 cfm in LW intake

LW Ventilating Quantities

- Prior to 12/13/09 the LW was ventilated with ~60,000 cfm.
- Failure of ground control in the LW HG necessitated a change to relocate the HG 22 return air course on 12/23/09.
 - LW ventilating quantity increased to ~140,000 cfm.
 - HG 22 quantity was ~20,000 cfm.
 - Operator tried to reverse belt direction and failed.
- Between approval of plans for tailgate 22 and the start of the section, the LW quantity decreased 50,000 cfm in three days.
- In mid-February and beginning of March 2010, several unexplained fluctuations in LW air quantity occurred
 - On 2/24, 110,760 cfm
 - On 2/25, 77,700 cfm

 - On 3/5, 82,368 cfm
 - On 3/6, 113,978 cfm

LW Ventilating Quantities

- On 3/9/10 unapproved changes were cited in the LW tailgate
 - Prior to the order the LW quantity was ~80,000 cfm
 - After correction of cited condition, the LW quantity was ~77,000 cfm
- The operator decided to install equipment regulating doors on the LW intake around March 17, 2010
 - The operator has stated this was done to ensure adequate air for HG 22
 - The LW intake quantity was reduced ~20,000 cfm to 60,000 cfm by 3/22/10
 - The HG 22 air quantity increased slightly

Ventilation

- Weekly Examinations and Air Measurements
 - Measurements for numerous air splits not recorded
 - Measurements for air splits recorded intermittently
 - Measurements for belt air quantity and direction not recorded
 - Measurements for evaluation points never recorded or incomplete

Ventilation

- Chronic ventilation problems at UBB
 - Number of ventilation-related citations and orders
 - Indicated by testimony of those who provided information to the investigators
- Many equipment doors used in lieu of overcasts
 - Did not reliably separate air courses
 - Often left open
 - Subject to damage and increased leakage

Equipment Door



Dust Suppression

- Water supply used for dust suppression was inadequate for LW
 - Improperly-filtered river water
- Tailgate drum
 - 7 missing spray nozzles
 - Unapproved spray nozzles
 - Minimum water pressure could not be maintained
- Functioning dust suppression would have reduced float coal dust generation

Tail Drum of Longwall Shearer



UBB Tailgate Drum



Shearer Drum (Missing Sprays)



Shearer Drum (All Sprays Installed)



Examinations

- MSHA's findings are based on examination of record books and testimony about examinations at UBB
- Two sets of books
 - Hazards recorded in production and maintenance reports, not listed in required examination books
 - CM section should have been evacuated and power disconnected - (1.5% methane) – they just waited 25 minutes for it to clear
 - Shearer did not have functioning water sprays
- Required gas readings not recorded
 - Examiners assigned by the mine operator did not turn on gas detectors
- Required air readings not recorded
- Corrective actions not recorded
 - Belts needed clean-up or rock dusting

Two Sets of Records

Onshift Report

Production Report

DAILY AND ONSHIFT REPORT
MINE FOREMAN OR ASSISTANT

Use Infillite Pencil or Ink
Date: 3-2-10 Shift: EVE

Area or Section: Headgate #22

Violations and other Hazardous Conditions Observed and Reported

| Location | Violation or Hazardous Condition | Action taken |
|----------------------|----------------------------------|-------------------|
| #1 .05 CH4 20.802 | Part Bolted | Bolted |
| #2 .05 CH4 20.802 | Scrap cut | Finished & Bolted |
| #3 .10 20.802 | NONE | |

Examinations for Methane in Working Places

| Location | Time | Methane Content |
|----------|-------------|-----------------|
| 1-3 | 4:10-4:40 | .30 |
| 1-3 | 6:10-6:40 | .25 |
| 1-3 | 8:10-8:40 | .30 |
| 1-3 | 10:10-10:40 | .30 |

Examinations for Methane in Return Airways

| Location | Time | Methane Content |
|----------|------|-----------------|
| Return | 4:10 | .25 |
| Return | 8:08 | .30 |

Number of Bolts Tested: 25
Number of Bolts Tested Above Range: 0

Remarks (Statement as to General Conditions of Mine or Area of Mine): Went over para 4 paragraph 4 MIMW Plan and para 4 paragraph 4-10 Roofcontrol plan with electric crew at 4:00

