CONTENT:

APPENDIX 5.3-1 to 5.5

VOLUME 4 of 4

REPORT of INVESTIGATION

SAGO MINE EXPLOSION

JANUARY 2, 2006

WEST VIRGINIA OFFICE of MINERS' HEALTH

SAFETY AND TRAINING

DECEMBER 11, 2006

RON WOOTEN, DIRECTOR

APPENDIX 5

The Investigation

(5.3) Omega Seals

- **Summary of Approved Construction**
- **West Virginia Code – Unused and Abandoned Parts of Mine**
- **Approvals and Requests for Sealing**
- **Inspection Report of Seals**
- **Seal Foundation Boring Test**

5.3-1 APPROVALS AND CONSTRUCTION

Chapter 22A-2-5 (effective 7/1/71) of The West Virginia Code and Title 36 Series 17 (effective 3/1/82) of the Administrative Rules and Regulations are a reference for the requirement of Unused and Abandoned Parts of Mine.
These are included in the appendix

Anker West Virginia Mining Company (ICG) representatives abandoned the area of the Sago mine referred to as North East Mains and 2nd. Left Mains. Initially this abandoned area was ventilated by the mine's ventilation system. Later a decision was made to seal this area.

On October 12, 2005, Anker West Virginia Mining Company submitted to the WVMHS&T Region One (received 10/13/05) a request to add an Omega Concrete Block Seal Method and Plans to the approved ventilation plan. The Region One office reviewed and approved this request on October 14, 2005.
This request and approval are listed in the appendix

On October 12, 2005, Anker West Virginia Mining Company submitted to the WVMHS&T Region One office (received 10/18/05) a request to of a Seal Plan for 2nd. Left Mains and a two step plan for ventilation of this area. The Region One office reviewed and approved this request on October 18, 2005.
This request and approval are listed in the appendix

According to testimony of persons interviewed, the ventilation controls installed and the seal construction was performed by employees of Anker West Virginia Mining Company and employees of Garrett Mine Service an Independent Contractor.
See transcripts of persons interviewed

On December 9, 2005, prior to completion of the seals and Step 2 of the approved plan, Mr. John Collins, District Mine Inspector, WVMHS&T, conducted an inspection of the seals. *See a copy of the inspection report in the appendix*

According to testimony of persons interviewed the Seal Plan and Step 2 of the approved plan was completed within a few days after the inspection of Mr. Collins on December 9, 2005. *See transcripts of persons interviewed*

§22A-2-5. Unused and abandoned parts of mine.

(a) In any mine, all workings which are abandoned after the first day of July, one thousand nine hundred seventy-one, shall be sealed or ventilated. If such workings are sealed, the sealing shall be done with incombustible material in a manner prescribed by the director, and one or more of the seals of every sealed area shall be fitted with a pipe and cap or valve to permit the sampling of gases and measuring of hydrostatic pressure behind the seals. For the purpose of this section, working within a panel shall not be deemed to be abandoned until such panel is abandoned.

(b) Air that has passed through an abandoned area or an area which is inaccessible or unsafe for inspection shall not be used to ventilate any working place in any working mine, unless permission is granted by the director with unanimous agreement of the technical and mine safety review committee. Air that has been used to ventilate seals shall not be used to ventilate any working place in any working mine. No air which has been used to ventilate an area from which the pillars have been removed shall be used to ventilate any working place in a mine, except that such air, if it does not contain 0.25 volume percent or more of methane, may be used to ventilate enough advancing working places immediately adjacent to the line of retreat to maintain an orderly sequence of pillar recovery on a set of entries. Before sealed areas, temporary or permanent, are reopened, the director shall be notified.

TITLE 36 SERIES 17
UNUSED AND ABANDONED PARTS OF MINE

§36-17-1. General.

1.1. Scope. -- Rules and regulations governing unused and abandoned parts of mine
1.2. Authority. -- W. Va. Code §22-6-4
1.3. Filing Date. -- January 22, 1982
1.4. Effective Date. -- March 1, 1982

§36-17-2. Effect of Regulations.

2.1. These rules and regulations shall have the effect of law and violations shall be deemed a violation of law and so cited with the same effect as law. All provisions of Article one A, Chapter twenty-two A, of the Code relative to enforcement are applicable to the enforcement of these rules and regulation.

§36-17-3. Definitions.

All terms used in these rules and regulations, not defined herein, shall have the meanings set forth in Section One, Article One A, Chapter Twenty-Two A of the Code.

§36-17-4. Unused And Abandoned Parts Of Mine.

4.1. (a) In any mine, all workings which are abandoned after the effective date of this rule shall be sealed or ventilated. If such workings are sealed, the sealing shall be done with incombustible material in a manner prescribed by the Director of the Department of Energy, and one or more of the seals of every sealed area shall be fitted with a pipe and cap or valve to permit the sampling of gases and measuring of hydrostatic pressure behind the seals. For the purpose of this section, working within a panel shall not be deemed to be abandoned until such panel is abandoned.
(b) Air that has been used to ventilate seals shall not be used to ventilate any working place in any mine, unless prior approval is obtained from the Director of the Department of Energy. Air that has passed through an abandoned working or an area which is inaccessible or unsafe for inspection shall not be used to ventilate any working place in any mine.
(c) No air which has been used to ventilate an area from which the pillars have been removed shall be used to ventilate any working place in a mine, except that such air, if it does not contain 0.25 volume percent or more of methane, may be used to ventilate enough advancing working places immediately adjacent to the line of retreat to maintain an orderly sequence of pillar recovery on a set of entries. Before sealed areas, temporary or permanent are reopened, the Director of the Department of Energy shall be notified.

STATE OF WEST VIRGINIA
OFFICE OF MINERS' HEALTH, SAFETY AND TRAINING
BUREAU OF COMMERCE
205 MARION SQUARE
FAIRMONT WV 26554

Region One

October 14, 2005

COMPANY: Anker West Virginia Mining Company, Inc.

ADDRESS: Route 9, Box 507, Buckhannon, WV 26201

This is to acknowledge receipt of your ventilation plan for:

Sago Mine	U-2016-98B
Mine	Permit No.

Your submitted change has been:

X Accepted

_____ Rejected

REMARKS: Your request to add an Omega Concrete Block Seal Method to your ventilation plan has been reviewed and approved.

NOTE: Method for sealing abandoned or worked out areas requirements Pages 1 and 2 are enclosed. All that apply must be complied with.

John Collins
District Inspector

Mark Wilfong
Inspector-At-Large

Anker West Virginia Mining Company
Rt. 9 Box 507
Buckkannon, WV 26201

October 12, 2005

Brian Mills, Inspector at Large
WV Office of Miners Health Safety & Training
205 Marion Square
Fairmont, WV 26554-2800

RE: Sago Mine's Ventilation Plan Changes

Mr. Mills:

Anker West Virginia Mining Company wishes to add an Omega Concrete Block Seal Method and Plan to our current Ventilation Plan for our Sago Mine, WVOMHS&T ID # U-2016-98B. It should be noted, that at this time, we only wish to add the non-hitched style to our plan. (See attached diagrams).

If you have any questions on this matter, please feel free to contact me at 304-471-3300.

Sincerely,

Joe Myers
FOR Al Schoonover
Safety Director

Guidelines for installation of Omega Block Concrete Seals

1. All loose material will be removed from the roof, ribs, and floor to accommodate seal construction and supplemental supports. The seals will be constructed at such a location so that a permanent block seal can be installed in front of the omega seal, if required in the future.

2. The seal will be constructed with Omega blocks using one of the following Methods:

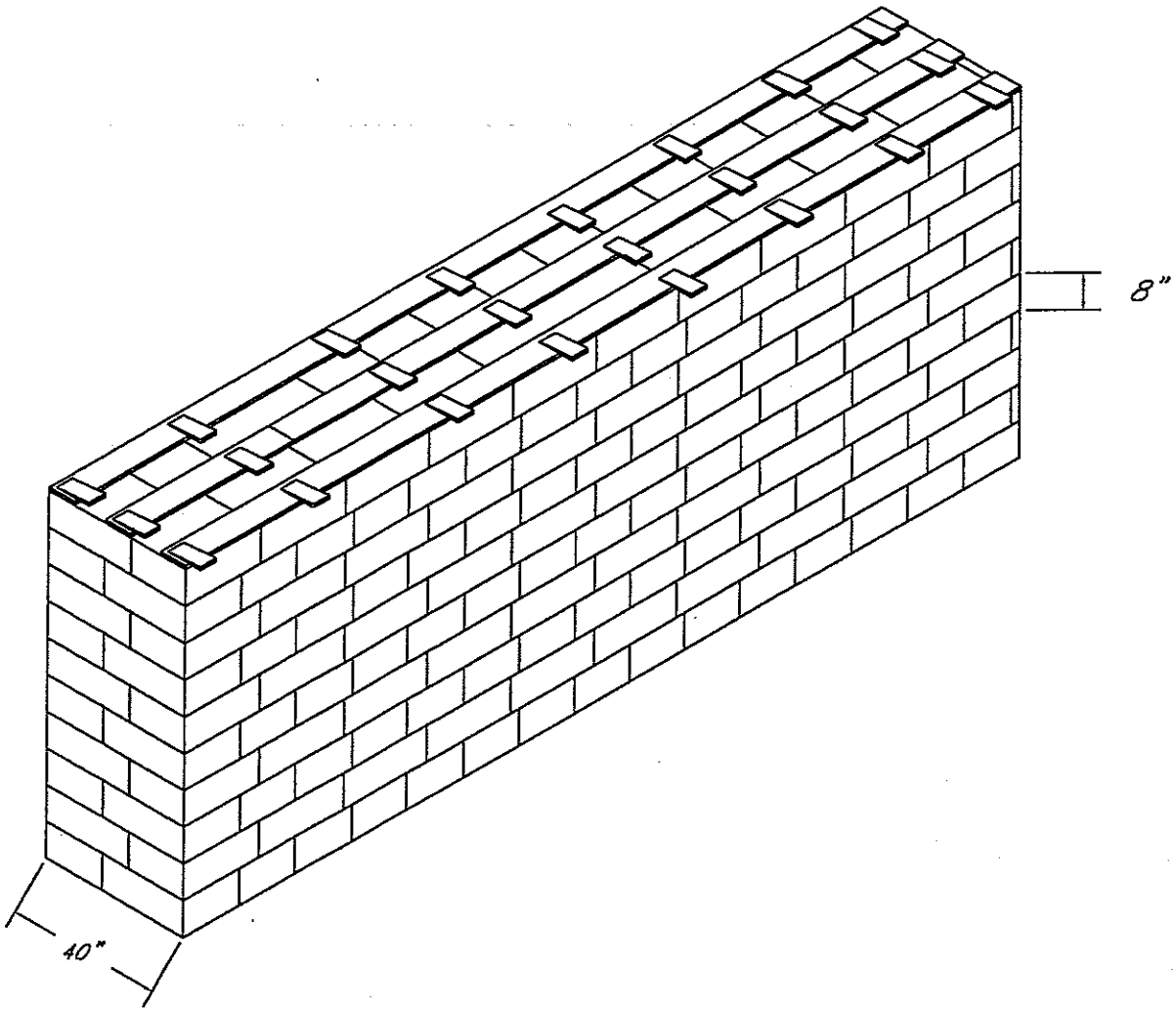
   A) Total thickness of 40"
   B) No hitching required.
   C) Joints must be staggered.
   D) All joints shall be a minimum of ¼" thick and be mortared using an approved mortar/sealant.
   E) Three rows of wood planks running the entire length of the seal shall be installed across the top of the seal.
   F) Wedges will be placed on 1 Foot centers or less, with an approved sealant used to fill the gaps.
   G) An approved sealant shall be used as full face coating on both sides of the seal.
   H) Seals shall be installed at least 10 feet from the corner of the pillar.
   I) Sample pipes shall be installed as per 75.335, or relative to the WVOMHS&T's §36-17-4, and as prescribed by the Director.

SAGO MINE

40" THICK OMEGA BLOCK SEAL

FOR USE WITH SEALS UP TO 8 FT HIGH BY 20 FT WIDE

1. Total thickness 40 inches
2. No hitching required
3. Joints must be staggered
4. All joints shall be a minimum 1/4 inch thich and be motared using an approved motar/sealant
5. Three rows of wood planks running the entire length of the seal shall be installed across the top of the seal
6. Wedges will be placed on 1' centers or less with an approved sealant used to fill the gaps
7. An approved sealant shall be used as full face coating on both sides of the seal.



- Seals shall be at least 10 feet from the corner of the pillar
- Sampling pipes shall be installed as per 36-17-4, and as prescribed by the Director

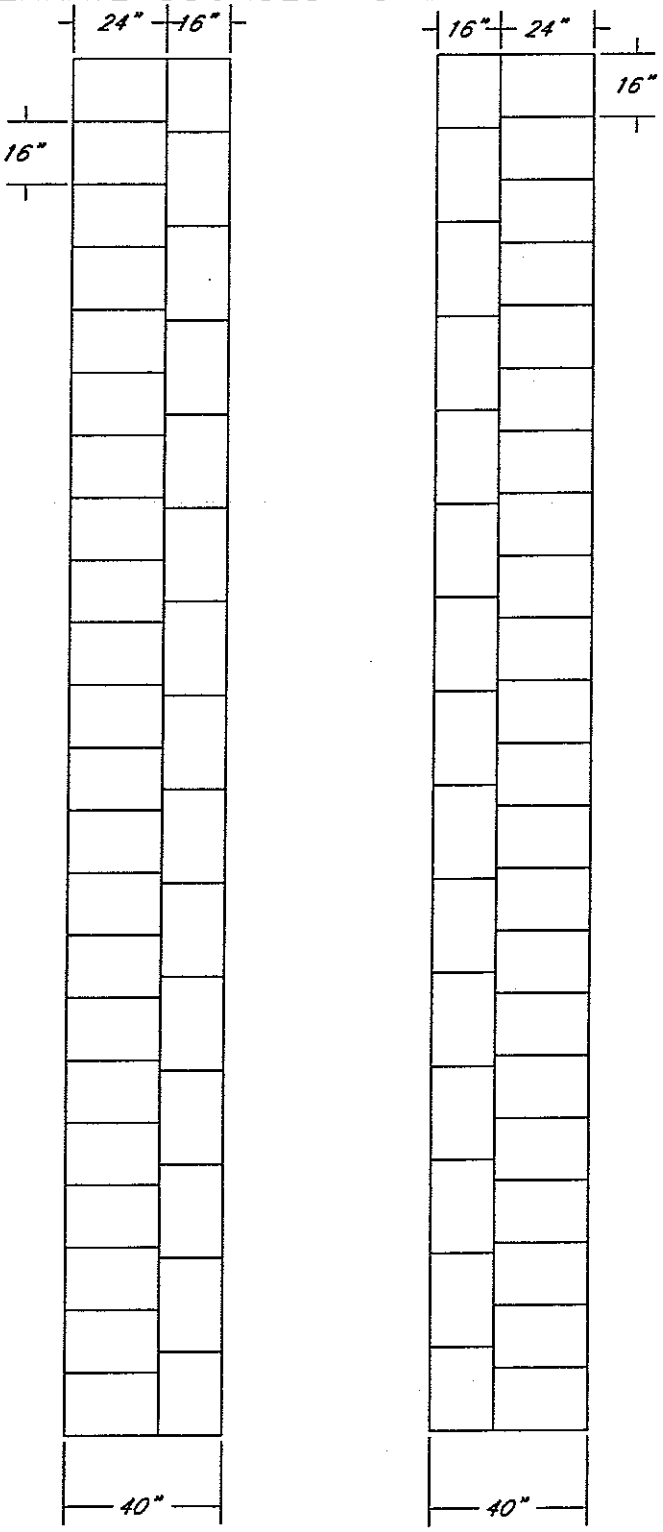
SAGO MINE

40" THICK OMEGA BLOCK SEAL

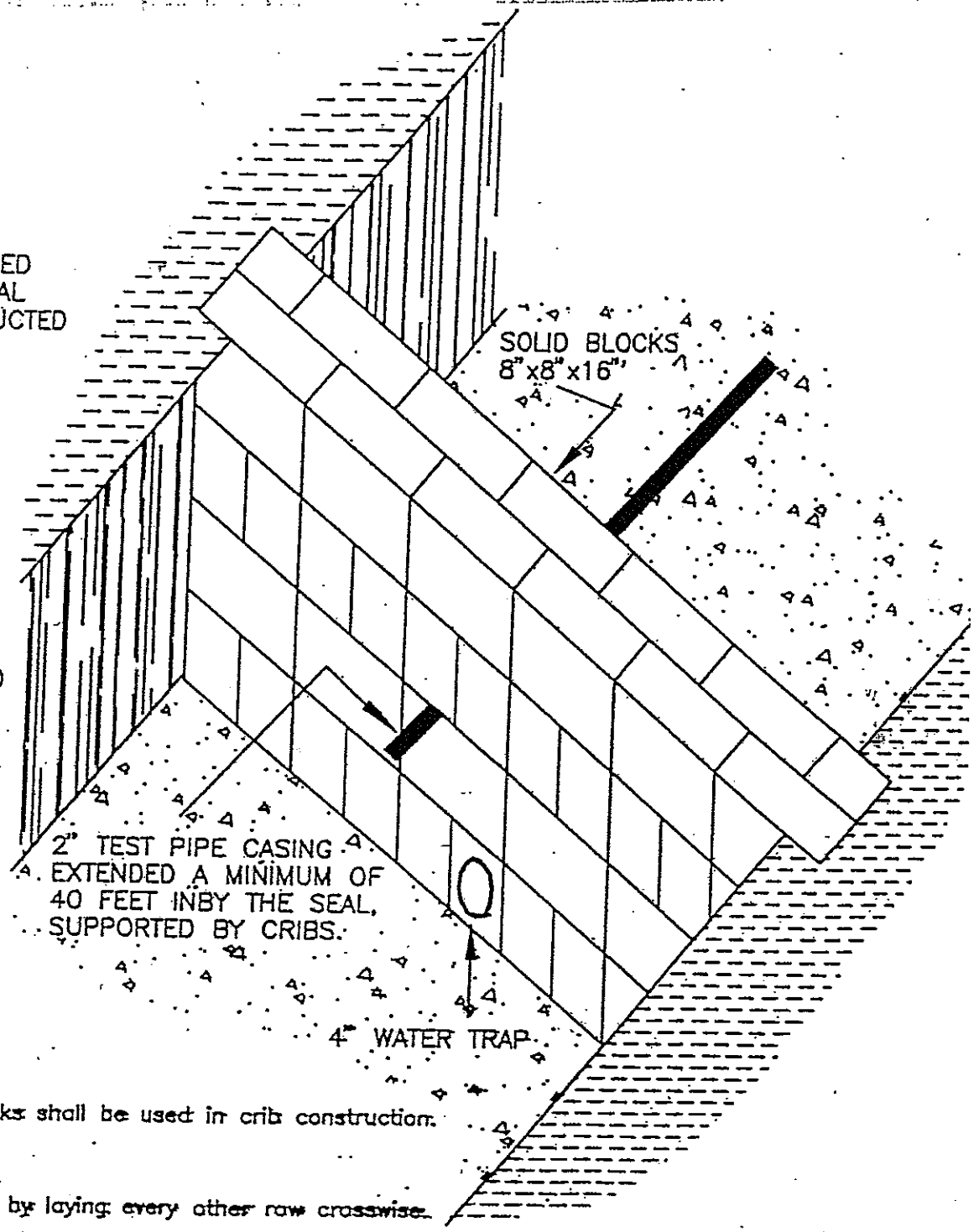
CONTRUCTION PLAN

FOR USE WITH SEALS UP TO 8 FT HIGH BY 20 FT WIDE

ALTERNATE COURSES TO STAGGER JOINTS



METHOD FOR SEALING ABANDONED OR WORKED OUT AREAS



BLOCKS TO BE ANCHORED ONE FOOT IN SOLID COAL AND SHALL BE CONSTRUCTED ON SOLID BOTTOM.

NO ROWS OF BLOCKS ITH CONCRETE MOTAR NES AND 1/2" PLASTER N THE OUT-BY-SIDE AND POSSIBLE ON THE IDE.

A minimum of 30" crib blocks shall be used in crib construction.

Blocks are to be interlocked by laying every other row crosswise.

A minimum of two cribs are to be built inby and outby each seal.

Seals must be built a minimum of 10 feet inby the corner of the coal block.