Mine: U8B Date: 3-2-10
Shift: EVE

Accident Yes No If yes complete
I-2 Chain: I-2
Condition of Floor: OK

Production Report

Mine: U8B Date: 3-2-10
Shift: EVE

Production Staffing (circle one)
Seam: Modified Dual
Stabling Level: Full Short
Number of Vacancies: 1
Shortage Code: A
of Contractors: 1
Manhours: 2.00
Pillaring Yes No
No. of Inspectors: MSHA MHSI
No. of Violations: MSHA 0 MHSI 0

Foreman's Production Report

Mine: U8B
Area: Headgate #22
Foreman: [Redacted]
Shift: EVE

| Time | Location | Methane Content |
|-------------|----------|-----------------|
| 4:10-4:40 | 1-3 | .30 |
| 6:10-6:40 | 1-3 | .25 |
| 8:10-8:40 | 1-3 | .30 |
| 10:10-10:40 | 1-3 | .30 |

25 min Reventelating to get methane out of #3 1.5% Reduce to .30

Two Sets of Records

Onshift Report

Maintenance Report

Use Indelible Pencil or Ink

DAILY AND ONSHIFT REPORT
MINE FOREMAN OR ASSISTANT

Date: 3-1-10 shift: Eve Area or Section: Longwall

Violations and other Hazardous Conditions Observed and Reported

| Location | CH ₄ | O ₂ | Name Observed | Action taken |
|----------------------|-----------------|----------------|---------------|--------------|
| 1. Face | 0% | 20.8% | | None |
| 2. Roof Supports | " | " | " | " |
| 3. Power Center | " | " | " | " |
| 4. Chargers | " | " | " | " |
| 6. Track | " | " | " | " |
| 6. Travelways | " | " | " | " |
| 7. Barricade Station | " | " | " | " |

Examinations for Methane in Working Places

| Location | Time | Methane Content | Location | Time | Methane Content |
|----------|----------|-----------------|----------|------|-----------------|
| 1. Face | 4:45 PM | 0% | 11. | | |
| 2. | 6:45 PM | 0% | 12. | | |
| 3. | 8:43 PM | 0% | 13. | | |
| 4. | 10:42 PM | 0% | 14. | | |
| 5. | 12:40 AM | 0% | 15. | | |
| 6. | | | 16. | | |
| 7. | | | 17. | | |
| 8. | | | 18. | | |
| 9. | | | 19. | | |
| 10. | | | 20. | | |

Examinations for Methane in Return Aircourses

| Location | Time | Methane Content | Location | Time | Methane Content |
|-----------|----------|-----------------|----------|------|-----------------|
| 1. Return | 5:50 PM | 0% | 6. | | |
| 2. | 7:48 PM | 0% | 7. | | |
| 3. | 9:48 PM | 0% | 8. | | |
| 4. | 11:45 PM | 0% | 9. | | |
| 5. | | | 10. | | |

Number of Bolts Tested: _____
Number of Bolts Torqued Above Range: _____ Below Range: _____

If majority of bolts tested in any working place falls outside approved torque range, state what action was taken

Remarks (Statement as to General Conditions of Mine or Area of Mine): discussed longwall dust & methane plan

Performance
UBB Longwall
Monday, 3/1/2010
B Crew, Shift Chief

| Equipment | Job Description | Estimated Time | Comments/Initials |
|------------------|---|----------------|-------------------|
| Face Conveyor | Utilize the bretby gauge to check the bretby trough to insure bretby will clear. If not wide enough, repair and record locations where repairs were made. | | |
| | Hang gauge at #5 shield when complete. (On-Shift) | 20 minutes | [Redacted] |
| | Check slim line in cable handler, especially near couplings looking for fatigue do to movement, replace as needed. (On-Shift) | 20 minutes | [Redacted] |
| | Did you put ACT in manual mode on your shift _____, if so explain why. Did you put yellow handle detent valve in and set to 1500 PSI? (On-Shift) | 5 minutes | |
| General Longwall | Check oxygen and acetylene tanks. Record the number of empty oxygen | | |

"Added 5 gal oil to T/E ranging arm. Had no water on either drum, cleaned several and stopped right back up, removed 8 on each end, ran like that rest of shift to try and flush drums, told 3rd shift"

inhearer

Check down blade bolts, replace if more than one is missing (Pre-shift) 5 minutes [Redacted]

*Added 5 gal oil to T/E ranging arm
Had no water on either drum, cleaned several and stopped right back up, removed 8 on each end, ran like that rest of shift to try and flush drums, told 3rd shift*