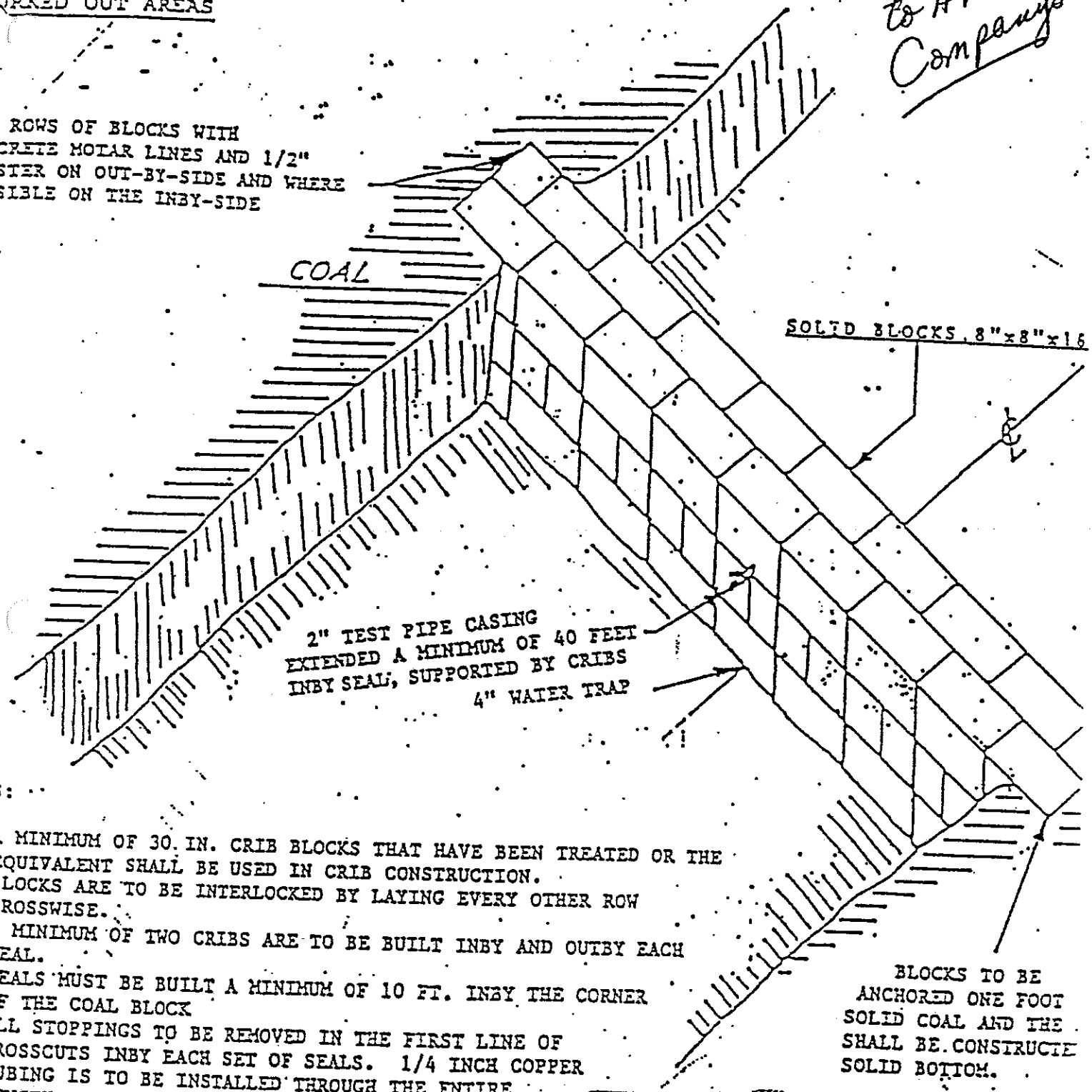
All stoppings to be removed in the line of crosscuts inby each set s. 1/4" copper tubing is to be installed through the entire of the 2" test pipe casing.

Each of the above pipes must be installed in each set of seals. The 2" text pipe casing must be in the seal of the highest elevation. The division office shall be notified before the seals are finished so that the district inspector can check to see if the seals have been constructed to specifications.

DEPARTMENT OF ENERGY
Division of Mines and Minerals
Effective as of 12/13/85

Distribute to All Companys

PLAN FOR SEALING ABANDONED OR WORKED OUT AREAS



ES:

A MINIMUM OF 30 IN. CRIB BLOCKS THAT HAVE BEEN TREATED OR THE EQUIVALENT SHALL BE USED IN CRIB CONSTRUCTION. BLOCKS ARE TO BE INTERLOCKED BY LAYING EVERY OTHER ROW CROSSWISE.

A MINIMUM OF TWO CRIBS ARE TO BE BUILT INBY AND OUTBY EACH SEAL.

SEALS MUST BE BUILT A MINIMUM OF 10 FT. INBY THE CORNER OF THE COAL BLOCK

ALL STOPPINGS TO BE REMOVED IN THE FIRST LINE OF CROSSCUTS INBY EACH SET OF SEALS. 1/4 INCH COPPER TUBING IS TO BE INSTALLED THROUGH THE ENTIRE LENGTH OF THE 2" TEST PIPE CASING.

EACH OF THE ABOVE PIPES MUST BE INSTALLED IN EACH SET OF SEALS. THE 2" TEST PIPE CASING MUST BE IN THE SEAL OF THE HIGHEST ELEVATION AND THE WATER TRAP IN THE SEAL OF LOWEST ELEVATION.

IVISION OFFICE SHALL BE NOTIFIED BEFORE SEALS ARE FINISHED SO THAT THE DISTRICT INSPECTOR CAN CHECK TO SEE IF THE SEALS HAVE BEEN CONSTRUCTED TO SPECIFICATIONS.

COMPANY: _____

MINE: _____

_____

SIGNATURE OF COMPANY OFFICIAL & T

STATE OF WEST VIRGINIA
OFFICE OF MINERS' HEALTH, SAFETY AND TRAINING
BUREAU OF COMMERCE
205 MARION SQUARE
FAIRMONT WV 26554

Region One

October 18, 2005

COMPANY: Anker West Virginia Mining Company

ADDRESS: 2708 Cranberry Square, Morgantown, WV 26508

This is to acknowledge receipt of your **ventilation plan** for:

Sago	U-2016-98B
Mine	Permit No.

Your submitted change has been:

X Accepted

_____ Rejected

REMARKS: Seal plan for 2nd. Left Mains.
(Letter and Maps dated October 12, 2005)

John Collins
District Inspector

Mark Wilfong
Inspector-At-Large

Anker West Virginia Mining Company
Rt. 9 Box 507
Buckkannon, WV 26201

October 12, 2005

Brian Mills, Inspector at Large
WV Office of Miners Health Safety & Training
205 Marion Square
Fairmont, WV 26554-2800

RE: Sago Mine's Ventilation Plan Changes

Mr. Mills:

Anker West Virginia Mining Company wishes to inform you of our intentions to develop a new set of mains in our Sago Mine, WVOMHS&T ID # U-2016-98B. This development will be located in between our current 1st Left Mains and our current 2nd Left Mains.

Note: As described in the seal plan for the 2nd Left Mains, submitted on this date, we wish to develop the ventilation to this area in two steps, (Step #1 and Step #2 - See attached map).

If you have any questions on this matter, please feel free to contact me at 304-471-3300.

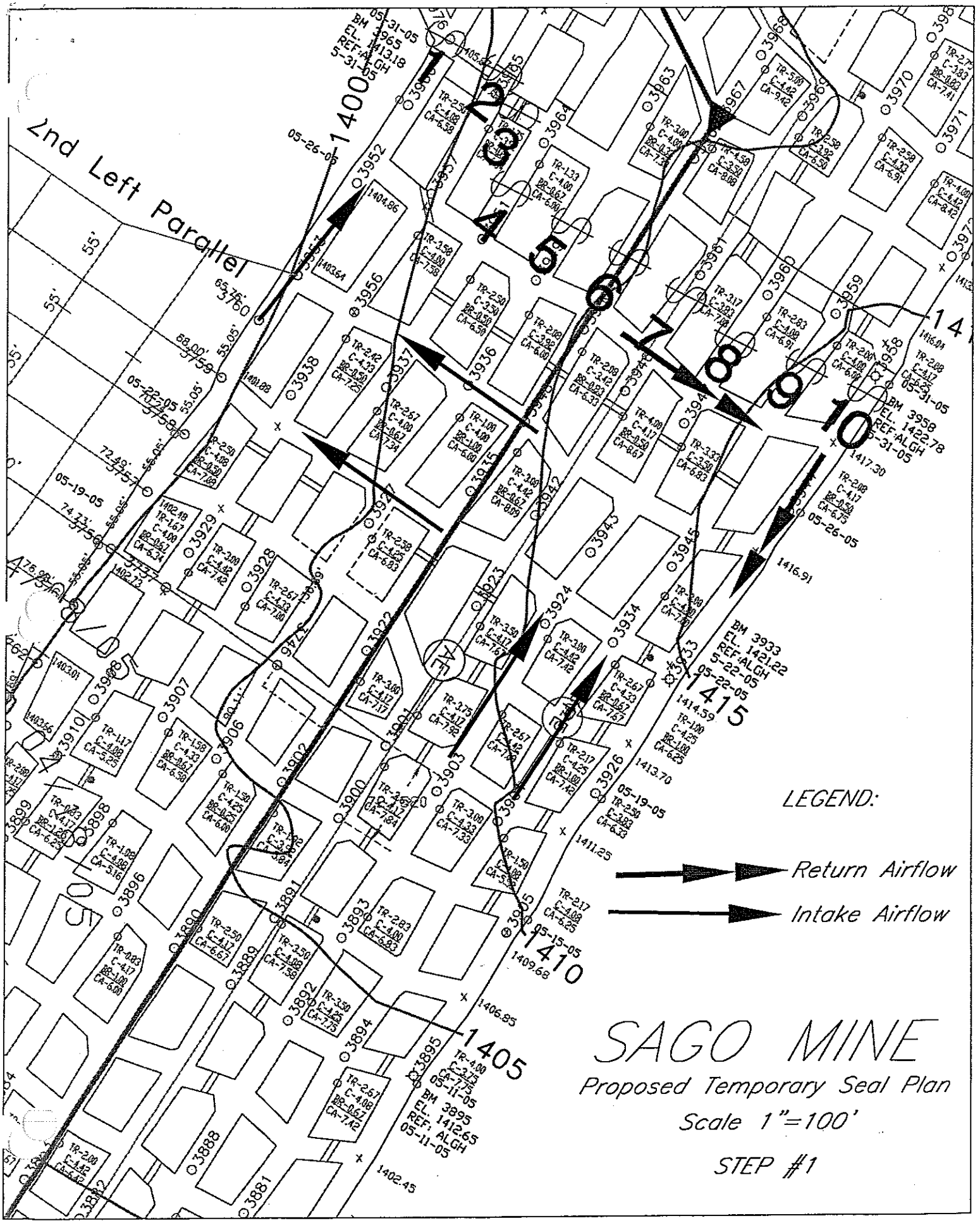
Sincerely,

Joe Myers

For Al Schoonover
Safety Director

OMEGA SEAL AND SEQUENCE PLAN
For
SAGO MINE

The mine seals being proposed will be constructed across our North East Mains, just inby the area that will be the future location of the 2nd Mains Unit. The proposed seals will be constructed across the North East Mains area in such a manner that the No. 2-8 seals will be constructed first, with seal numbers 1 and 10 be constructed simultaneously. It should be noted that for a temporary time frame, (not to exceed a four week period after the construction of said seals), that we will course air from a left-to-right direction, (from the number 1 entry towards the number 9 entry), in order to ventilate these seals; however, once we have constructed the necessary overcasts on the future 2nd Left Mains the air flow direction will be switched to a right-to-left direction, (From the number 9 entry towards the number 1 entry). See attached mapping to see air flow direction and ventilation control devices.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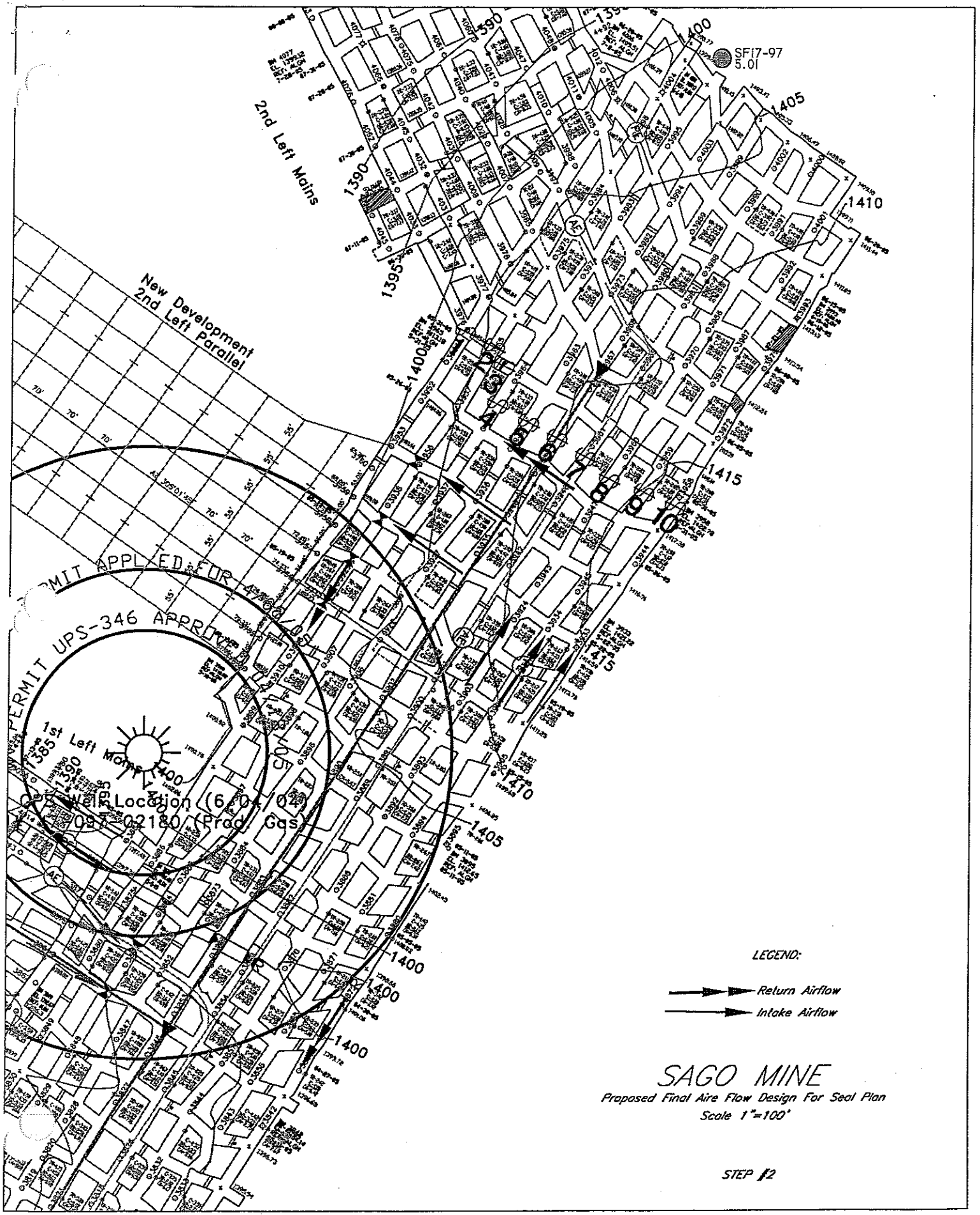
LEGEND:
Return Airflow
Intake Airflow
SAGO MINE
Proposed Temporary Seal Plan
Scale 1"=100'
STEP #1



SAGO MINE

Proposed Final Aire Flow Design For Seal Plan

Scale 1"=100'

STEP #2

IF-001
Rev. 2-98

West Virginia Office of Miners' Health, Safety and Training
INSPECTION REPORT

Record No. LM-739 Date: Dec. 9 2005 Regular Inspection No.: N/A

Case No. N/A Inspector Number: 2

Facility Type
Underground: ✓
Surface:
Contractor:
Preparation:
Quarry:

Type of Inspection

Regular:		Electrical:	
Idle:*		Shaft & Slope:	
Investigation:*		Roof Control:	
Complaint:*		BIT/ JSA:	(If this block is checked please use bit/jsa inspection form)
Other:*	✓		

Company Name: Anker WV Mining Co., Inc WV Permit No.: U-2016-98

Mine Name: Logo Mine Phone: 473-1626 Contractor ID: N/A

Mine Location: Logo County: Logan

Company Address: Rt. 9 Box 507, Buffalomon, WV Zip: 26201

No. of Employees: 138 No. of Shifts: 3 No. of Sections: 2

Shifts Inspected: Day: 1 Evening: Midnight: Tot. Insp. Days: 1

Mine Foreman: Ed Thurmond Certificate No.: 35993 Miners Rep: N/A

VIOLATIONS BY CATEGORY

Mine Maps:		Coal Dust & Rock Dust:		Electricity:	
Ventilation:		Roof, Face & Ribs:		Safeguards for Mech. Eq.:	
Equipment:		Explosives & Blasting:		Surface Structures & Prac:	
Foreman:		Protective Clothing:		Auger Mining:	
Fire Boss:		Transportation:		Underground Workings:	
Highwalls:		Excavating:		Tipples & Cleaning Plants:	
Drilling:		Dust (Surface):		Misc. Safety Provisions:	
Haulage:		Compressed Gases:		General Safety Provisions:	
First Aid:		Fire Protection:		Other Categories:	
Hoisting:					

VIOLATIONS / ORDERS ISSUED:

Orders: Failure to Abate: IPA: 71-WC:

Total Violations Issued: Total Violations Abated:

COMMENTS:

*If this is an idle inspection, investigation, or complaint, please state the reasons:

Examined seals #1-10 across North East Mains. The seals may be closed. The seals are built as approved on 10/14/05.

Brian Mills
Inspector-at-large

Tim Collins #2
Inspector and number

ICG - Sago Mine - Foundation Boring For Seal Area

6/13/06 & 6/14/06

Attendance:				
	Terry Taylor	MSHA	6/13/06	6/14/06
	Paul Sanchez	PSI Consulting	6/13/06	6/14/06
	Russel Dresch	MSHA	6/13/06	6/14/06
	Ron Bowersox	UMWA	6/13/06	6/14/06
	Charles Dunbar	ICG	6/13/06	
	Brian Curtis	ICG	6/13/06	6/14/06
	John Stemple	ICG	6/13/06	6/14/06
	John Cruse	WVMHST	6/13/06	6/14/06

Each entry will have a minimum of 3 test borings along center line of seal footprint. Up to 3 additonal borings will be performed at each seal on site specific (random) locations. The test bore will target up to 6 inches of foundation and mine floor and 3 inches in diameter.

The machine used to bore the holes is a hand held shop grinder and has only one speed setting (high rpm). The boring tool can cut up to 10 inches and has a coarse tooth - carbid tip cutting surface. No lubrication or cooling fluid will be applied to cutting surface while boring.

Entry No.1 — Seal No.1

Note: Note: This entry is a high traffic area and is used to acces inby areas of the old workings. Scoop, mantrips and bulk duster has been in this area since the explosion. The floor shows wear from these activiities.

I.D.	Location	Findings	Avg. Bloc Bond Thickness
S1-1	5 Ft. From Lt Rib	Can't obtain core but pulled a bag sample of the mixture of pad and floor have been pulled. Observed some creek gravel in the sample - at the bottom of the boring. Total depth of 6 inches. Sample is conglomerate of floor & bloc bond.	1 1/2 Inches
S1-2	10 Ft. From Lt. Rib Appx 1 1/2 Ft. Lt. of Seal Terrace	1.5 Inches of Bloc Bond - Total Depth of 4 Inches.	
S1-3	15 Ft. From Lt. Rib	2.25 Inches Bloc Bond	
S1-4	1 Ft. From Rt. Rib	1 Inches Bloc Bond	
S1-5	1.33 Ft From Lt. Rib	2.75 Inches Bloc Bond	
S1-6	7 Ft. From Lt. Rib	1.5 Inches of Bloc Bond - Used Hilti Drill To Get A Clean Cut	
S1-7	4.66 Ft. From Rt. Rib	0 Inches of Block Bond	

ICG - Sago Mine - Foundation Boring For Seal Area

6/13/06 & 6/14/06

Entry No.2

Seal No.2

Note: Addppted new method of measuring Bloc Bond thickness. Take 3 measurements in same boring. Attempted to record thickness @ 12:00, 4:00 & 8:00 in each boring.

I.D.	Location	Findings					
S2-1	5 Ft. From Lt Rib	2			Inches Bloc Bond		Firm
S2-2	10 Ft. From Lt. Rib	1	0.25	0.5	Inches Bloc Bond		Hard
S2-3	15 Ft. From Lt. Rib	2	1.5	3.25	Inches Bloc Bond	T.D. 4 in.	Hard
S2-4	2.5 Ft. From Rt. Rib	1	0.75	0.5	Inches Bloc Bond		Hard
Samples removed from this area were not well hydarated but have set up to a firm to hard consistency.							

Avg. Bloc Bond Thickness
1 2/7
Inches

2 to 3 Crosscut

Seal No.3

I.D.	Location	Findings					
S3-1	5 Ft. From Lt Rib	3	1.5	1.5	Inches Bloc Bond	T.D. 4"	Hard
S3-2	10 Ft. From Lt. Rib	2.25	2	2.75	Inches Bloc Bond	T.D. 6"	Firm
S3-3	15 Ft. From Lt. Rib	0.75	0.75	1	Inches Bloc Bond	T.D. 2.75"	Firm
S3-4	1.5 Ft. From Rt. Rib	1			Inches Bloc Bond		Hard
Samples 1 & 3 were the best samples and a boring of them were semi intact.							

Avg. Bloc Bond Thickness
1 2/3
Inches

Entry No.3

Seal No.4

I.D.	Location	Findings				
S4-1	5 Ft. From Lt Rib	0	0	0	Inches Bloc Bond	
S4-2	10 Ft. From Lt. Rib	0.125	Trace	Trace	Inches Bloc Bond	
S4-3	15 Ft. From Lt. Rib	0.25	Trace	Trace	Inches Bloc Bond	
S4-4	1.5 Ft. From Lt. Rib	2.75			Inches Bloc Bond	Cut Good Sample
Appx. 5/8" soft to firm zone between bloc bond and floor.						

Avg. Bloc Bond Thickness
2/5
Inches

ICG - Sago Mine - Foundation Boring For Seal Area

6/13/06 & 6/14/06

Entry No.4								Seal No.5
I.D.	Location	Findings						
S5-1	5 Ft. From Lt Rib	1	1	1.625	Inches Bloc Bond		Firm	Avg. Bloc Bond Thickness
S5-2	10 Ft. From Lt. Rib	1.25	1	0.375	Inches Bloc Bond	T.D. 2.75"	Firm	2/3
S5-3	15 Ft. From Lt. Rib	0.25	0.5	0.25	Inches Bloc Bond	T.D. 2.5"	Hard	Inches
S5-4	1 Ft. From Lt. Rib	0.75	Trace	Trace	Inches Bloc Bond	T.D 3.25"		

Entry No.5								Seal No.6
I.D.	Location	Findings						
S6-1	5 Ft. From Lt Rib	1.75	1	1.5	Inches Bloc Bond			Avg. Bloc Bond Thickness
S6-2	10 Ft. From Lt. Rib	1	1.5	1	Inches Bloc Bond			1
S6-3	15 Ft. From Lt. Rib	1.5	0.625	1	Inches Bloc Bond	T.D. 5.5"		Inches
S6-4	14 Ft. From Lt. Rib	1.25			Inches Bloc Bond - Pried Up From Floor			
S6-5	1 Ft. From Lt. Rib	1.5	Trace	Trace	Inches Bloc Bond		Soft	

Entry No.6								Seal No.7
I.D.	Location	Findings						
S7-1	5 Ft. From Lt Rib	1.625	1.5	1.24	Inches Bloc Bond	T.D.4.25"	Hard	Avg. Bloc Bond Thickness
S7-2	10 Ft. From Lt. Rib	0.25	0.5	1.25	Inches Bloc Bond	T.D. 2"	Hard	1
S7-3	15 Ft. From Lt. Rib	1.25	1.25	1.25	Inches Bloc Bond	T.D. 6"	Hard	Inches
S7-4	1 Ft. From Rt. Rib	0.5	0.5	0.5	Inches Bloc Bond	T.D 3.5"	Firm	
S7-6	3.75 Ft. From Rt. Rib	1			Inches Bloc Bond	T.D 3.5"	Hard	
In sample S7-6 we drilled thru 3 1/2" of omega block and bored 1" of bloc bond								

APPENDIX 5

The Investigation

(5.4) Flames and Forces

(5.4-1) Mapping of Explosion Forces

- **Flames and Forces Map**
- **Belt Hanger Survey 1 – Map**
- **Belt Hangers – Maps 1 through 7 of 7**
- **Floor Contour Map**
- **Roof Contour Map**

Basemap Legend

- Roof falls that occurred prior to Omega Seal completion
- Sumps
- 1394 — Bottom contours in feet above sea level. (Survey by Alpha Eng.- contour construction by John Cruse -- WVOMHS&T)
- Ventilation stopping (red circle indicates it was knocked before explosion)
- Ventilation overcast

This map is intended as a generalized depiction of certain underground features as mapped underground following the explosion which occurred a Sago Mine No.1 on Jan. 2, 2006. This representation is based on direct observations and measurements by the WV Office of Miners' Health, Safety, and Training, and others, is largely INTERPRETIVE, and is current to approximately the dated indicated below but is subject to change with new or revised information without notification to any parties who may have recieved this version or prior version.

MG GPS WELL LOCATION (6/04/04)
API# 47-097-01251 (PROD. GAS)

SFI7-97
5.01

Spad 3771
N 706,445.72
E 2,226,561.27
NAD 27 WV-S

Spad 3904
N 706,503.71
E 2,228,844.75
NAD 27 WV-S

Upper Elev. 1416
Lower Elev. 1410
Upper Elev. 1418
fell before seals built
Lower Elev. 1414
Upper Elev. 1410
Lower Elev. 1406
fall (part new)
Upper Elev. 1414
Lower Elev. 1410

0 50 100 150 200
FEET

FLAMES and FORCES MAP of SAGO MINE No.1

Upshur County, West Virginia

Following explosion of January 2, 2006

--PRELIMINARY--
NOT FINAL

UPDATE 11-18-06

WORKMAP LEGEND

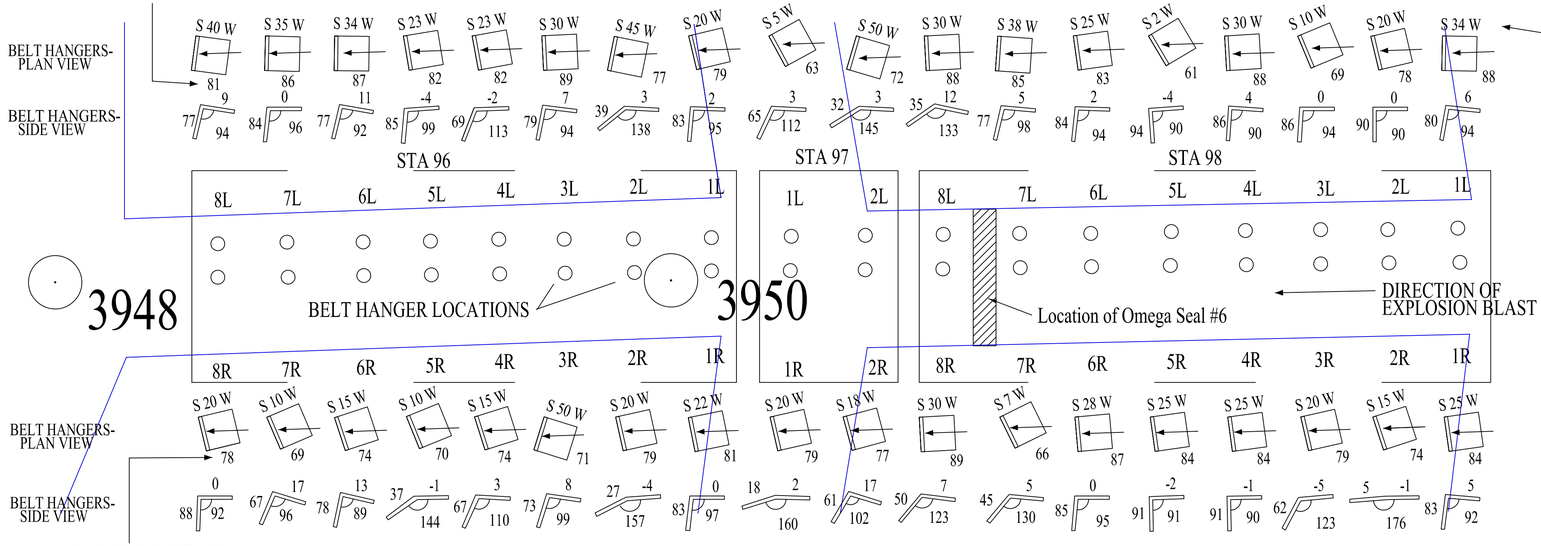
- Direction of intial explosion forces
- Direction of secondary explosion forces
- Dominant direction: but order is uncertain
- Areas not bottom-mined showing only minor roof-plate damage
- Major damage to pans / plates: may be indicative of "pressure piling"
- Locations of water pools at time of explosion
- Roof falls that occured after Ω seals built
  Red -- fell after Ωseals were built but before re-entry
  Black-- fell after re-entry
- Locations where steel roof mesh was traced visually for continuity
- Seals: as-built locations (pre-explosion)
- Areas bottom-mined on retreat

NOTE: Most bottom mined areas show relatively little roof plate / pan damage

CONTRIBUTORS:

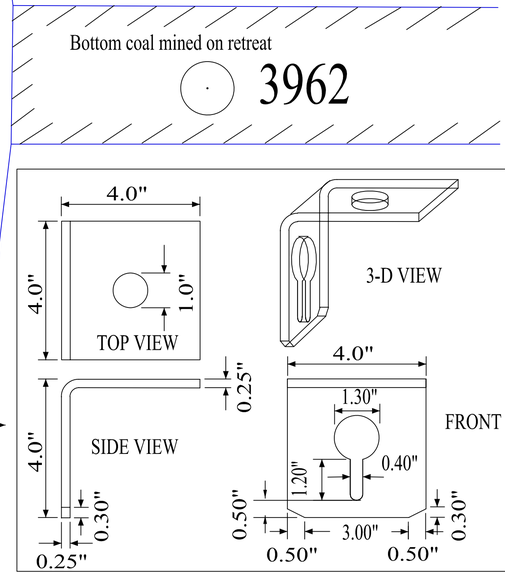
Monte Hieb, Chief Engineer
John Collin, Inspector
John Cruse, Engineer
Jeff Bennett, Inspector
Barry Fletcher, Inspector

PLAN VIEW OF BELT HANGERS AND MINE LAYOUT ALONG BELT ENTRY (#5 ENTRY)



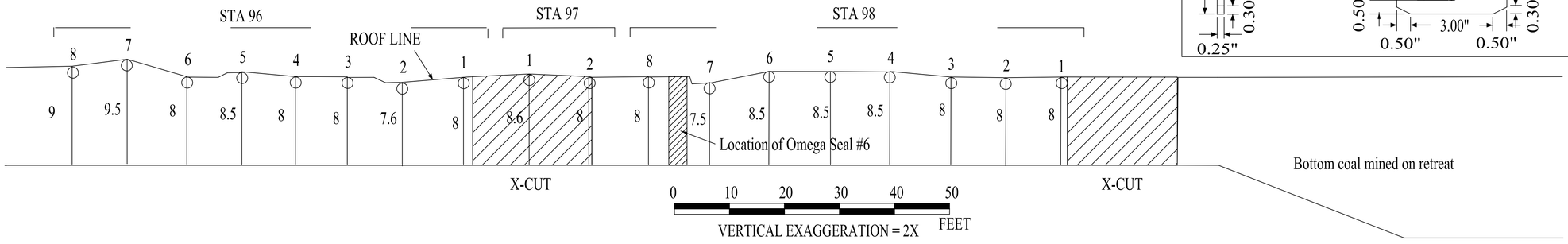
ORIENTATION OF BELT HANGERS AFTER EXPLOSION-
INBY AND OUTBY SEAL #6
SAGO MINE, UPSHUR CO., WV
FEBRUARY 16, 2006
MAPPED BY MONTE HIEB AND JEFF BENNET
WVOMHST

COMPASS BEARINGS HAVE BEEN ADJUSTED TO TRUE NORTH



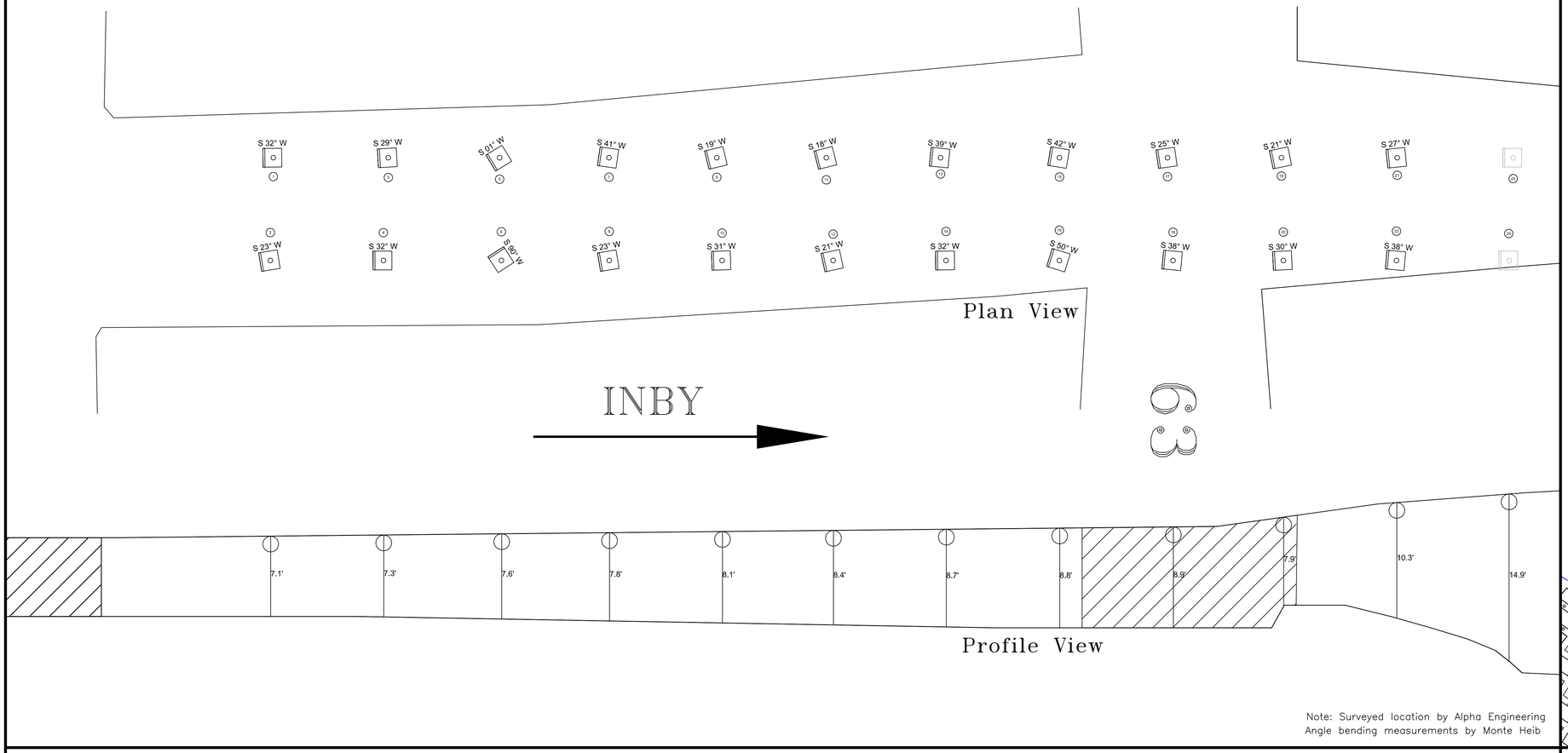
DETAILS OF BELT HANGER DIMENSIONS

PROFILE VIEW OF BELT HANGERS AND MINING HEIGHTS



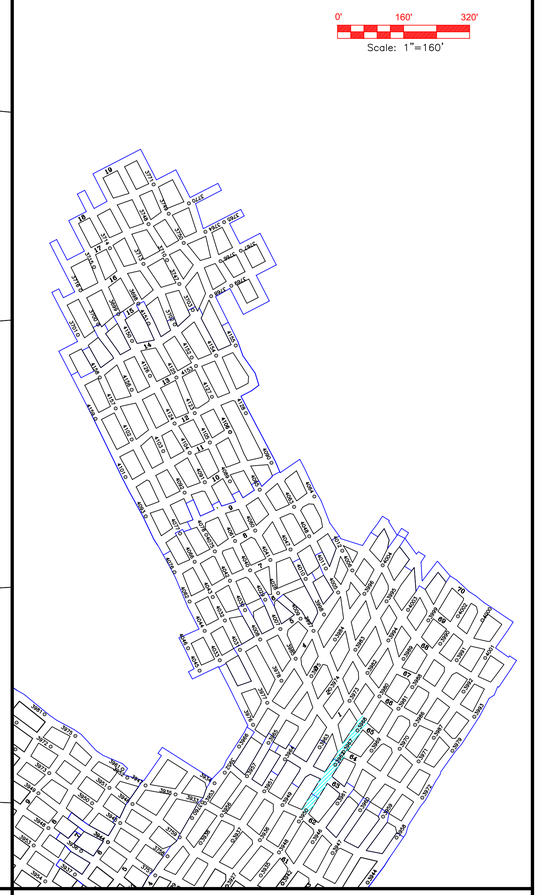
Belt Hanger Survey 1

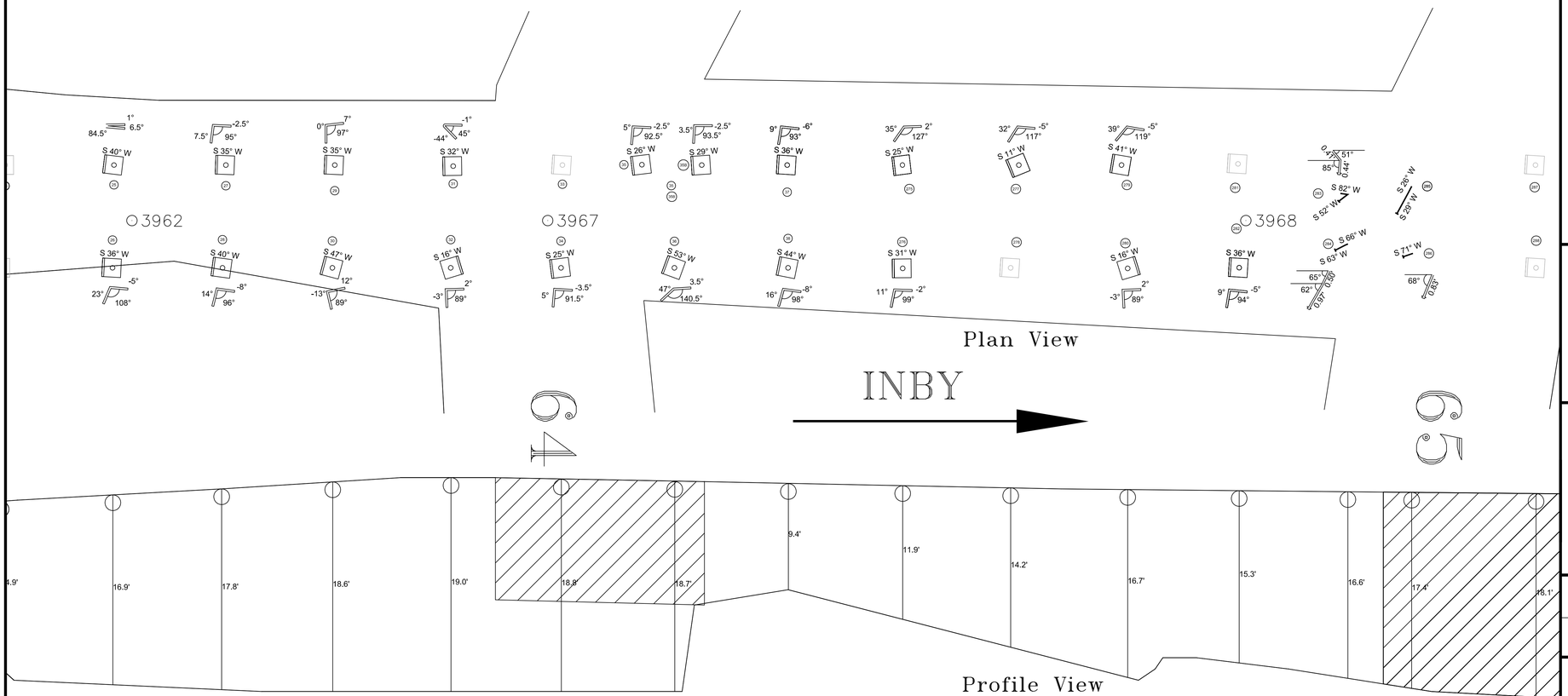
Sago Belt Hangers.dwg



Note: Surveyed location by Alpha Engineering
Angle bending measurements by Monte Heib

Location of Measurements

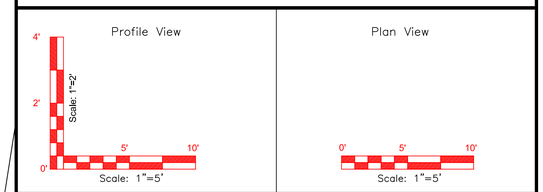




Note: Surveyed location and angle bending measurements by Alpha Engineering

NOTES

1. Angle measurements made using a Swanson angle finder and surveyed locations and calculations.
2. Heights in profile view are from belt hanger to floor.
3. Cross-cuts are shown as cross-hatched in profile view.
4. Those present for angle work were MSHA, ICG, WV Office of Miner's Health, Saftey and Training, Alpha Engineering.