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 - Examiners assigned by the mine operator did not turn on gas detectors
- Required air readings not recorded
- Corrective actions not recorded
 - Belts needed clean-up or rock dusting

UBB Midnight Shift Summary for April 5, 2010

- Preshifts for CM sections on morning of 4/5/2010 reported few hazards
- Preshift/ onshifts for belts on morning of 4/5/2010
 - Reported 6 of 10 belts needed rock dusting
 - Reported 5 of 10 belts needed cleaning

UBB Day Shift Summary for April 5, 2010

- LW Preshift Report for the oncoming evening shift called out at 2:40 PM
 - No methane
 - 56,840 cfm air in intake
 - No hazards
- HG 22 preshift
 - One entry that needed rockdusting
- TG 22 preshift
 - No hazards reported
- Conveyor belt preshift/ onshift
 - 8 of 10 belts needed rockdusting
 - 6 of 10 belts needed cleaning
- Production
 - HG 22 normal
 - TG 22 normal

Review of Belt Examination Records Concerning Rock Dust

| Belt | LEGEND: | | | | | | | | | | | | |
|------------|-----------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | Belt needs to be rockdusted | | | | | | Rockdust applied to some part of belt | | | | | | |
| | 4/1/10 1st Day | 4/1/10 2nd Eve | 4/2/10 3rd Mid | 4/2/10 1st Day | 4/2/10 2nd Eve | 4/3/10 3rd Mid | 4/3/10 1st Day | 4/3/10 2nd Eve | 4/3/10 3rd Mid | 4/4/10 1st Day | 4/4/10 2nd Eve | 4/4/10 3rd Mid | 4/5/10 1st Day |
| Ellis #4 | | | | | | | | Electrical | No Exam | No Exam | Electrical | | |
| Ellis #5 | | | | | | | | Electrical | No Exam | No Exam | Electrical | | |
| North No.4 | | | | | | | | Electrical | No Exam | No Exam | Electrical | | |
| North No.5 | | | | | | | | Electrical | No Exam | No Exam | Electrical | | |
| North No.6 | | | | | | | | Electrical | No Exam | No Exam | Electrical | | |
| North No.7 | | | | | | | | Electrical | No Exam | No Exam | Electrical | | |
| Longwall | | | | | | | | Electrical | No Exam | No Exam | Idle | | |
| TG No.1 | | | | | Idle | Idle | | Idle | No Exam | No Exam | Idle | | |
| TG No.2 | | | | | Idle | Idle | | Idle | No Exam | No Exam | Idle | | |
| HG22 | | | | | | | | Electrical | No Exam | No Exam | Idle | No Exam | |

Examination and Maintenance of the Longwall Bleeders

- The company designee to make methane checks and examine LW bleeders
 - Weekly examination
 - Preshift exam pumping crew
- Multigas detector was not turned on since March 18, 2010 prior to about 7 PM on April 5, 2010
 - Could not make required exams with detector turned off
 - If there were any problems with methane on the LW it should have been noticed if the detector was operating
- He and his crew left LW at 2:30 PM

Examinations

- Examination books required to be counter-signed by upper management
 - UBB managers were aware that chronic hazardous conditions were not recorded as corrected
 - Testimony indicates UBB management pressured examiners to not record hazards in books
 - Many hazards were not recorded
- Evidence indicates the operator:
 - Failed to perform required examinations
 - Performed inadequate examinations
 - Ignored hazardous conditions

Rock Dust

- Citation history
 - 17 rock dust violations within one year prior to explosion
 - 11 of these citations mention float coal dust
- Interviews indicate rockdust problems
 - Generally, only the track and belts were rock dusted
 - Some areas were only rock dusted as developed
 - Float coal dust would accumulate in belt entries
- Problems with bulk duster
 - Rail-mounted pod duster, 1.6 ton capacity
 - Only covers two entries for approximately 10 crosscuts
 - Unit was more than 25 years old, problems with air compressor
 - Single crew dusted on midnight shift
 - Regularly taken off rock dusting to do other work
 - Regularly could not find a motor to pull rail duster
 - High rate of turnover for bulk dusting crew
 - Limited time to apply rock dust during shift

3/18/10

Bulk Dusted

From Mother drive up to 76^{brk} Done with hose.