LEGEND

BELT HANGER	
LOOSE BELT HANGER	
ROOF BOLT	
BELT HANGER # AND ACTUAL LOCATION	21
SURVEY STATIONS	04150
BREAK NUMBER	14

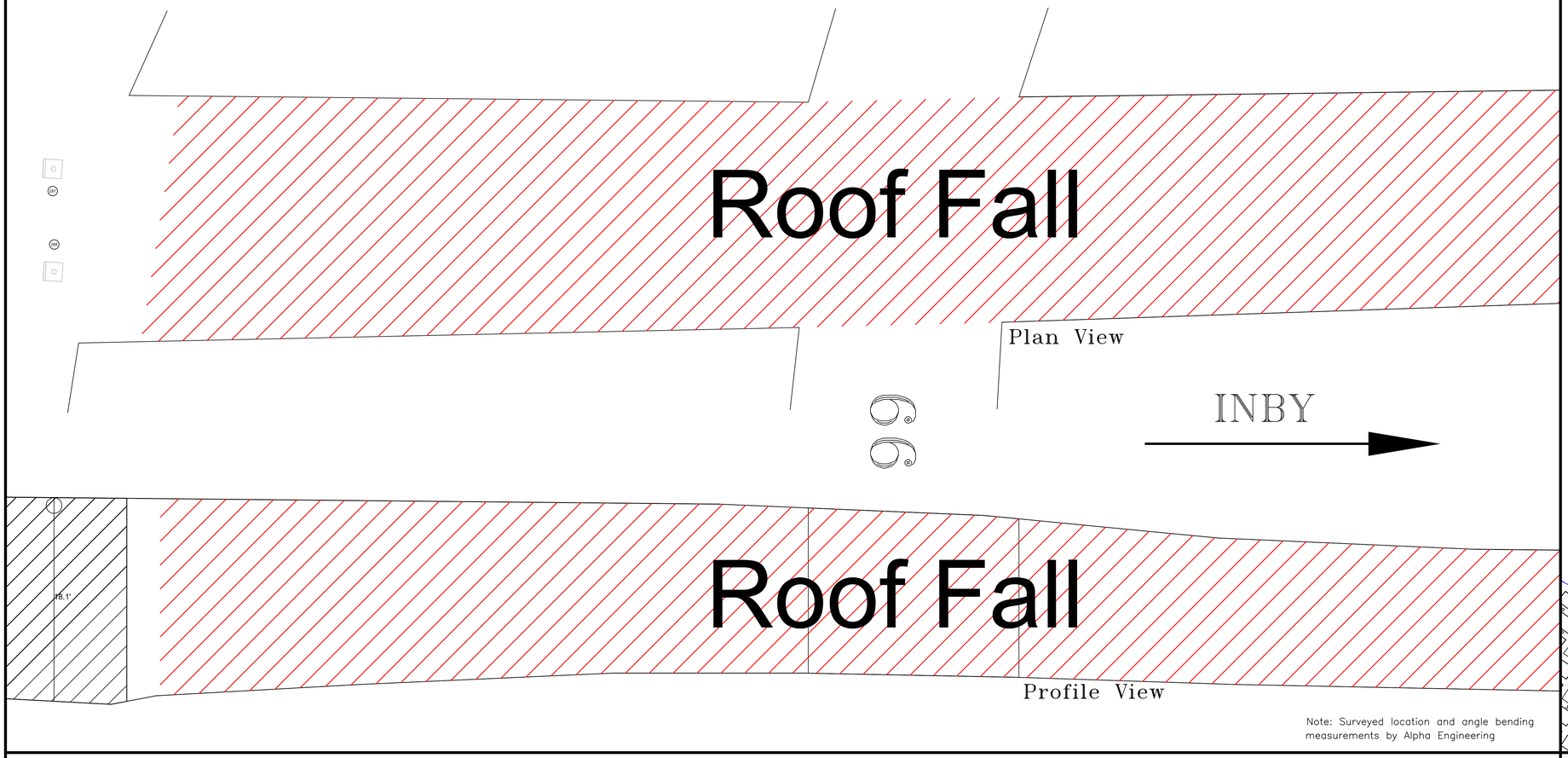
Sago – 2nd Left Belt Hangers

Page: 1 of 7

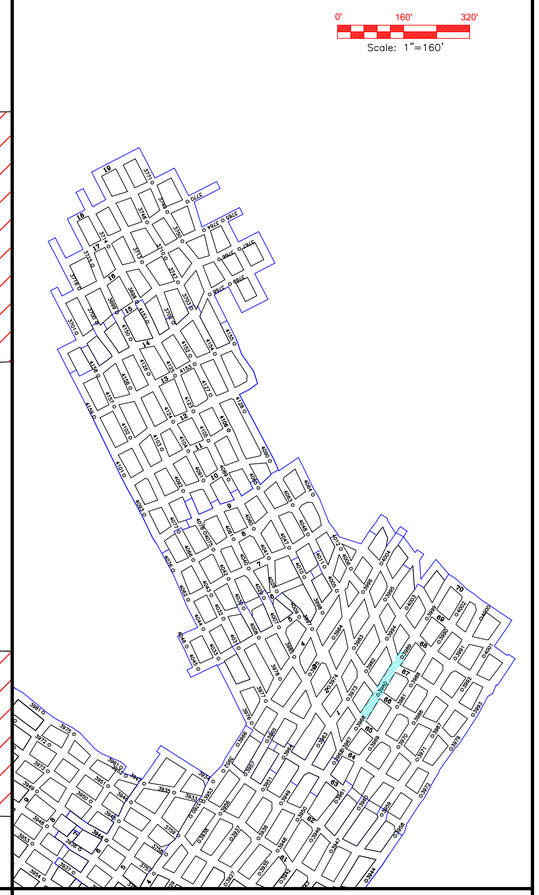
ALPHA ENGINEERING SERVICES, INC.
P.O. BOX 5121, BECKLEY, WV. 25802 PH.(304)255-4121 FX.(304)255-4156

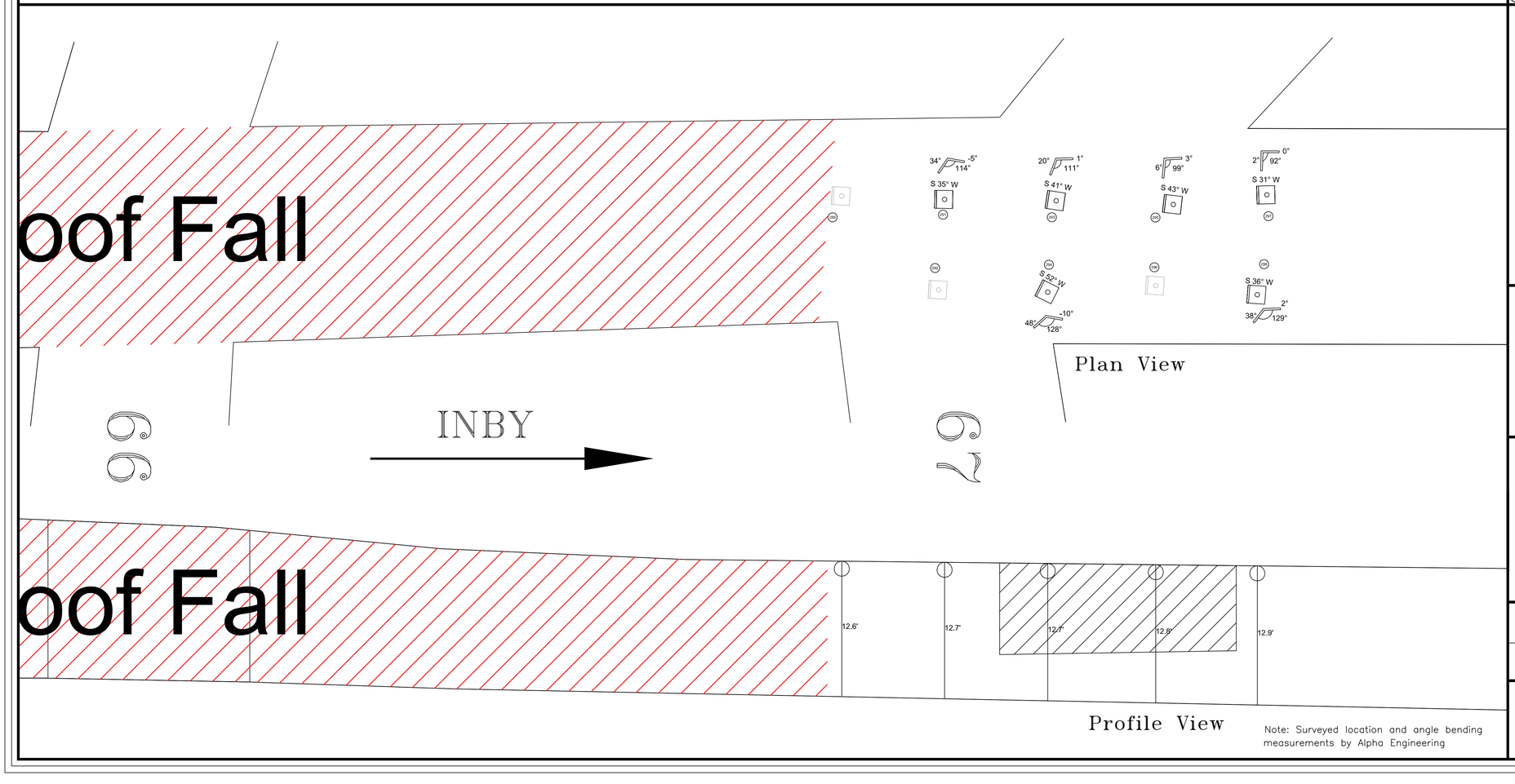
SCALE: See Above
DATE: 6/07/06

Wolf Run Mining Co.
1 Edmiston Way, Suite 211
Buckhannon, WV 26201



Location of Measurements





NOTES

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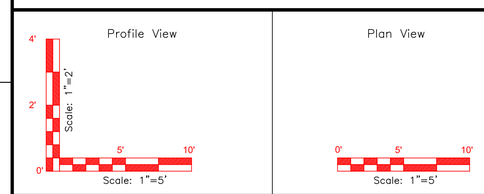
2. Heights in profile view are from belt hanger to floor.
3. Cross-cuts are shown as cross-hatched in profile view.
4. Those present for angle work were MSHA, ICG, WV Office of Miner's Health, Saftey and Training, Alpha Engineering.



LEGEND

BELT HANGER	
LOOSE BELT HANGER	
ROOF BOLT	
BELT HANGER # AND ACTUAL LOCATION	21
SURVEY STATIONS	04150
BREAK NUMBER	14

Sago – 2nd Left Belt Hangers

ALPHA ENGINEERING SERVICES, INC.
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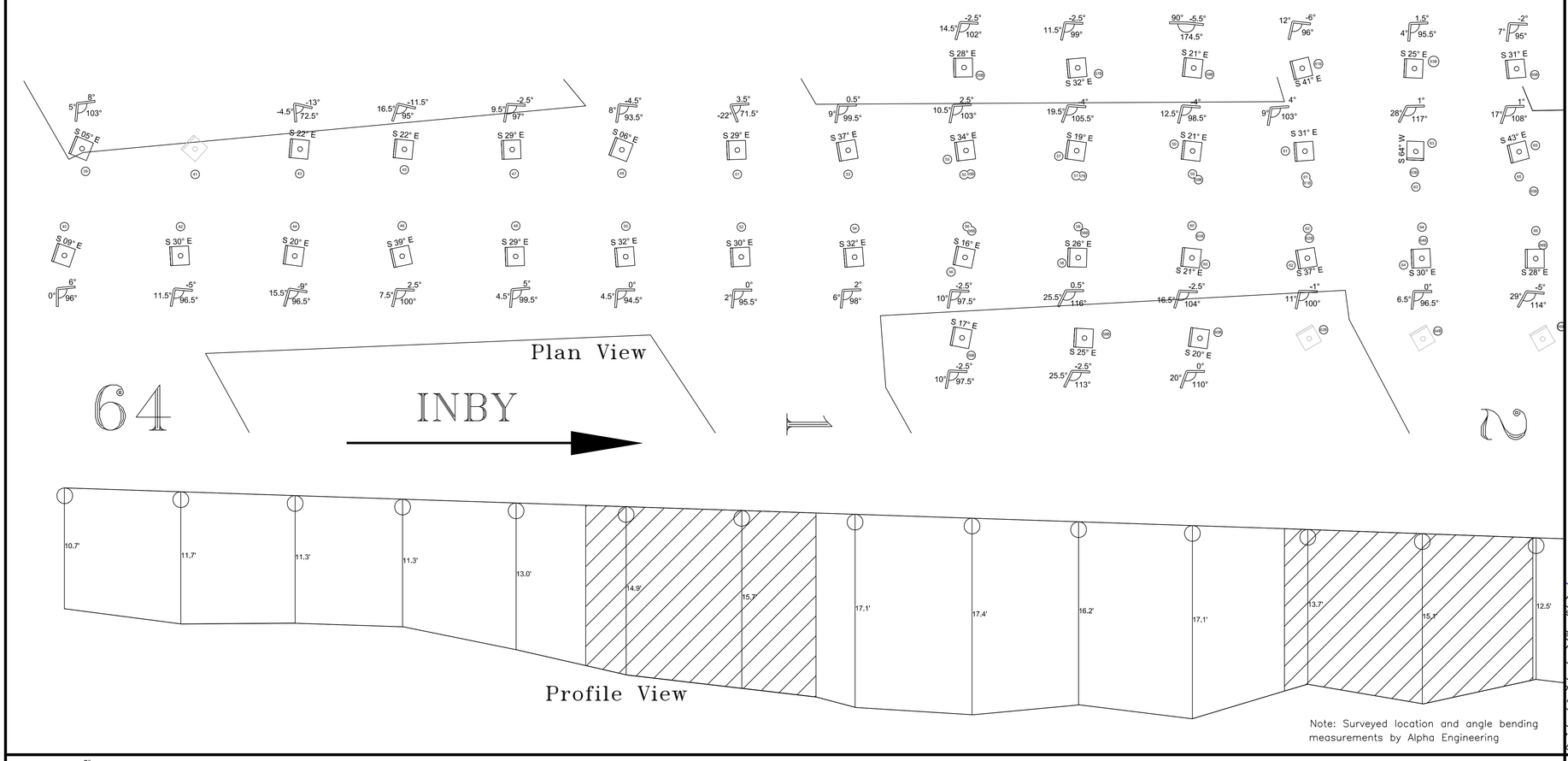
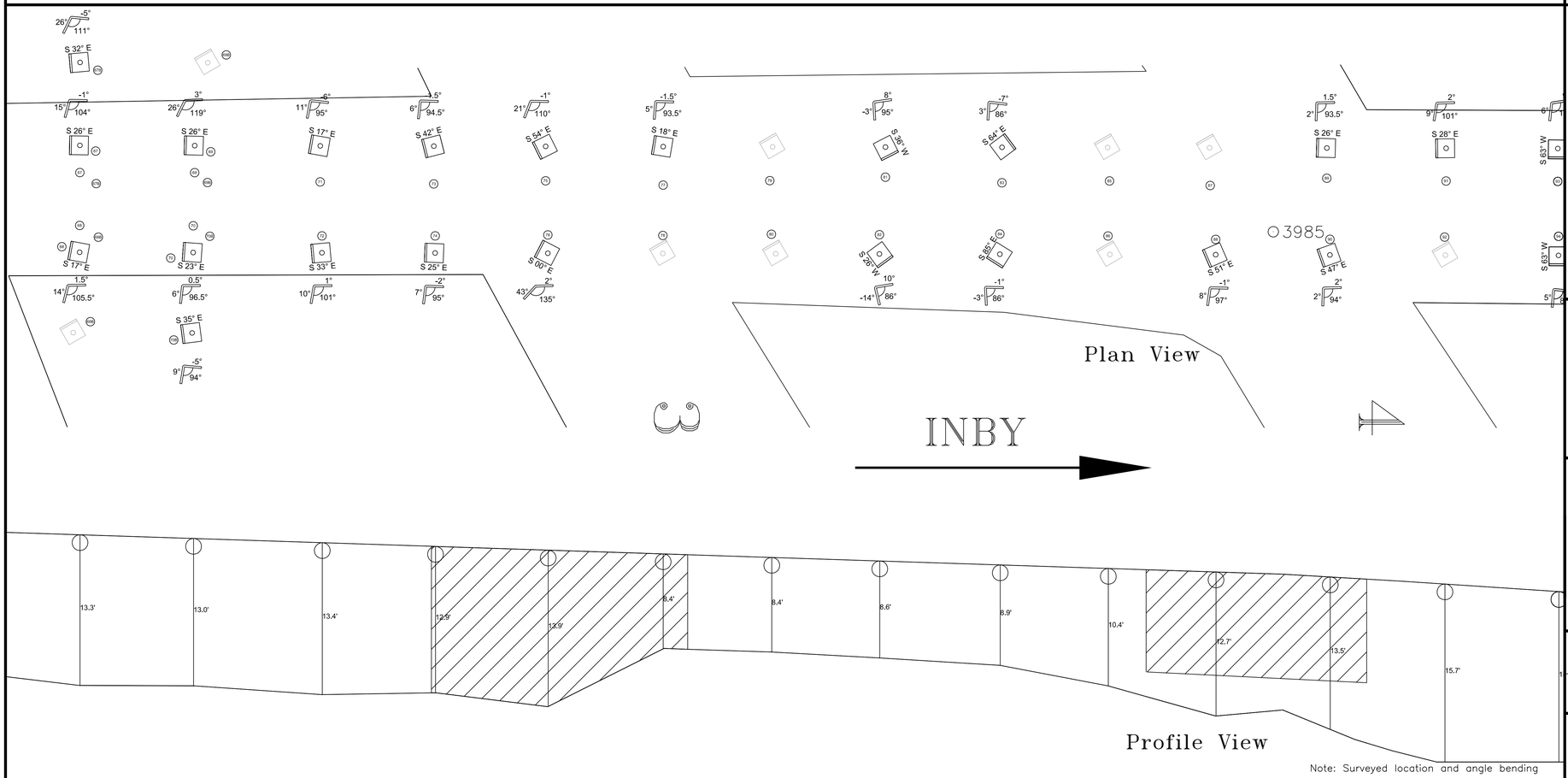


Note: Surveyed location and angle bending measurements by Alpha Engineering



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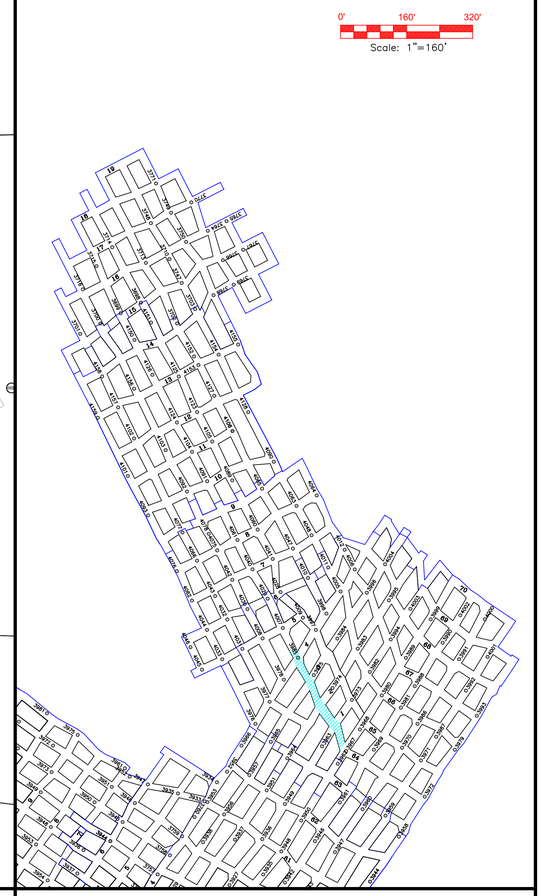

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Profile View

Scale: 1"=2'

Plan View

Scale: 1"=5'

LEGEND

BELT HANGER	
LOOSE BELT HANGER	
ROOF BOLT	
BELT HANGER # AND ACTUAL LOCATION	21
SURVEY STATIONS	04150
BREAK NUMBER	14

Sago - 2nd Left Belt Hangers

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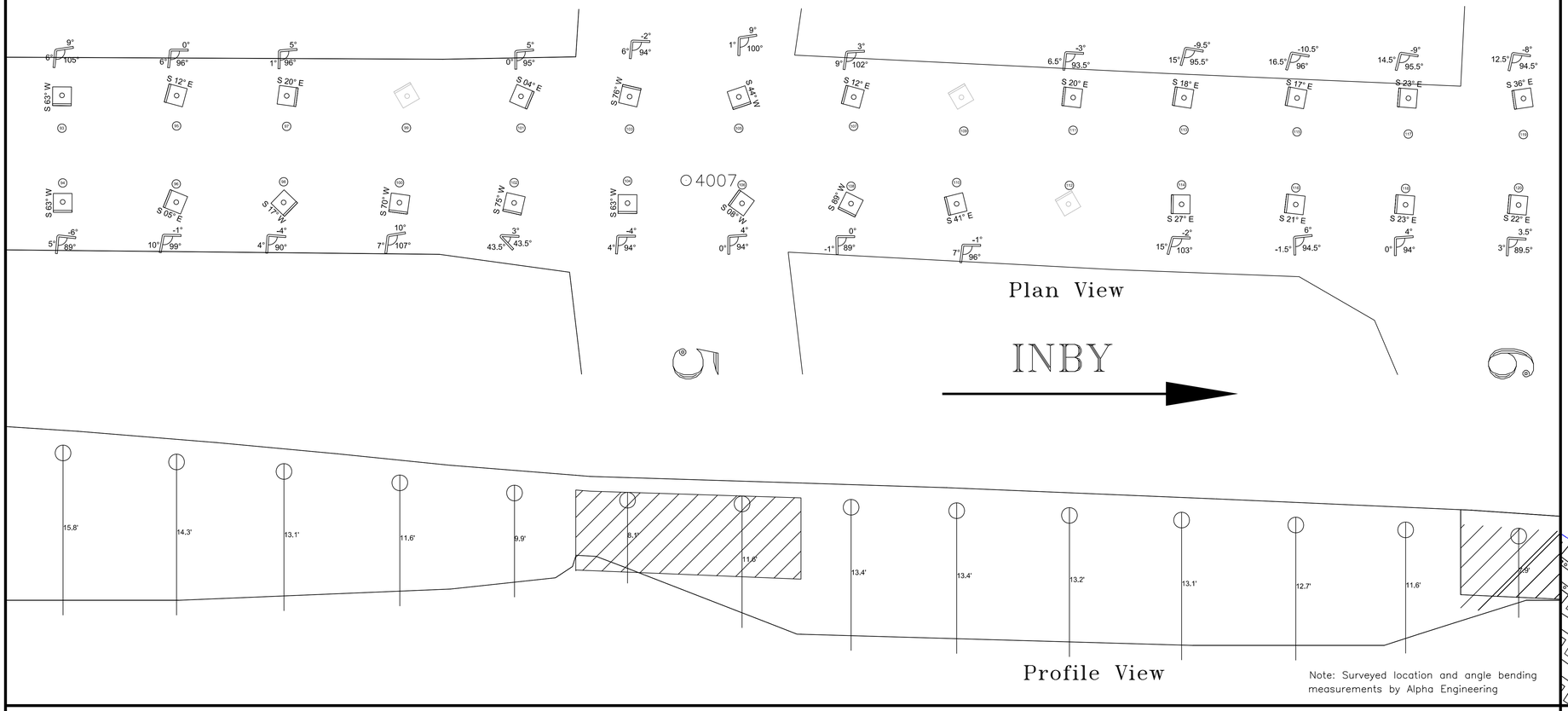

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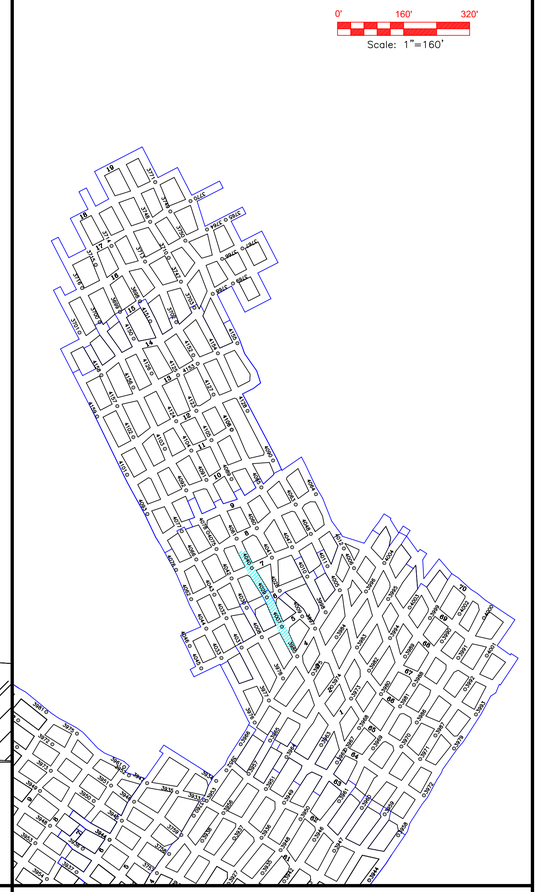

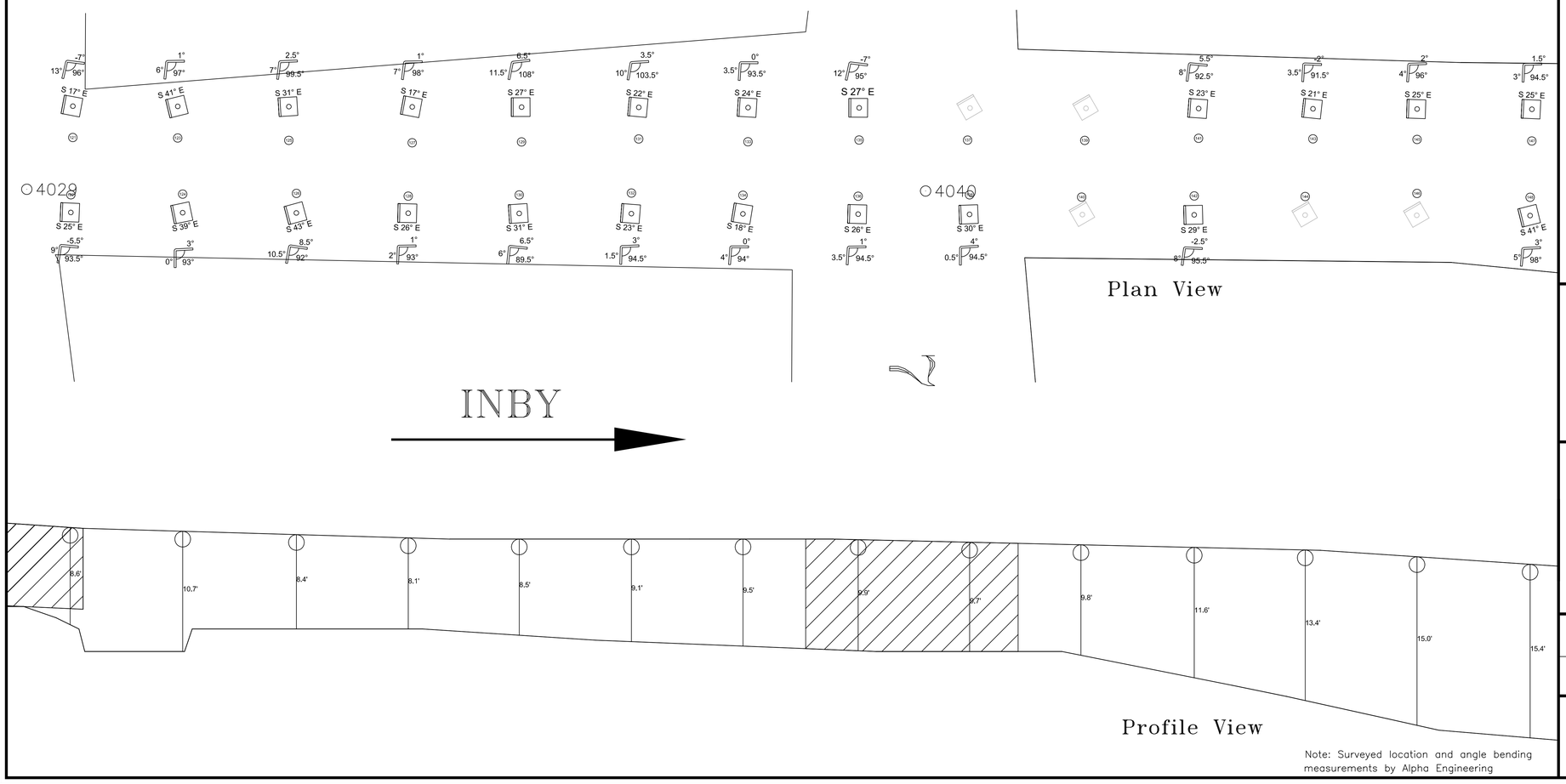

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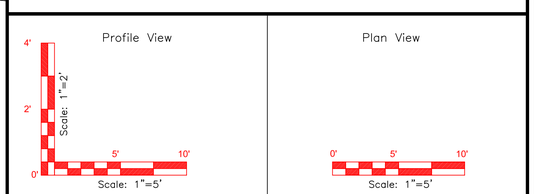

LEGEND

BELT HANGER	
LOOSE BELT HANGER	
ROOF BOLT	
BELT HANGER # AND ACTUAL LOCATION	21
SURVEY STATIONS	04150
BREAK NUMBER	14

Sago - 2nd Left Belt Hangers

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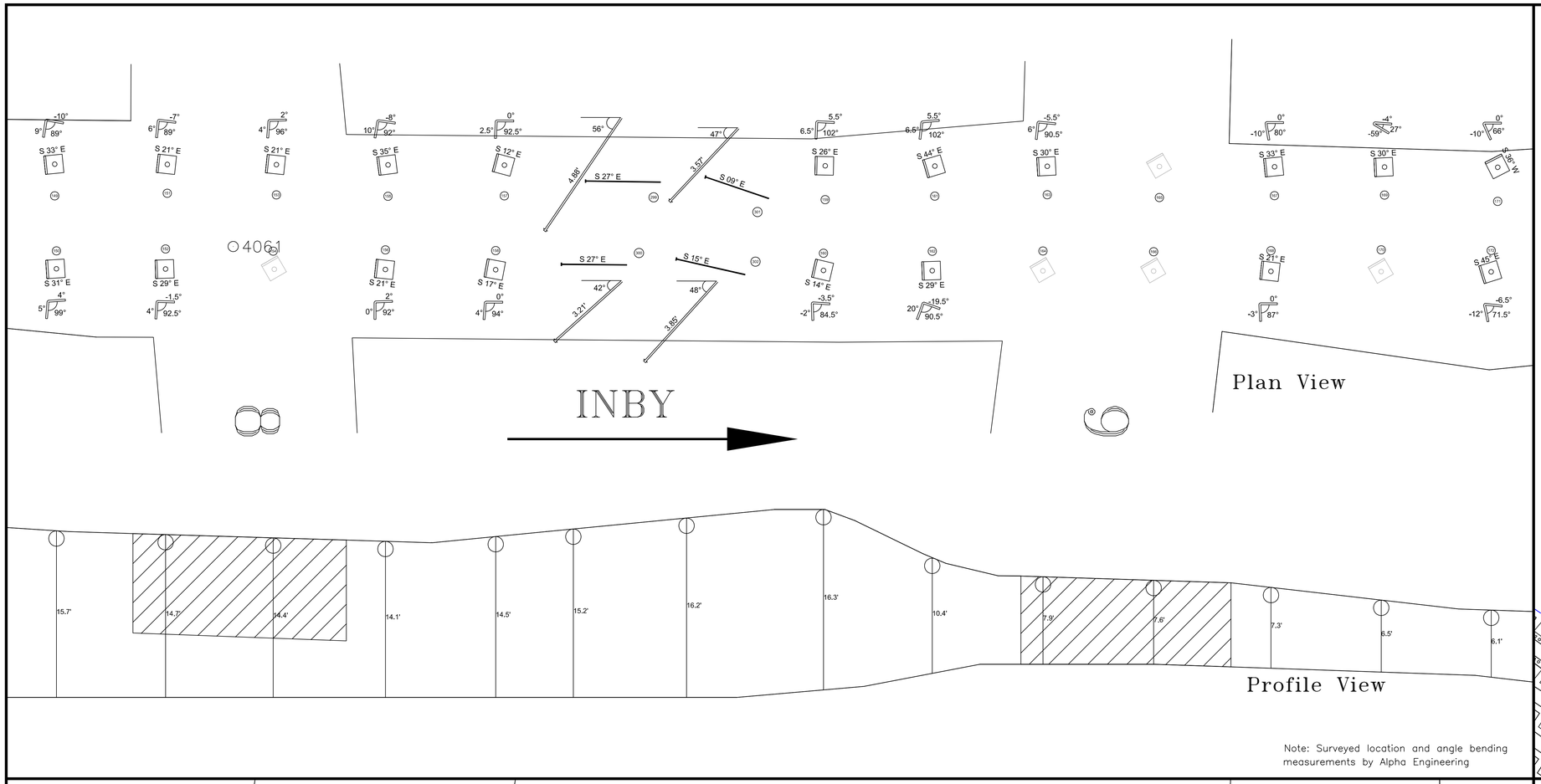

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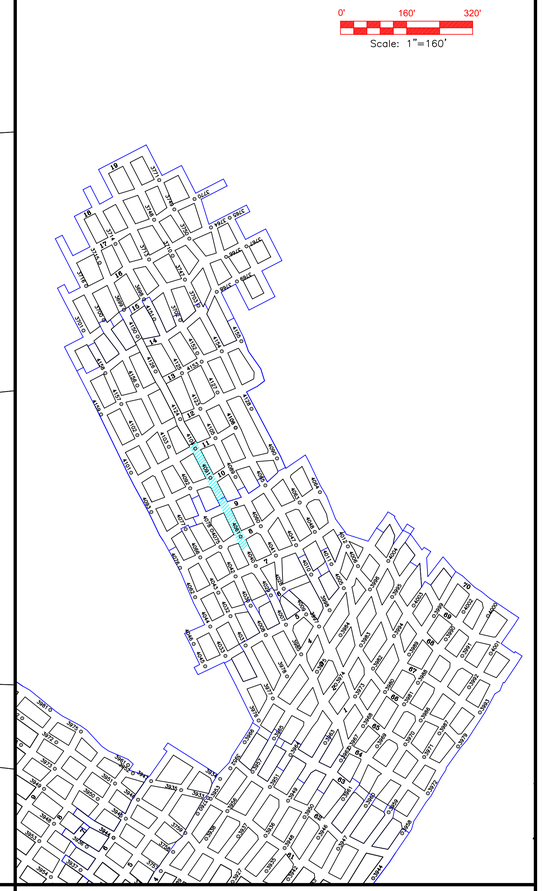

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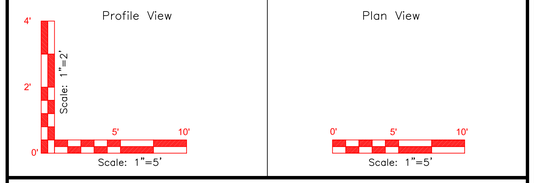

LEGEND

BELT HANGER	
LOOSE BELT HANGER	
ROOF BOLT	
BELT HANGER # AND ACTUAL LOCATION	21
SURVEY STATIONS	04150
BREAK NUMBER	14

Sago – 2nd Left Belt Hangers

Page: 5 of 7

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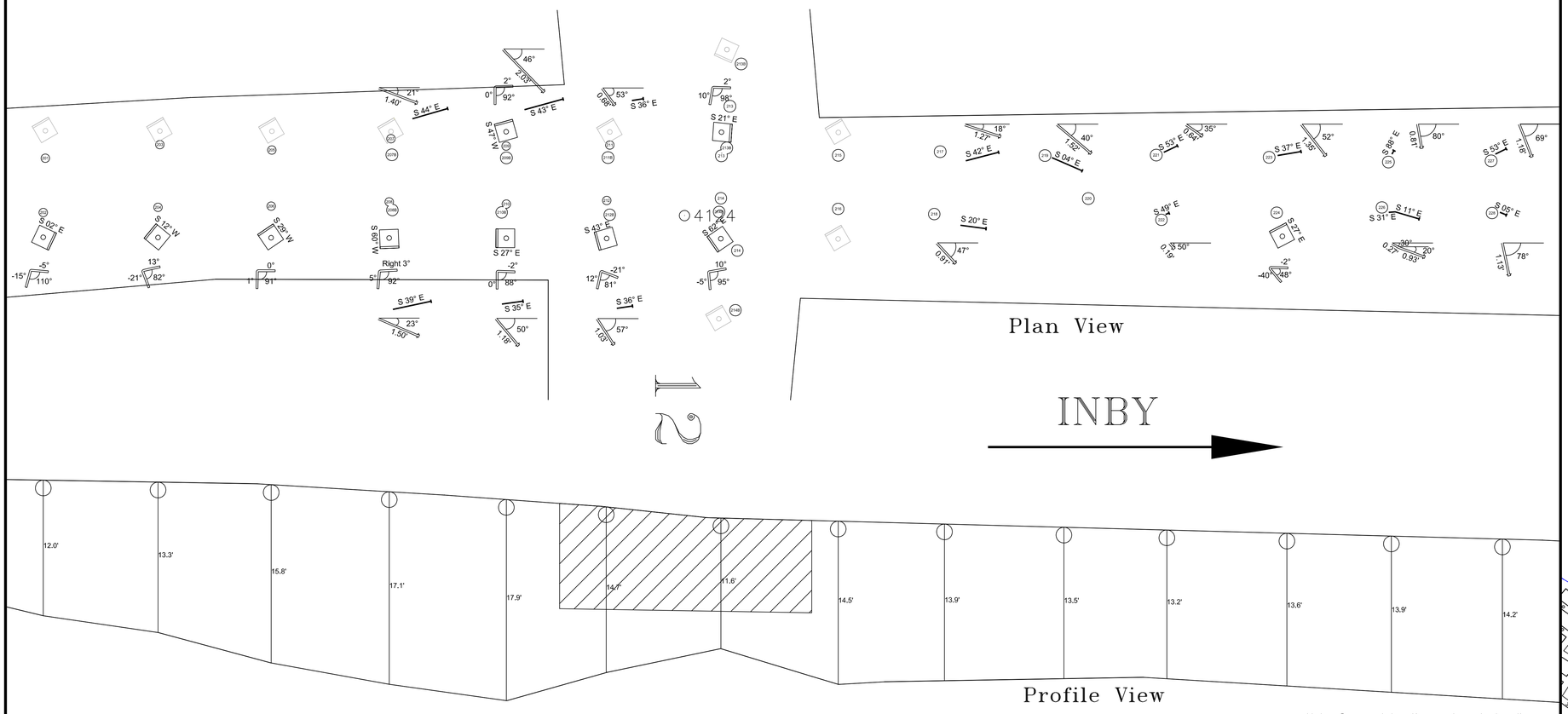

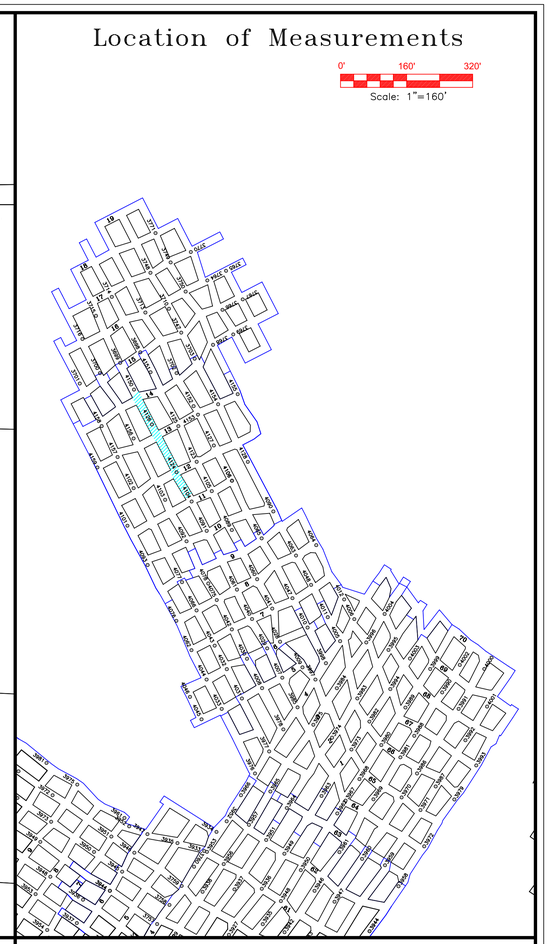

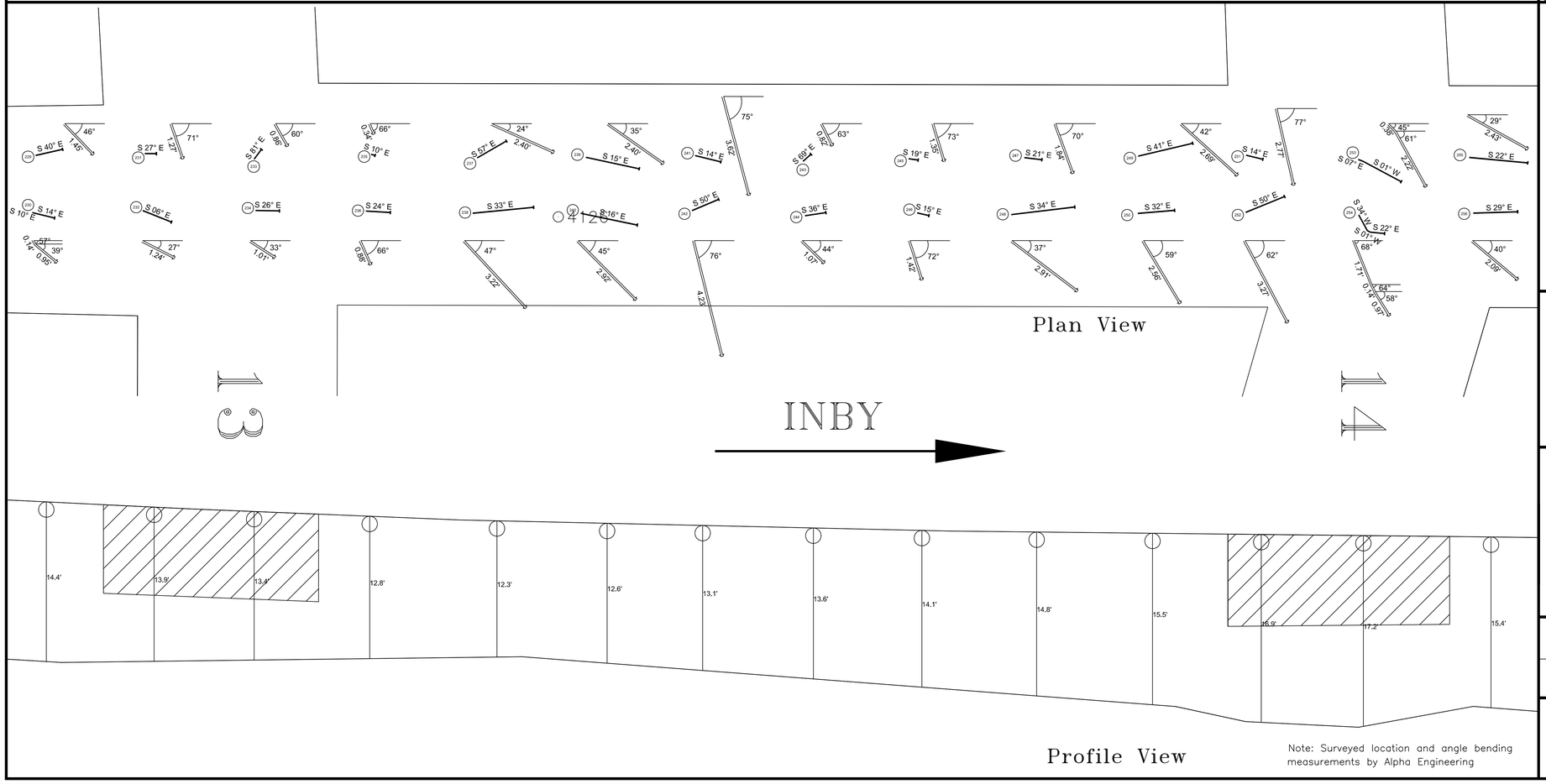

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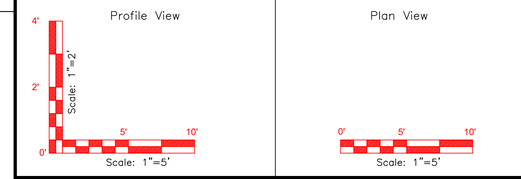