3/20/10

Bulk Dusted

LW Belt + Motherdrive

3-22-10

Hand Dusted

Shoveled 6N Head + Dusted
" 5N Head + Dusted
" 4N Head + Dusted

3-23-10

No Dust

NO RIDE NO Help NO spotter
I'll call you today. I'm set up to fail here.

Hand Dusted

3-24-10 NO Help, went to 78 + pickup u ^{silk} _{stakars}
Finished Hand Dusting 4N Belt
from 7 Brk. to Ellis switch.
Shoveled 4 Head + Hand Dusted
" 5 " + " "

Grease Dusty changed

Filter

Page of Rock Dust Crew's Notebook

Rock Dust on LW Tailgate

- LW tailgate had a low roof
 - Extensive floor heaving
 - Bulk duster could not be used on TG of LW
- Each LW pass generates float coal dust even with effective water sprays
- No evidence of rock dust applied to TG after development
 - No records were found during the investigation
 - Confirmed by statements of UBB Manager and others

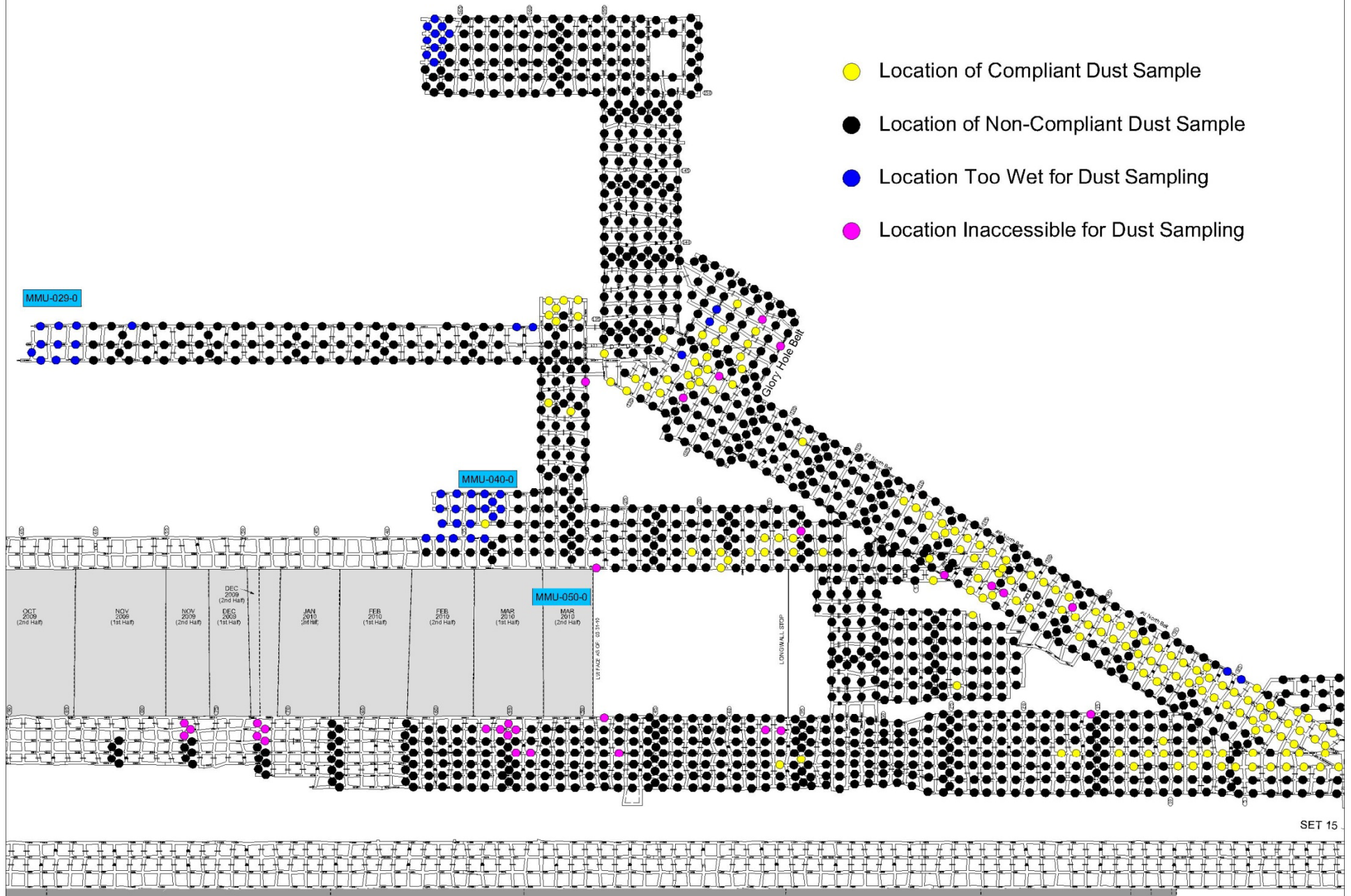
Bruceston Explosion Test



Bruceston Explosion Test



Results of Post-Explosion Rock Dust Analysis



MSHA Inspection History

| Inspection Quarter (FY) | Citations Issued | Orders Issued | Inspection Hours |
|--------------------------------|-------------------------|----------------------|-------------------------|
| 2009-2 | 91 | 1 | 349 |
| 2009-3 | 119 | 16 | 507 |
| 2009-4 | 149 | 23 | 658 |
| 2010-1 | 58 | 9 | 542 |
| 2010-2 | 101 | 7 | 607 |
| 2010-3 | 5 | 1 | 22 |

Training Deficiencies at UBB

- Inadequate training or no training of miners
 - 263 employee and contractor files were reviewed.
 - 205 training deficiencies were found
 - 104 miners did not receive or did not complete required “experienced miner” training before commencing work at UBB
 - 42 miners did not receive training before they were assigned to perform a new job task

Training records for two years prior to explosion

Illegal Advance Notice

- Security guards radioed the mine office when mine inspectors arrived
- Dispatchers relayed the information underground and tracked the movements of mine inspectors
- Production sections involved in the explosion had at least one-hour advance notice of inspections
 - Time to correct non-compliant conditions and/or shut-down production
 - Air flows increased at area to be inspected
- Mine inspectors rarely arrived on sections unannounced
- Advance notice severely limited the effectiveness of MSHA inspection efforts at UBB
 - MSHA still issued more 104(d) orders at UBB than in any other coal mine in the year prior to the accident