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LOOSE BELT HANGER	
ROOF BOLT	
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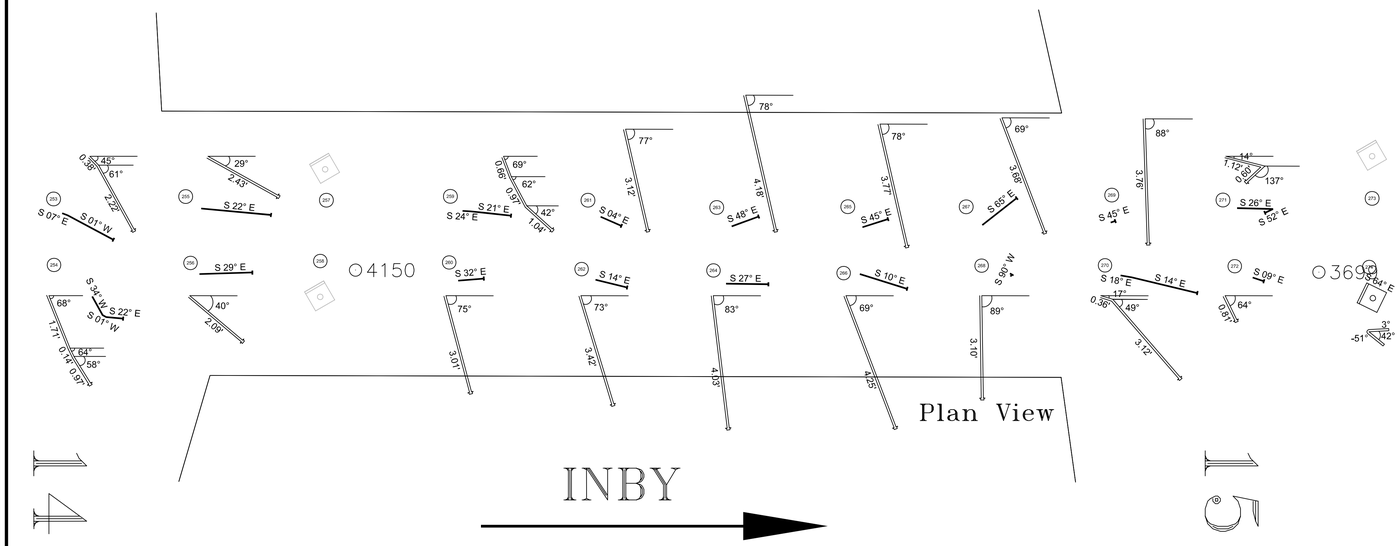
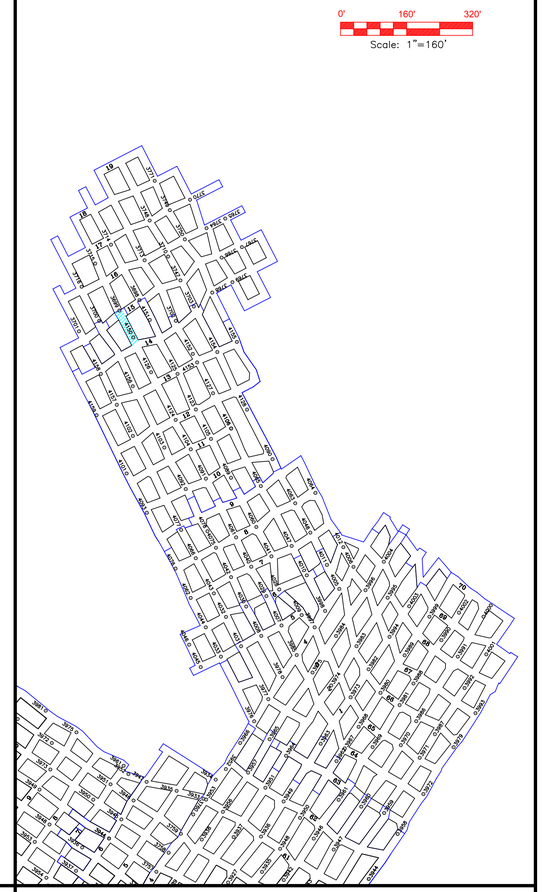


Note: Surveyed location and angle bending measurements by Alpha Engineering

Location of Measurements



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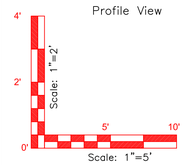
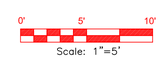


Plan View



LEGEND

BELT HANGER	
LOOSE BELT HANGER	
ROOF BOLT	
BELT HANGER # AND ACTUAL LOCATION	21
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Sago - 2nd Left Belt Hangers

Page: 7 of 7

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Wolf Run Mining Co.
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Buckhannon, WV 26201

Scale : 1" = 100'

Floor Contour Map

1390	Contours
	Seal Location
	Pillars
	Mine Boundary

Date: 11-21-2006

MG GPS WELL LOCATION (6/04/04)
API# 47-097-01251 (PROD. GAS)

Appx. Water Floorline

Upper Elev. 1416
Lower Elev. 1410
Upper Elev. 1410
Lower Elev. 1406
Upper Elev. 1418
Lower Elev. 1414
Upper Elev. 1414
Lower Elev. 1410

SEALED AREA 06-08-06 Volume.dwg

Scale : 1" = 100'

WEST VIRGINIA HEALTH OFFICE OF SAFETY TRAINING MINERS
www.wvminesafety.org

Roof Contour Map

1390	Contours
	Seal Location
	Pillars
	Mine Boundary

Date: 11-21-2006

MG GPS WELL LOCATION (6/04/04)
API# 47-097-01251 (PROD. GAS)

Roofline
Water
Approx.
Lower Elev. 1394
Upper Elev. 1402
Upper Elev. 1424
Upper Elev. 1422
Lower Elev. 1420
Upper Elev. 1426
Lower Elev. 1422

SEALED AREA 06-08-08 Volume.dwg

APPENDIX 5

The Investigation

(5.4-2) Origin of Explosion

- **Evaluation of Roof Anomaly – Letter**
- **Description of Pump Cable Lengths and Associations**

(5.4-4) Methane Concentrations

- **Methane Liberation Study**
- **Mass Balance Calculations**
- **Pre-explosion Airflow**

(5.4-5) Coking Test - MSHA

- **Coking and Rock Dust Survey (Map and Data)**

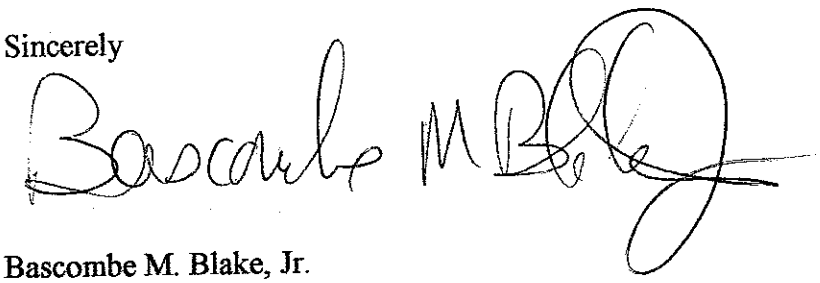
Monte Hieb
WV Office of Miner's Health and Safety
142 Industrial Drive
Oak Hill, WV 29501

Dear Monte:

Attached is a copy of my report on the anomaly investigated at the Sago Mine in March and April. As I detail in the report, I see nothing inconsistent with an interpretation that the anomaly was formed by the impression of a log on a soft, muddy substrate. As per our discussion earlier this week, I will photograph the sample in my possession and forward digital photographs next week. I will curate the sample in the Survey's paleobotanical collection until the investigation is concluded or the investigators request the sample.

If you have any questions or need any further work, contact me at any time at the Survey.

Sincerely



Bascombe M. Blake, Jr.
Senior Geologist and Paleobotanist
West Virginia Geological and Economic Survey
1 Mont Chateau Road
Morgantown, WV 26507

Paleobotanical and Sedimentological Report on Sago Mine Roof Anomaly

Bascombe M. Blake, Jr.
Senior Geologist
West Virginia Geological and Economic Survey

June, 2006

The Sago Mine was visited twice, once on March 28 and again on April 6, to examine and sample an anomaly in the mine roof near the origin of the explosion that occurred in early 2006. The anomaly consisted of a straight feature in the roof of the mine extending continuously across an entry from both ribs. The investigation was initiated to determine, if possible, the genesis of the anomaly.

The Middle Kittanning and locally Lower Kittanning coal beds are mined in the Sago Mine. In the vicinity of the anomaly, the mine roof comprises approximately 2 meters of dark, centimeter-scale laminations of siltstone and silty shale as seen in exposures associated with coal extraction and roof falls. The presence of several regionally extensive, millimeter-scale incompetent clay layers make it difficult to prevent the top from falling after coal extraction. As a result, approximately a meter of roof material was removed during or shortly after mining. The anomaly consisted of a 9-10 centimeter-wide, convex-downward feature covered in a soft, clayey material consisting of either wet rock dust or original clay material associated with the clayey disconformity discussed above. The anomaly followed a straight course between both ribs. Locally, the anomaly was covered partially by steel plates that were part of the roof support system. The convexity of the anomaly was only several millimeters. The anomaly was examined from a ladder provided by the coal company. Examination of the anomaly and associated strata at the rib intersections failed to find coaly material that would have formed from compressed plant material. It was not possible to examine the bottom concave counterpart to the anomaly as the material was removed prior to my visit.

My initial impression after visit one on March 28 was that the anomaly was a poorly-preserved plant stem, most likely a tree-like lycopod that fell onto a soft mud substrate during deposition and either rotted *in situ* or floated away during a subsequent episode of deeper, low-energy water after forming a depression in the substrate. No definitive anatomical details were observed during this visit.

The Sago Mine was visited a second time on April 6, 2006 to reexamine the anomaly and to observe samples being removed from the mine roof for additional detailed analyses. Additional *in situ* examination of the anomaly prior to sampling did not add additional data to those noted during the initial visit. Four samples, numbered 1 through 4, were removed from the roof utilizing portable rock saws. Sample 1 was obtained for additional study in my laboratory. I marked the sample with my initials immediately after it was removed from the roof and chain of custody was maintained during transportation from the mine and to my laboratory. My initials were present on the sample and noted during examination at the lab.

Description of roof sample taken on April 6, 2006

The sample was arbitrarily numbered 1 (out of four) and comprises a 10 to 45 mm thick, irregular parallelogram-shaped slab of medium to dark gray, laminated silty shale and siltstone The sample measured 31 and 36 cm along the two long edges and 17.5 and 18.0 cm along the two short edges. Originally, the sample was covered in a soft, clayey material less than 1 mm thick. The anomaly is roughly centered on the sample and extends along the long axis of the sample. The anomaly is 9 cm across and is convex-downward. The convexity is only several mm. The anomaly was covered with a dark gray to black, fine, possibly carbonaceous material mixed with the soft clayey material covering the rest of the sample. The material was carefully removed and saved in vials. Prior to removing the material covering the anomaly, a microscopic examination was conducted to determine if any of the dark coating was in organic connection with the surface of the anomaly. Based on this examination, it was determined that the dark material was not in direct organic connection with the surface of the anomaly so no further tests on this material were conducted. The surface of the sample was cleaned with water and a soft brush to prevent damage to the surface of the sample. The cleaning proceeded in stages from the end of the sample and each cleaned area was examined sequentially under the binocular microscope (up to 30X) to ensure that the cleaning was not removing material germane to the study. The cleaned surface of the anomaly was rough and irregular with minor relief. The surface of the sample outside the anomaly was smoother than within the anomaly. Very faint longitudinal stria suggestive of *Sigillarian* periderm structures were noted near one end of the sample. In cross section, the anomaly comprises a lens-shaped mass of silty shale that thins towards both edges to nearly nothing. Small fragments of comminuted plant debris (CPD) are mixed in the sediment. The post- cleaning examination did not reveal any material consistent with compressed and/or coalified plant material. No further testing is suggested as thin section examination of the anomaly material would yield cellular structures associated with the CPD in the fill and not related to the anomaly maker.

Analysis

The anomaly appears to be a filled impression formed when a plant stem, possibly a tree-like lycopod, floated or fell onto a muddy substrate, forming a depression. A depositional hiatus occurred at this time as indicated by the regionally widespread "clayey" layer within the laminated siltstone and shale sequence. The stem was removed from the substrate either by floating during a gentle flood or rotted during the depositional hiatus, leaving a concavity on the sediment substrate. Subsequent depositional events filled the depression with CPD-bearing silt and mud. The anomaly clearly formed during deposition of the roof sequence of the mine and no evidence of post-deposition alteration was noted. It is unfortunate, however, that the original substrate, now preserved as the immediate roof of the mine, was not available for study. No further testing or sampling is recommended at this time as additional information would require examination of the sub-anomaly material which can only be obtained by removing part of one or both ribs. The lack of coalified material where the anomaly intersects the ribs indicates the lack of preserved plant material. Therefore, I do not think excavation of the ribs will add additional material or information.

State of West Virginia

Office of Miner's Health, Safety and Training
Region One
205 Marion Square
Fairmont, WV 26554

May 25, 2006

In conjunction with the ongoing investigation of the mine disaster that occurred at the Anker WV Mining Company, Sago Mine on January 02, 2006 this is a report of the findings of the examinations conducted of a pump cable located in the old 2 Left area of the Sago mine.

John Collins, District Inspector, conducted the examinations of the cable on Monday February 13, 2006 and Thursday May 25, 2006. Other examinations of the cable, including the removal of the cable coupler, removal of the ends at each cable break and the removal of the inline starting box for testing purposes have also been conducted by MSHA and/or the WV OMHST.

Due to the amount of water being made in the face area of the old 2nd Left section this cable was used to power an electrical de-watering pump located near the stopped working face of the #6 entry. Mining advancement had been stopped on the old 2nd Left section and retreat mining operations consisting of mining the lower coal seam was being conducted. As the section was moved back additional cable would be added to allow use of the pump.

The cable is a Tiger Brand, 6/3 cable, Lead Cured, 600-2000 volt, 3-C 6 AGW, Type G-GC, P-7K-184035-MSHA*CPE, FT1, FT5-50C. This information was taken from the pieces of cable and the information is embedded in a repeated pattern manner on the cable.

Upon inspection of the cable it was found to be separated into four (4) pieces. Location and condition as described.

The #1 piece of cable which is the out-by piece with the cable coupler attached measured approximately 199 feet 6 inches in length. The coupler had an identification tag attached identifying the coupler as pump #13. It was discovered that this coupler had previously been used to power a pump #13 located near the old 2nd Left belt conveyor drive. This pump had been taken out of service and the coupler and some of the pump cable was added to the pump cable of the pump which is located in the face area of old 2nd Left. The coupler was located on the mine floor in the (old track) #5 entry near the out-by right side corner of the crosscut located near spad 4028.

During retreat mining the section power center had been located just out-by spad 4028 and the pump cable coupler had been connected. Pieces of wire and one (1) cable hanger are located attached to the roof screen near the coupler location which could have been used to hang the coupler. The mine floor is dry in this area at this time but was wet during the time of mining.

Approximately (65) feet of slack cable was located looped back into the crosscut right at this location. The cable then extended in-by located on the mine floor for one crosscut with approximately (41) feet of slack cable located in the crosscut left at spad 4041. This slack cable was located along the out-by rib of the left crosscut between the #4 and #5 entries. The slack cable was twisted and sort of entangled with a piece of old power cable located in this crosscut. The pump cable appeared not to have been placed at this location in any type of organized manner. This piece of cable has three (3) permanent splices, and one (1) repaired place. No cable hangers or wire was found attached to the cable and no other damage was observed. It appears that the #1 piece of cable had been torn apart creating cable piece #2. The ends of cable #1 and #2 matched as if at one time being connected using the embedded cable information (MSHA/CPE) as a pattern match and evidence of the two (2) damaged ends matching. Evidence shows that the cable was pulled into at this location. The out-by end of the break is broken in a female manner and the in-by end of the break is broken in a male manner. When the slack cable of cable piece #1 was pulled out of the left crosscut and extended in-by in the #5 entry and the out-by end of cable piece #2 that was looped in-by back over itself was pulled out-by in the #5 entry the two (2) cables connection matched.

The #2 piece of cable which would be the second piece in-by the coupler, measured approximately 188 feet in length. The cable was located on the mine floor with the out-by end looped back in-by and against a wall where bottom mining had been stopped. The in-by area of the cable located near spad 4089 has crib blocks entangled in with the cable. The crib blocks are located both on top of and under the cable. The cable begins near spad 4041 and extends in-by in the #5 entry for a distance of 2 and ½ crosscuts. The in-by end of the #2 cable has evidence that the cable was pulled apart where as the conductor ends are broken at uneven lengths. Also, two (2) large damaged areas located near the in-by end show pull inthat the conductors are protruding out the side of the cables outer insulation. Two (2) small damaged areas with exposed insulated conductors also exist near this location. The #2 piece of cable has four (4) pieces of tie wire and metal spads still attached which would have been used to hang the cable. The in-by end of cable #2 matches the out-by end of cable #3 inthat the embedded pattern matches. (Out-by 184035 and in-by P-7k) and when pulled together in the #5 entry the cables connection matched.

The #3 piece of cable begins near spad 4089 and extends in-by in the #5 entry to just in-by spad 4105 a distance of approximately 1 and ¼ crosscuts or approximately 100 feet. The in-by end of the #3 cable looped back in-by for a distance of twenty-seven (27) feet. The #3 cable is located on the mine floor entangled with crib blocks both on top and under the cable. A large piece of white ventilation curtain which has evidence of being exposed to heat is entangled in the cable. There are two (2) nylon type hangers still

attached to the #3 cable near the in-by end which are burnt and very brittle. The in-by end of the #3 cable shows it was pulled apart at a permanent splice. No other splices were found.

Two (2) damaged areas exist in the #3 cable near the out-by end. One (1) area is small and has exposed insulated conductors. The other damaged area is 3 and ¼ inches long with exposed conductors that have the outer insulation burnt away. The insulation is burnt away on one phase conductor wire which is contacting the ground monitor wire which has the insulation burnt away at the same location and is contacting another phase conductor wire which also has the insulation burnt away. This condition would create a phase-to-phase condition if the cable were energized. The in-by end of cable #3 matches the out-by end of cable #4 and when pulled together in the #5 entry the cables connection match.

The #4 piece of cable begins just in-by spad 4105 and extends in-by in the #5 entry for a distance of four (4) crosscuts to spad 3698. The cable then extends through the crosscut right into the #6 entry and in-by for one (1) crosscut to spad 3713 where the cable passes through the crosscut right into the #7 entry at spad 3710. The cable is now installed in the #7 entry and extends in-by for two (2) crosscuts to the next to last open crosscut where it turns left and passes through into the #6 entry and connects to the starting box. It is believed that the cable then extends from the starting box in-by to the pumps located near the face in the last open crosscut of the #6 entry.

Due to the water being roofed from the starting box in-by, the exact location of the cable and pump is not known. The total length of the #4 cable would be approximately eleven (11) breaks or approximately 850 feet. Several repair places and splices exist in the #4 cable but all are in good repair and do not appear to have been damaged by the explosion. Most of the cable is still hung in-by elevation 1375 which is the approximate water roofed elevation at the time of the explosion. Part of the cable is still submerged in the #5 entry from spad 4125 in-by for a distance of two (2) crosscuts where the bottom mined area still holds water.

The total length of the pump cable is approximately 1,337 feet covering an approximate distance in the mine of 1, 250 feet.

On February 13, 2006 a written request was submitted to Anker WV Mining Company for information concerning this cable and pump. A copy of the request and response is attached.

Based upon evidence found during the examinations of the cable in question it was not found that the cable had been cut with an axe or that several breaks of cable had been dragged back and placed at a location during the time the cable was being used to provide power to the pump in the face of the #6 entry of old 2nd Left.

It is further believed that said cable was one continuous cable extending from the cable coupler near spad 4028 in-by to the pump located in the face of #6 entry of old 2nd Left at

the time of the explosion on January 2, 2006. I found no evidence that the power cable was or could have been energized at that time.

A request has been submitted for Anker WV Mining Company to recover the de-watering pump located in the face of #6 entry of the old 2nd Left working section.

The investigation as of this date is still ongoing and any information or findings are of a preliminary nature at this time.