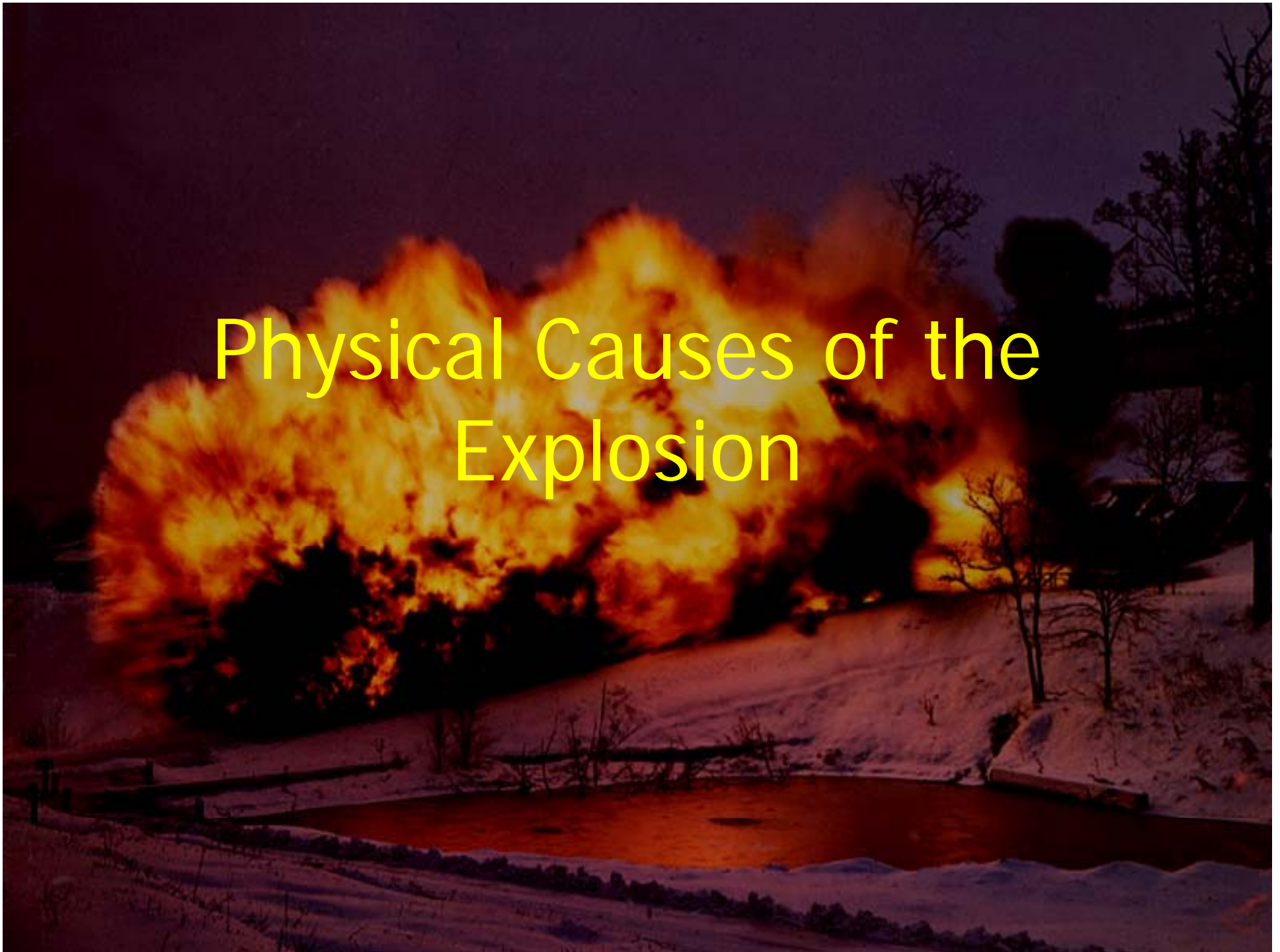
Intimidation of Miners

- UBB upper management threatened to fire first line management for not meeting production goals
 - Safety hazards such as insufficient air were not acceptable excuses for not running coal
 - A section foreman was fired for delaying production for about an hour to fix ventilation problems
 - Dean Jones (victim) was told “if he can't go up there to run coal, just bring your bucket outside and go home”
- Testimony indicated many miners were intimidated
 - Strongly discouraged from slowing or stopping production for safety reasons
 - Examiners were pressured not to list hazards in the books
 - Miners who were worried about conditions at the mine would not complain due to fear of retribution
 - Miners at UBB submitted only one underground hazard complaint since 2006

Engineering and Mine Planning

- Engineering at the mine performed on an ad hoc basis
 - No comprehensive mine planning
 - Trial and error method
 - Numerous plan denials by MSHA
 - Started at Logan's Fork mine
 - Excessive haste at UBB to speed up development for the LW
- Pillars in HG & TG of LW too small
 - Extensive floor heaving
 - Numerous roof falls and rib rolls
 - D-4 required a supplemental tailgate development
 - Restricted air flow and restricted travel of critical air courses
- After 2 months of LW mining, subsidence cracks developed up to the overlying Logan's Fork Mine
 - Water inundation November 16, 2009 flooded bleeders
 - Critical ventilation capacity lost due to flooding, roof falls, and floor heaving