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John Collins, District Inspector

JAC/jc

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1ST MSHA METHANE LIBERATION STUDY

SUMMARY PAGE

49 HOURS

02/07/06 8:00 AM TO 02/09/06 8:00 AM

	Sample ID	Collection Date	Time	O2 %	N2 %	CH4 %	CO2 %	TOTAL	Bottle Number		Air Quantity (cfm)	Air Quantity Total FT^3	Methane Liberation (cu-ft)
	AIRLOCK	02/07/06	8:00	20.95	77.98	0.028	0.12	100.00	K-9384	1	103	6,168	2
	AIRLOCK	02/07/06	9:00	20.62	78.14	0.021	0.29	100.00	K-8893	2	-139	-8,359	-2
	AIRLOCK	02/07/06	10:00	20.78	78.12	0.022	0.15	100.00	K-9349	3	-323	-19,352	-4
	AIRLOCK	02/07/06	11:00	20.85	78.10	0.021	0.09	100.00	K-9339	4	-173	-10,358	-2
	AIRLOCK	02/07/06	12:00	20.89	78.09	0.021	0.07	100.00	K-9322	5	-73	-4,375	-1
	AIRLOCK	02/07/06	13:00	20.63	78.17	0.025	0.25	100.00	K-9319	6	-164	-9,852	-2
	AIRLOCK	02/07/06	14:00	20.84	78.11	0.023	0.09	100.00	K-9321	7	65	3,921	1
	AIRLOCK	02/07/06	15:00	20.95	77.97	0.037	0.12	100.00	K-9320	8	-252	-15,138	-6
	AIRLOCK	02/07/06	16:00	20.76	78.13	0.024	0.15	100.00	K-9340	9	-194	-11,618	-3
	AIRLOCK	02/07/06	17:00	20.87	78.10	0.024	0.07	100.00	K-9355	10	510	30,592	7
	AIRLOCK	02/07/06	18:00	20.84	78.12	0.024	0.09	100.00	K-9316	11	122	7,303	2
	AIRLOCK	02/07/06	19:00	20.81	78.13	0.024	0.11	100.00	K-9326	12	313	18,778	4
	AIRLOCK	02/07/06	20:00	20.81	78.12	0.023	0.12	100.00	K-9337	13	96	5,777	1
	AIRLOCK	02/07/06	21:00	20.40	78.23	0.019	0.43	100.00	K-9317	32	451	27,075	5
	AIRLOCK	02/07/06	22:00	20.89	78.11	0.018	0.06	100.00	K-9345	14	235	14,105	3
	AIRLOCK	02/07/06	23:00	20.91	78.08	0.020	0.06	100.00	K-9328	15	242	14,529	3
	AIRLOCK	02/08/06	0:00	20.42	78.19	0.018	0.44	100.00	K-9335	16	643	38,596	7
	AIRLOCK	02/08/06	1:00	20.55	78.15	0.021	0.35	100.00	K-9327	17	414	24,846	5
	AIRLOCK	02/08/06	2:00	20.65	78.15	0.021	0.26	100.00	K-9336	18	257	15,405	3
	AIRLOCK	02/08/06	3:00	20.83	78.12	0.021	0.10	100.00	K-9325	19	490	29,397	6
	AIRLOCK	02/08/06	4:00	20.72	78.14	0.015	0.19	100.00	K-9331	20	298	17,859	3
	AIRLOCK	02/08/06	5:00	20.86	78.11	0.024	0.08	100.00	K-9377	21	530	31,806	8
	AIRLOCK	02/08/06	6:00	20.33	78.24	0.023	0.48	100.00	K-9356	22	335	20,086	5
	AIRLOCK	02/08/06	7:00	20.57	78.20	0.024	0.28	100.00	K-9366	23	391	23,467	6
	AIRLOCK	02/08/06	8:00	20.49	78.18	0.025	0.38	100.00	K-9360	43	290	17,380	4
	AIRLOCK	02/08/06	9:00	20.84	78.15	0.022	0.06	100.00	K-9376	24	229	13,744	3
	AIRLOCK	02/08/06	10:00	20.88	78.11	0.023	0.05	100.00	K-9365	25	-137	-8,245	-2
	AIRLOCK	02/08/06	11:00	20.90	78.09	0.023	0.05	100.00	K-9375	26	139	8,362	2
	AIRLOCK	02/08/06	12:00	20.83	78.08	0.026	0.13	100.00	K-9329	44	-156	-9,332	-2
	AIRLOCK	02/08/06	13:00	20.86	78.09	0.029	0.09	100.00	K-9346	27	-70	-4,215	-1
	AIRLOCK	02/08/06	14:00	20.69	78.13	0.032	0.22	100.00	K-9385	45	184	11,020	4
	AIRLOCK	02/08/06	15:00	20.65	78.16	0.029	0.24	100.00	K-9396	28	-159	-9,535	-3
	AIRLOCK	02/08/06	16:00	20.84	78.10	0.027	0.10	100.00	K-9392	29	166	9,978	3
	AIRLOCK	02/08/06	17:00	20.89	78.07	0.030	0.08	100.00	K-9395	46	508	30,464	9
	AIRLOCK	02/08/06	18:00	20.50	78.20	0.027	0.35	100.00	K-9386	30	325	19,524	5
	AIRLOCK	02/08/06	19:00	20.91	78.08	0.029	0.05	100.00	K-9393	47	343	20,579	6
	AIRLOCK	02/08/06	20:00	20.85	78.11	0.024	0.09	100.00	K-9394	31	416	24,972	6
	AIRLOCK	02/08/06	21:00	20.90	78.10	0.023	0.05	100.00	K-9398	49	195	11,695	3
	AIRLOCK	02/08/06	22:00	20.91	78.09	0.023	0.05	100.00	K-9381	33	167	10,025	2
	AIRLOCK	02/08/06	23:00	20.88	78.10	0.024	0.06	100.00	K-9338	34	431	25,845	6
	AIRLOCK	02/09/06	0:00	20.88	78.11	0.024	0.06	100.00	K-9387	48	542	32,496	8
	AIRLOCK	02/09/06	1:00	20.90	78.08	0.023	0.07	100.00	K-9330	35	310	18,584	4
	AIRLOCK	02/09/06	2:00	20.92	78.06	0.023	0.06	100.00	K-9367	36	830	49,826	12
	AIRLOCK	02/09/06	3:00	20.85	78.12	0.023	0.08	100.00	K-9391	37	715	42,915	10
	AIRLOCK	02/09/06	4:00	20.89	78.09	0.022	0.07	100.00	K-9315	38	698	41,853	9

	Sample ID	Collection Date	Time	O2 %	N2 %	CH4 %	CO2 %	TOTAL	Bottle Number		Air Quantity (cfm)	Air Quantity Total FT^3	Liberation (cu-ft)			
	AIRLOCK	02/09/06	5:00	20.87	78.13	0.025	0.08	100.03	K-9347	39	799	47,958	12			
	AIRLOCK	02/09/06	6:00	20.95	78.04	0.029	0.05	100.00	K-9378	40	692	41,537	12			
	AIRLOCK	02/09/06	7:00	20.89	78.10	0.022	0.06	100.00	K-9389	41	753	45,151	10			
	AIRLOCK	02/09/06	8:00	20.71	78.11	0.025	0.22	100.00	K-9390	42	1,172	70,327	18	HOURS	49	
											13,559	813,567	172			
	BH-5 Mine	02/07/06	8:00	20.89	78.04	0.200	0.06	99.19	K-8865	55			407			
	BH-5 Mine	02/07/06	9:00	20.84	77.96	0.213	0.06	100.00	K-8826	62			439			
	BH-5 Mine	02/07/06	10:00	20.82	77.98	0.214	0.06	100.00	K-8856	56			415			
	BH-5 Mine	02/07/06	11:00	20.81	78.01	0.210	0.05	100.00	K-8827	57			407			
	BH-5 Mine	02/07/06	12:00	20.82	77.98	0.217	0.05	100.00	K-8857	94			463			
	BH-5 Mine	02/07/06	13:00	20.95	77.88	0.188	0.06	100.00	K-8817	50			332			
	BH-5 Mine	02/07/06	14:00	20.80	77.99	0.220	0.06	100.00	K-8828	58			423			
	BH-5 Mine	02/07/06	15:00	20.81	77.98	0.216	0.06	100.00	K-8876	59			430			
	BH-5 Mine	02/07/06	16:00	20.81	77.98	0.215	0.06	100.00	K-8858	60			425			
	BH-5 Mine	02/07/06	17:00	20.80	77.99	0.217	0.06	100.00	K-8810	61			437			
	BH-5 Mine	02/07/06	18:00	20.95	77.84	0.222	0.06	100.00	K-8896	51			467			
	BH-5 Mine	02/07/06	19:00	20.95	77.84	0.218	0.06	100.00	K-8885	52			456			
	BH-5 Mine	02/07/06	20:00	20.95	77.84	0.219	0.06	100.00	K-8877	53			461			
	BH-5 Mine	02/07/06	21:00	20.95	77.84	0.219	0.06	100.00	K-8887	54			453			
	BH-5 Mine	02/07/06	22:00	20.80	77.99	0.221	0.06	100.00	K-8868	63			466			
	BH-5 Mine	02/07/06	23:00	20.81	77.98	0.220	0.06	100.00	K-8840	64			471			
	BH-5 Mine	02/08/06	0:00	20.78	78.04	0.220	0.03	100.00	K-8895	88			476			
	BH-5 Mine	02/08/06	1:00	20.80	77.99	0.223	0.06	100.00	K-8860	87			485			
	BH-5 Mine	02/08/06	2:00	20.81	77.98	0.221	0.06	100.00	K-8890	81			477			
	BH-5 Mine	02/08/06	3:00	20.80	77.99	0.218	0.06	100.00	K-8832	85			478			
	BH-5 Mine	02/08/06	4:00	20.81	78.01	0.218	0.03	100.00	K-8862	83			461			
	BH-5 Mine	02/08/06	5:00	20.82	77.99	0.218	0.05	100.00	K-8841	82			459			
	BH-5 Mine	02/08/06	6:00	20.81	77.99	0.211	0.06	100.00	K-8871	84			447			
	BH-5 Mine	02/08/06	7:00	20.81	77.99	0.217	0.05	100.00	K-8821	86			466			
	BH-5 Mine	02/08/06	8:00	20.81	78.01	0.211	0.04	100.00	K-8820	66			457			
	BH-5 Mine	02/08/06	9:00	20.82	77.98	0.216	0.05	100.00	K-8804	67			455			
	BH-5 Mine	02/08/06	10:00	20.81	77.98	0.217	0.06	100.00	K-8812	68			443			
	BH-5 Mine	02/08/06	11:00	20.81	77.98	0.221	0.06	100.00	K-8803	69			473			
	BH-5 Mine	02/08/06	12:00	20.82	77.98	0.212	0.06	100.00	K-8808	70			437			
	BH-5 Mine	02/08/06	13:00	20.82	77.97	0.221	0.06	100.00	K-8807	71			440			
	BH-5 Mine	02/08/06	14:00	20.81	78.00	0.205	0.05	100.00	K-8864	72			426			
	BH-5 Mine	02/08/06	15:00	20.82	77.98	0.213	0.06	100.00	K-8843	73			433			
	BH-5 Mine	02/08/06	16:00	20.83	77.97	0.205	0.06	100.00	K-8800	74			416			
	BH-5 Mine	02/08/06	17:00	20.92	78.06	0.035	0.05	100.00	K-8830	75			25			
	BH-5 Mine	02/08/06	18:00	20.76	78.03	0.220	0.06	100.00	K-8945	76			435			
	BH-5 Mine	02/08/06	19:00	20.76	78.03	0.215	0.06	100.00	K-8936	65			444			
	BH-5 Mine	02/08/06	20:00	20.83	77.96	0.212	0.07	100.00	K-8967	77			428			
	BH-5 Mine	02/08/06	21:00	20.82	77.99	0.199	0.06	100.00	K-8991	78			394			
	BH-5 Mine	02/08/06	22:00	20.85	77.95	0.208	0.06	100.00	K-8977	79			428			
	BH-5 Mine	02/08/06	23:00	20.85	78.00	0.170	0.06	100.00	K-8959	80			337			
	BH-5 Mine	02/09/06	0:00	20.83	77.99	0.194	0.06	100.00	K-8993	196			382			
	BH-5 Mine	02/09/06	1:00	20.83	77.96	0.215	0.06	100.00	K-8937	188			432			
	BH-5 Mine	02/09/06	2:00	20.84	77.97	0.200	0.06	100.00	K-8998	189			422			
	BH-5 Mine	02/09/06	3:00	20.84	77.97	0.195	0.06	100.00	K-8925	190			386			
	BH-5 Mine	02/09/06	4:00	20.84	77.97	0.210	0.06	100.00	K-8969	191			419			
	BH-5 Mine	02/09/06	5:00	20.81	77.99	0.204	0.06	100.00	K-8938	192			405			

Sample ID	Collection Date	Time	O2 %	N2 %	CH4 %	CO2 %	TOTAL	Bottle Number		Air Quantity (cfm)	Air Quantity Total FT^3	Liberation (cu-ft)			
BH-5 Mine	02/09/06	6:00	20.84	77.99	0.186	0.06	100.00	K-8987	*193*			388			
BH-5 Mine	02/09/06	7:00	20.83	77.99	0.194	0.06	100.00	K-8961	*194*			407			
BH-5 Mine	02/09/06	8:00	20.85	77.96	0.207	0.06	100.00	K-8980	*195*			441	HOURS	49	
					0.207							**20,854**			
BH-7 Top	02/07/06	8:00	20.77	77.85	0.390	0.06	99.07	K-8866	*89*	3,991	239,470	875			
BH-5 Top	02/07/06	9:00	20.81	77.98	0.215	0.06	100.00	K-8825	*90*	3,749	224,943	428			
BH-5 Top	02/07/06	10:00	20.81	78.00	0.198	0.06	100.00	K-8845	*91*	3,749	224,943	389			
BH-5 Top	02/07/06	11:00	20.80	77.99	0.218	0.06	100.00	K-8837	*92*	3,749	224,943	434			
BH-5 Top	02/07/06	12:00	20.95	77.84	0.220	0.06	100.00	K-8847	*93*	3,932	235,922	461			
BH-5 Top	02/07/06	13:00	20.81	77.98	0.220	0.06	100.00	K-8818	*95*	3,686	221,162	432			
BH-5 Top	02/07/06	14:00	*NO SAMPLE*		0.220		1.15	*K-8809*	*96*	3,749	224,943	439			
BH-5 Top	02/07/06	15:00	20.82	77.97	0.218	0.06	101.00	K-8867	*97*	3,686	221,162	428			
BH-5 Top	02/07/06	16:00	*NO SAMPLE*		0.220		1.15	*K-8848*	*98*	3,728	223,683	436			
BH-5 Top	02/07/06	17:00	*NO SAMPLE*		0.220		0.22	*K-8819*	*99*	3,749	224,922	439			
BH-7 Top	02/07/06	18:00	20.93	77.67	0.405	0.06	99.07	K-8897	*100*	3,830	229,785	874			
BH-5 Top	02/07/06	19:00	20.95	77.83	0.221	0.07	100.00	K-8891	*101*	3,830	229,785	450			
BH-5 Top	02/07/06	20:00	20.95	77.84	0.219	0.06	100.00	K-8886	*102*	3,830	229,785	446			
BH-5 Top	02/07/06	21:00	20.82	77.97	0.221	0.06	100.00	K-8894	*103*	3,768	226,082	444			
BH-5 Top	02/07/06	22:00	20.81	77.97	0.222	0.06	100.00	K-8869	*104*	3,868	232,099	457			
BH-5 Top	02/07/06	23:00	20.95	77.83	0.223	0.07	100.00	K-8849	*105*	3,909	234,558	465			
BH-5 Top	02/08/06	0:00	20.77	78.02	0.224	0.05	100.00	K-8879	*127*	3,949	236,942	471			
BH-5 Top	02/08/06	1:00	20.78	78.04	0.201	0.06	100.00	K-8870	*106*	3,949	236,942	418			
BH-5 Top	02/08/06	2:00	20.82	78.01	0.183	0.06	100.00	K-8881	*108*	3,909	234,558	369			
BH-5 Top	02/08/06	3:00	20.76	78.04	0.222	0.05	100.00	K-8833	*122*	3,909	234,558	463			
BH-5 Top	02/08/06	4:00	20.81	77.99	0.209	0.06	100.00	K-8880	*126*	3,867	232,016	427			
BH-5 Top	02/08/06	5:00	20.76	78.04	0.217	0.05	100.00	K-8873	*124*	3,868	232,099	447			
BH-5 Top	02/08/06	6:00	20.80	78.03	0.187	0.06	100.00	K-8861	*123*	3,871	232,244	377			
BH-5 Top	02/08/06	7:00	20.81	78.04	0.166	0.05	100.00	K-8823	*125*	3,910	234,628	331			
BH-5 Top	02/08/06	8:00	20.81	77.99	0.209	0.06	100.00	K-8822	*109*	3,990	239,401	440			
BH-5 Top	02/08/06	9:00	20.82	77.97	0.219	0.06	100.00	K-8811	*110*	3,889	233,350	452			
BH-5 Top	02/08/06	10:00	20.80	78.00	0.219	0.05	100.00	K-8813	*111*	3,829	229,764	445			
BH-5 Top	02/08/06	11:00	20.81	77.98	0.221	0.06	100.00	K-8863	*112*	4,008	240,480	471			
BH-5 Top	02/08/06	12:00	20.80	77.99	0.222	0.06	100.00	K-8854	*113*	3,846	230,780	455			
BH-5 Top	02/08/06	13:00	20.82	77.97	0.222	0.06	100.00	K-8824	*114*	3,682	220,907	435			
BH-5 Top	02/08/06	14:00	20.80	77.98	0.224	0.06	100.00	K-8853	*115*	3,926	235,590	469			
BH-5 Top	02/08/06	15:00	20.82	77.97	0.225	0.06	100.00	K-8874	*116*	3,826	229,579	458			
BH-5 Top	02/08/06	16:00	20.85	77.96	0.202	0.06	100.00	K-8801	*135*	3,826	229,579	406			
BH-5 Top	02/08/06	17:00	20.77	78.04	0.203	0.06	100.00	K-8924	*117*	3,826	229,579	408			
BH-5 Top	02/08/06	18:00	20.83	77.98	0.205	0.06	100.00	K-8955	*118*	3,701	222,090	399			
BH-5 Top	02/08/06	19:00	20.81	77.98	0.219	0.06	100.00	K-8946	*119*	3,845	230,712	446			
BH-5 Top	02/08/06	20:00	20.81	77.99	0.218	0.06	100.00	K-8975	*120*	3,784	227,014	437			
BH-5 Top	02/08/06	21:00	20.85	77.95	0.216	0.06	100.00	K-8997	*136*	3,721	223,255	427			
BH-5 Top	02/08/06	22:00	20.78	78.01	0.220	0.06	100.00	K-8985	*121*	3,826	229,579	447			
BH-5 Top	02/08/06	23:00	20.84	77.98	0.180	0.07	100.00	K-8968	*137*	3,807	228,430	353			
BH-5 Top	02/09/06	0:00	20.75	78.08	0.188	0.06	100.00	K-8992	*138*	3,868	232,099	376			
BH-5 Top	02/09/06	1:00	20.83	78.03	0.150	0.06	100.00	K-8947	*128*	3,828	229,690	288			
BH-5 Top	02/09/06	2:00	20.79	78.10	0.110	0.07	100.00	K-8994	*129*	4,024	241,461	205			
BH-5 Top	02/09/06	3:00	20.81	77.99	0.221	0.06	100.00	K-8916	*107*	3,868	232,099	455			
BH-5 Top	02/09/06	4:00	20.82	77.99	0.206	0.06	100.00	K-8960	*130*	3,868	232,099	420			
BH-5 Top	02/09/06	5:00	20.79	78.03	0.194	0.05	100.00	K-8927	*131*	3,847	230,839	391			