Physical Causes of the Explosion



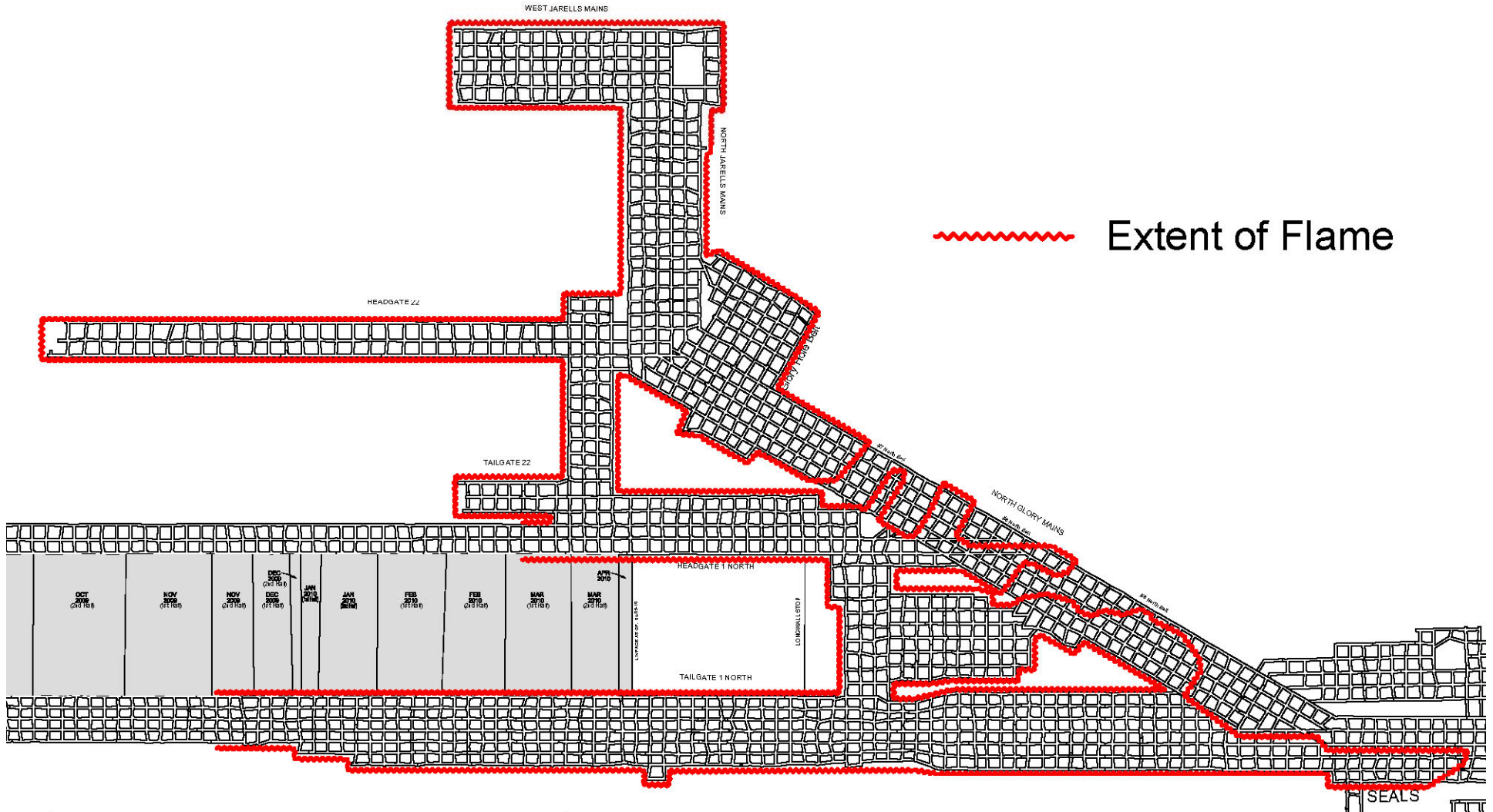
Potential Ignition Sources

- The most likely ignition source is from the LW shearer cutting sandstone
 - Worn bits
 - Nonfunctional and missing water sprays
- Other, less likely, sources:
 - Rock fall
 - Pan line
- Nearly all recovered electrical components have been tested and checked for possible ignition sources and none were identified
 - Remaining components will most likely not be identified as possible ignition sources

Most Likely Cause of Explosion

- Methane liberated from floor cracks
 - Floor cracks with methane liberations identified at Shields 160 and 171
- A limited amount of methane in explosive range occurred at shearer
- Ignited at shearer due to cutting through sandstone
- The crew left the shearer location
- Flame from initial ignition ignited an accumulation of methane
- A localized explosion occurred and traveled through the outby crosscut of the tailgate, suspended coal dust, and propagated into a major coal dust explosion

Explosion Flame Map



Detection of Methane

- The methane monitors on the tail of the LW and on the shearer did not de-energize electrical power
- Information collected from the handheld gas detector located at shield 83 did not record elevated methane levels prior to the explosion
- Information collected from handheld gas detectors carried by UBB employees who traveled to within two XCs of the LW face on the TG side approximately 2 hours after the explosion recorded a methane level of only 0.3%
- On 4/5 rescue team members advanced to shield 120 on the LW face
 - Did not report any sound emanating from the LW face or TG entry which would have indicated a large volume of gas release
 - Did not report elevated levels of methane along the LW until reaching shield 120 - reported 2.0 percent methane

Conclusion

- Operator failures that contributed to the explosion:
 - Inadequate application of rock dust
 - Inadequate control of float coal dust
 - Missing and non-functioning water sprays and insufficient water pressure on the LW shearer
 - Emphasis on productivity to the detriment of safety

Conclusion

- Most likely cause of the accident was a limited amount of methane
 - Ignited by the LW shearer cutting sandstone
- Methane ignition transitioned into a massive coal dust explosion
- This explosion could and should have been prevented by the mine operator