Sample ID	Collection Date	Time	O2 %	N2 %	CH4 %	CO2 %	TOTAL	Bottle Number		Air Quantity (cfm)	Air Quantity Total FT^3	Liberation (cu-ft)			
BH-5 Top	02/09/06	6:00	20.81	77.99	0.214	0.06	100.00	K-8978	*132*	4,081	244,865	463			
BH-5 Top	02/09/06	7:00	20.76	78.04	0.222	0.05	100.00	K-8962	*133*	4,060	243,599	479			
BH-5 Top	02/09/06	8:00	20.79	78.01	0.220	0.05	100.00	K-8989	*134*	4,060	243,599	474	HOURS	49	
					0.216				TOTAL	188,877	11,332,615	21,701			
BH-7 Top	02/07/06	8:00	20.80	78.00	0.211	0.05	99.07	K-8875	*144*	892	53,497	100			
BH-7 Top	02/07/06	9:00	20.77	77.86	0.393	0.06	100.00	K-8835	*145*	892	53,497	197			
BH-7 Top	02/07/06	10:00	20.76	77.85	0.403	0.06	100.00	K-8855	*147*	892	53,497	202			
BH-7 Top	02/07/06	11:00	*NO SAMPLE*		0.400		1.33	*K-8846*	*148*	892	53,497	201			
BH-7 Top	02/07/06	12:00	*NO SAMPLE*		0.400		1.33	*K-8836*	*149*	892	53,497	201			
BH-5 Top	02/07/06	13:00	*NO SAMPLE*		0.400		0.40	*K-8816*	*150*	963	57,783	217			
BH-7 Top	02/07/06	14:00	20.77	77.81	0.429	0.06	100.00	K-8838	*139*	963	57,783	233			
BH-5 Top	02/07/06	15:00	20.75	77.85	0.412	0.06	100.00	K-8884	*151*	892	53,497	207			
BH-7 Top	02/07/06	16:00	20.93	77.67	0.408	0.06	100.00	K-8839	*153*	892	53,497	205			
BH-7 Top	02/07/06	17:00	*NO SAMPLE*		0.400		1.33	*K-8829*	*152*	892	53,497	201			
BH-7 Top	02/07/06	18:00	*NO SAMPLE*		0.400		0.40	*K-8899*	*146*	722	43,332	162			
BH-7 Top	02/07/06	19:00	20.81	77.79	0.396	0.07	100.00	K-8892	*154*	730	43,814	162			
BH-7 Top	02/08/06	20:00	20.81	77.85	0.355	0.06	100.00	K-8984	*143*	830	49,800	164			
BH-7 Top	02/07/06	20:00	20.81	77.81	0.378	0.07	100.00	K-9311	*155*	997	59,811	211			
BH-7 Top	02/07/06	21:00	20.95	77.66	0.401	0.06	100.00	K-8898	*140*	997	59,811	225			
BH-7 Top	02/07/06	22:00	20.94	77.66	0.405	0.06	100.00	K-8878	*141*	1,030	61,773	235			
BH-7 Top	02/07/06	23:00	20.77	77.83	0.402	0.06	100.00	K-8859	*142*	1,091	65,469	247			
BH-7 Top	02/08/06	0:00	20.74	77.87	0.405	0.06	100.00	K-8888	*156*	1,029	61,712	235			
BH-7 Top	02/08/06	1:00	20.71	77.90	0.409	0.05	100.00	K-8850	*175*	1,044	62,649	240			
BH-7 Top	02/08/06	2:00	20.79	77.99	0.224	0.07	100.00	K-8882	*174*	1,028	61,652	123			
BH-7 Top	02/08/06	3:00	20.74	77.86	0.416	0.06	100.00	K-8872	*170*	1,044	62,649	245			
BH-7 Top	02/08/06	4:00	20.73	77.87	0.420	0.05	100.00	K-8889	*176*	1,092	65,520	259			
BH-7 Top	02/08/06	5:00	20.74	77.89	0.393	0.05	100.00	K-8842	*173*	1,044	62,649	231			
BH-7 Top	02/08/06	6:00	20.75	77.89	0.377	0.06	100.00	K-8552	*171*	1,061	63,646	224			
BH-7 Top	02/08/06	7:00	20.74	77.88	0.390	0.06	100.00	K-8831	*172*	963	57,783	211			
BH-7 Top	02/08/06	8:00	20.76	77.85	0.406	0.06	100.00	K-8814	*157*	953	57,200	218			
BH-7 Top	02/08/06	9:00	20.78	77.82	0.414	0.06	100.00	K-8851	*158*	963	57,783	225			
BH-7 Top	02/08/06	10:00	20.75	77.83	0.430	0.06	100.00	K-8805	*159*	928	55,681	225			
BH-7 Top	02/08/06	11:00	20.76	77.83	0.425	0.06	100.00	K-8806	*160*	928	55,681	223			
BH-7 Top	02/08/06	12:00	20.76	77.82	0.431	0.06	100.00	K-8844	*161*	928	55,681	226			
BH-7 Top	02/08/06	13:00	20.75	77.81	0.449	0.06	100.00	K-8834	*162*	971	58,233	247			
BH-7 Top	02/08/06	14:00	20.76	77.80	0.448	0.06	100.00	K-8883	*163*	1,028	61,676	261			
BH-7 Top	02/08/06	15:00	20.76	77.83	0.424	0.06	100.00	K-8815	*164*	1,037	62,201	248			
BH-7 Top	02/08/06	16:00	20.82	77.85	0.348	0.06	100.00	K-8802	*165*	995	59,704	193			
BH-7 Top	02/08/06	17:00	20.81	77.86	0.339	0.06	100.00	K-8935	*186*	1,004	60,250	189			
BH-7 Top	02/08/06	18:00	20.80	77.89	0.326	0.06	100.00	K-8966	*166*	928	55,681	168			
BH-7 Top	02/08/06	19:00	20.80	77.89	0.324	0.06	100.00	K-8956	*187*	1,030	61,773	185			
BH-7 Top	02/08/06	21:00	20.79	77.86	0.357	0.06	100.00	K-8999	*167*	1,004	60,250	200			
BH-7 Top	02/08/06	22:00	20.80	77.89	0.307	0.07	100.00	K-8996	*168*	1,004	60,250	170			
BH-7 Top	02/08/06	23:00	20.78	77.91	0.323	0.06	100.00	K-8976	*169*	971	58,233	174			
BH-7 Top	02/09/06	0:00	20.75	77.88	0.384	0.06	100.00	K-8986	*177*	970	58,216	209			
BH-7 Top	02/09/06	1:00	20.75	77.84	0.427	0.06	100.00	K-8948	*178*	995	59,704	240			
BH-7 Top	02/09/06	2:00	20.80	77.90	0.311	0.06	100.00	K-8995	*179*	1,036	62,188	178			
BH-7 Top	02/09/06	3:00	20.83	77.97	0.210	0.05	100.00	K-8926	*180*	1,011	60,641	112			
BH-7 Top	02/09/06	4:00	20.76	77.84	0.417	0.06	100.00	K-8988	*181*	1,026	61,577	242			
BH-7 Top	02/09/06	5:00	20.77	77.88	0.364	0.06	100.00	K-8917	*182*	1,099	65,945	224			

	Sample ID	Collection Date	Time	O2 %	N2 %	CH4 %	CO2 %	TOTAL	Bottle Number		Air Quantity (cfm)	Air Quantity Total FT^3	Liberation (cu-ft)			
	BH-7 Top	02/09/06	6:00	20.76	77.87	0.380	0.06	100.00	K-8970	*183*	1,091	65,483	232			
	BH-7 Top	02/09/06	7:00	20.78	77.87	0.366	0.06	100.00	K-8979	*184*	1,156	69,365	237			
	BH-7 Top	02/09/06	8:00	20.78	77.90	0.336	0.06	100.00	K-8971	*185*	1,143	68,559	213	HOURS	49	
										TOTAL	47,959	2,877,568	10,074			
	REG	02/07/06	8:00	20.95	77.98	0.030	0.11	99.07	K-9341	*197*	4,780	286,799	87			
	REG	02/07/06	9:00	20.91	78.10	0.018	0.05	99.07	K-9312	*198*	4,780	286,799	50		Nearest neighbor	
	REG	02/07/06	9:00	20.91	78.10	0.018	0.05	100.00	K-9312	*198*	4,780	286,799	50			
	REG	02/07/06	10:00	20.95	78.04	0.029	0.05	100.00	K-9313	*199*	4,963	297,791	88			
	REG	02/07/06	11:00	20.92	77.94	0.029	0.18	100.00	K-9307	*200*	4,813	288,798	84			
	REG	02/07/06	12:00	20.87	78.09	0.021	0.09	100.00	K-9306	*201*	4,897	293,794	61			
	REG	02/07/06	13:00	20.95	78.03	0.038	0.05	100.00	K-9350	*202*	4,813	288,798	110			
	REG	02/07/06	14:00	20.88	78.09	0.032	0.07	100.00	K-9951	*203*	4,647	278,805	88			
	REG	02/07/06	15:00	20.88	78.11	0.021	0.05	100.00	K-9314	*204*	4,830	289,797	62			
	REG	02/07/06	16:00	20.90	78.09	0.025	0.05	100.00	K-9333	*205*	4,813	288,798	73			
	REG	02/07/06	17:00	20.88	78.10	0.023	0.07	100.00	K-9318	*206*	4,130	247,826	57			
	REG	02/07/06	18:00	20.89	78.10	0.019	0.06	100.00	K-9310	*207*	4,430	265,814	50			
	REG	02/07/06	19:00	20.86	78.13	0.020	0.06	100.00	K-9309	*208*	4,247	254,822	51			
	REG	02/07/06	20:00	20.88	78.11	0.019	0.07	100.00	K-9304	*209*	4,563	273,808	51			
	REG	02/07/06	21:00	20.89	78.10	0.019	0.06	100.00	K-9348	*230*	4,314	258,819	48			
	REG	02/07/06	22:00	20.88	78.10	0.020	0.07	100.00	K-9305	*210*	4,630	277,805	55			
	REG	02/07/06	23:00	20.86	78.13	0.019	0.07	100.00	K-9301	*233*	4,697	281,803	53			
	REG	02/08/06	0:00	20.62	78.16	0.019	0.28	100.00	K-9368	*211*	4,397	263,815	50			
	REG	02/08/06	1:00	20.88	78.11	0.018	0.06	100.00	K-9357	*212*	4,563	273,808	50			
	REG	02/08/06	2:00	20.82	78.12	0.018	0.11	100.00	K-9303	*213*	4,697	281,803	50			
	REG	02/08/06	3:00	20.88	78.12	0.014	0.06	100.00	K-9359	*214*	4,447	266,813	38			
	REG	02/08/06	4:00	20.63	78.16	0.019	0.26	100.00	K-9358	*215*	4,613	276,806	54			
	REG	02/08/06	5:00	20.59	78.16	0.020	0.30	100.00	K-9332	*216*	4,430	265,814	54			
	REG	02/08/06	6:00	20.87	78.11	0.019	0.07	100.00	K-9302	*217*	4,580	274,808	51			
	REG	02/08/06	7:00	20.78	78.13	0.018	0.14	100.00	K-9300	*218*	4,580	274,808	50			
	REG	02/08/06	8:00	20.91	78.09	0.019	0.05	100.00	K-9308	*219*	4,663	279,804	54			
	REG	02/08/06	9:00	20.91	78.09	0.021	0.05	100.00	K-9369	*220*	4,613	276,806	58			
	REG	02/08/06	10:00	20.84	78.12	0.024	0.09	100.00	K-9379	*221*	4,930	295,793	70			
	REG	02/08/06	11:00	20.80	78.09	0.024	0.15	100.00	K-9342	*222*	4,797	287,798	69			
	REG	02/08/06	12:00	20.90	78.09	0.022	0.06	100.00	K-9352	*223*	4,930	295,793	66			
	REG	02/08/06	13:00	20.88	78.11	0.022	0.06	100.00	K-9323	*224*	4,680	280,803	62			
	REG	02/08/06	14:00	20.82	78.10	0.024	0.12	100.00	K-9324	*225*	4,713	282,802	69			
	REG	02/08/06	15:00	20.85	78.11	0.024	0.08	100.00	K-9334	*243*	5,013	300,789	73			
	REG	02/08/06	16:00	20.67	78.14	0.024	0.24	100.00	K-9361	*226*	4,697	281,803	66			
	REG	02/08/06	17:00	20.92	78.07	0.024	0.05	100.00	K-9343	*244*	4,314	258,819	62			
	REG	02/08/06	18:00	20.93	78.06	0.024	0.05	100.00	K-9380	*245*	4,380	262,816	64			
	REG	02/08/06	19:00	20.89	78.10	0.023	0.06	100.00	K-9371	*227*	4,430	265,814	60			
	REG	02/08/06	20:00	20.81	78.10	0.023	0.14	100.00	K-9370	*228*	4,397	263,815	61			
	REG	02/08/06	21:00	20.89	78.10	0.023	0.06	100.00	K-9399	*229*	4,530	271,810	63			
	REG	02/08/06	22:00	20.87	78.10	0.022	0.08	100.00	K-9388	*231*	4,663	279,804	61			
	REG	02/08/06	23:00	20.87	78.10	0.023	0.07	100.00	K-9362	*232*	4,347	260,817	59			
	REG	02/09/06	0:00	20.95	78.03	0.030	0.06	100.00	K-9344	*234*	4,297	257,819	77			
	REG	02/09/06	1:00	20.68	77.95	0.027	0.41	100.00	K-9354	*235*	4,514	270,810	74			
	REG	02/09/06	2:00	*NO SAMPLE*		0.025		0.96	*K-9353*	*236*	4,230	253,822	63			
	REG	02/09/06	3:00	20.95	77.99	0.028	0.10	100.00	K-9372	*237*	4,164	249,825	71			
	REG	02/09/06	4:00	20.95	78.04	0.030	0.05	100.00	K-9363	*238*	4,197	251,824	74			

	Sample ID	Collection Date	Time	O2 %	N2 %	CH4 %	CO2 %	TOTAL	Bottle Number		Air Quantity (cfm)	Air Quantity Total FT^3	Liberation (cu-ft)			
	REG	02/09/06	5:00	20.95	78.03	0.029	0.06	100.00	K-9382	*239*	4,147	248,826	71			
	REG	02/09/06	6:00	20.95	77.99	0.027	0.10	100.00	K-9373	*240*	4,480	268,812	73			
	REG	02/09/06	7:00	20.95	78.03	0.027	0.06	100.00	K-9364	*241*	4,464	267,812	72			
	REG	02/09/06	8:00	20.95	77.96	0.026	0.13	100.00	K-9383	*242*	4,031	241,831	63	HOURS	50	
										TOTAL	228,057	13,683,415	3,173			

MSHA Methane Liberation Study 2

SAGO Mine Air Samples - MSHA ID No. 46-08791

	10 cc UG Seal Regulator	50 cc UG Seal Regulator	10 cc Borehole #5	10 cc Pump (mine)
3/2/2006 8:00			K9696	K9699
3/2/2006 9:00	K8915		K9692	K9691
3/2/2006 10:00	K8914		K9684	K9685
3/2/2006 11:00	K8949	D2953	K9676	K9675
3/2/2006 12:00	K8990		K9666	K9665
3/2/2006 13:00	K8981		K9645	K9655
3/2/2006 14:00	K8983		K9656	K9646
3/2/2006 15:00	K8909		K9636	K9635
3/2/2006 16:00	K8918		K9626	K9625
3/2/2006 17:00	K8910		K9617	K9616
3/2/2006 18:00	K8912		K9627	K9618
3/3/2006 8:00	K8919		K9698	K9694
3/3/2006 9:00	K8931		K9686	K9693
3/3/2006 10:00	K8921		K9687	K9678
3/3/2006 11:00	K8922		K9667	K9668
3/3/2006 12:00	K8911		K9657	K9658
3/3/2006 13:00	K8920		K9647	K9648
3/3/2006 14:00	K8923		K9638	K9637
3/3/2006 15:00	K8933		K9677	K9628
3/3/2006 16:00	K8941		K9610	K9619
3/3/2006 17:00	K8930		K9611	K9604

Miscellaneous
10 cc

3/1/2006 10:30	K8913	1 Left #1, 9 - 10 x-cut TM
3/1/2006 11:52	K8902	2 Left off 1 Left TM
3/1/2006	K2655	#1 Entry RS
3/1/2006	K2626	X-Cut 6 - 7, RS 09

Miscellaneous
50 cc

3/1/2006 11:56	D2841	Track Pitmouth
3/1/2006	D4916	#1 Pitmouth Return
3/1/2006 8:18	D4928	Return #1
3/1/2006	D4846	Beltline
3/1/2006	D4904	#2 Pitmouth
3/3/2006 12:30	MS001	BH #5 Exhaust
3/3/2006 12:18	RS001	Track entry at Drift, #4 Drift Opening
3/2/2006 10:58	D2953	Entry #9, Reg. to old 2 Left (listed above also)

UG Regulator

Bottle #	Date/Time	CO2	O2	CH4	C2H6
	3/2/06 8:00	0.060	20.85	0.020	0.000
K8915	3/2/06 9:00	0.060	20.85	0.020	0.000
K8914	3/2/06 10:00	0.060	20.85	0.020	0.000
K8949	3/2/06 11:00	0.070	20.91	0.030	0.000
K8990	3/2/06 12:00	0.060	20.79	0.030	0.000
K8981	3/2/06 13:00	0.060	20.80	0.020	0.000
K8983	3/2/06 14:00	0.060	20.69	0.020	0.000
K8909	3/2/06 15:00	0.060	20.77	0.020	0.000
K8918	3/2/06 16:00	0.060	20.86	0.020	0.000
K8910	3/2/06 17:00	0.060	20.84	0.020	0.000
K8913	3/2/06 18:00	0.060	20.84	0.020	0.000
K8919	3/3/06 8:00	0.050	20.83	0.020	0.000
K8931	3/3/06 9:00	0.060	20.80	0.020	0.000
K8921	3/3/06 10:00	0.060	20.86	0.020	0.000
K8922	3/3/06 11:00	0.050	20.84	0.010	0.000
K8911	3/3/06 12:00	0.050	20.85	0.010	0.000
K8920	3/3/06 13:00	0.040	20.85	0.020	0.000
K8923	3/3/06 14:00	0.050	20.79	0.020	0.000
K8933	3/3/06 15:00	0.060	20.83	0.010	0.000
K8941	3/3/06 16:00	0.060	20.85	0.020	0.000
K8930	3/3/06 17:00	0.050	20.81	0.020	0.000

Nearest neighbor

BH-5 Top

Bottle #	Date/Time	CO2	O2	CH4	C2H6	
K9696	3/2/06 8:00	0.080	20.74	0.240	0.000	
K9692	3/2/06 9:00	0.070	20.68	0.190	0.000	
K9684	3/2/06 10:00	0.070	20.75	0.250	0.000	
K9676	3/2/06 11:00	0.060	20.72	0.250	0.000	**Nearest neighbor**
K9666	3/2/06 12:00	0.070	20.73	0.250	0.000	
K9645	3/2/06 13:00	0.070	20.76	0.250	0.000	
K9656	3/2/06 14:00	0.070	20.73	0.250	0.000	
K9636	3/2/06 15:00	0.070	20.75	0.250	0.000	
K9626	3/2/06 16:00	0.070	20.72	0.250	0.000	
K9617	3/2/06 17:00	0.070	20.74	0.250	0.000	
K9627	3/2/06 18:00	0.070	20.76	0.260	0.000	
K9698	3/3/06 8:00	0.060	20.76	0.210	0.000	
K9686	3/3/06 9:00	0.060	20.73	0.210	0.000	
K9687	3/3/06 10:00	0.060	20.76	0.210	0.000	
K9667	3/3/06 11:00	0.060	20.75	0.200	0.000	
K9657	3/3/06 12:00	0.060	20.73	0.200	0.000	
K9647	3/3/06 13:00	0.060	20.73	0.200	0.000	
K9638	3/3/06 14:00	0.060	20.73	0.200	0.000	
K9677	3/3/06 15:00	0.060	20.76	0.200	0.000	
K9610	3/3/06 16:00	0.070	20.75	0.190	0.000	
K9611	3/3/06 17:00	0.060	20.74	0.190	0.000	

Pump Mine

Bottle #	Date/Time	CO2	O2	CH4	C2H6
K9699	3/2/06 8:00	0.070	20.69	0.240	0.000
K9691	3/2/06 9:00	0.060	20.72	0.240	0.000
K9685	3/2/06 10:00	0.060	20.70	0.240	0.000
K9675	3/2/06 11:00	0.070	20.73	0.250	0.000
K9665	3/2/06 12:00	0.070	20.72	0.240	0.000
K9655	3/2/06 13:00	0.070	20.86	0.250	0.000
K9646	3/2/06 14:00	0.070	20.72	0.240	0.000
K9635	3/2/06 15:00	0.070	20.73	0.240	0.000
K9625	3/2/06 16:00	0.070	20.73	0.240	0.000
K9616	3/2/06 17:00	0.060	20.72	0.240	0.000
K9618	3/2/06 18:00	0.060	20.71	0.240	0.000
K9694	3/3/06 8:00	0.060	20.75	0.200	0.000
K9693	3/3/06 9:00	0.050	20.73	0.190	0.000
K9678	3/3/06 10:00	0.060	20.70	0.190	0.000
K9668	3/3/06 11:00	0.060	20.70	0.190	0.000
K9658	3/3/06 12:00	0.060	20.75	0.180	0.000
K9648	3/3/06 13:00	0.060	20.74	0.180	0.000
K9637	3/3/06 14:00	0.060	20.70	0.180	0.000
K9628	3/3/06 15:00	0.060	20.70	0.190	0.000
K9619	3/3/06 16:00	0.060	20.69	0.180	0.000
K9604	3/3/06 17:00	0.060	20.68	0.180	0.000

MISC

Bottle #	Location	Date/Time	CO2	O2	CH4	C2H6
K8913	1 Left #1 Entry, 9-10 xc	3/1/06 10:30	0.060	20.74	0.090	0.000
K8902	2 Left off 1 Left	3/1/06 11:52	0.050	20.79	0.090	0.000
K2655	#1 Entry - RS	3/1/06	0.070	20.90	0.040	0.000
K2626	x-cut 6-7 - RS 09	3/1/06	0.070	20.89	0.040	0.000

50 cc

Bottle #	Location	Date/Time	H2 (ppm)	O2 (%)	CH4 (%)	CO (ppm)	CO2 (%)	C2H2 (ppm)	C2H4 (ppm)	C2H6 (ppm)	AR (%)
D2841	Track Pitmouth	3/1/06 11:56	1	20.8	NDA	NDA	0.04	NDA	NDA	NDA	0.93
D4916	#1 Pitmouth	3/1/06 0:00	4	20.8	0.06	NDA	0.04	NDA	NDA	NDA	0.93
D4928	Return #1	3/1/06 8:18	1	20.8	NDA	NDA	0.04	NDA	NDA	NDA	0.93
D4846	Beltline Pitmouth	3/1/06 0:00	4	20.8	0.02	NDA	0.04	NDA	NDA	NDA	0.93
D4904	#2 Pitmouth	3/1/06 0:00	1	20.8	NDA	NDA	0.05	NDA	NDA	NDA	0.93
MS001	BH5 Exhaust	3/3/06 12:30	7	20.7	0.02	4	0.04	NDA	NDA	NDA	0.93
RS001	Track Entry Drift	3/3/06 12:18	11	20.8	0.01	2	0.04	NDA	NDA	NDA	0.93
D2953	#9 Entry Regulator	3/2/06 10:58	3	20.8	0.02	3	0.04	NDA	NDA	NDA	0.93

UG Reg Quantities

Area = 44.5

Date/Time	Vel	Corr	Corr Vel	Quantity (CFM)	Quantity (Total FT^3)	
3/2/06 8:00	77	33	110	4,895	293,700	Nearest neighbor
3/2/06 9:00	77	33	110	4,895	293,700	
3/2/06 10:00	98	30	128	5,696	341,760	
3/2/06 11:00	96	30	126	5,607	336,420	
3/2/06 12:00	92	31	123	5,474	328,410	
3/2/06 13:00	99	30	129	5,741	344,430	
3/2/06 14:00	107	29	136	6,052	363,120	
3/2/06 15:00	95	31	126	5,607	336,420	
3/2/06 16:00	99	30	129	5,741	344,430	
3/2/06 17:00	92	31	123	5,474	328,410	
3/2/06 18:00	98	30	128	5,696	341,760	
3/3/06 8:00	111	28	139	6,186	371,130	
3/3/06 9:00	103	30	133	5,919	355,110	
3/3/06 10:00	113	28	141	6,275	376,470	
3/3/06 11:00	115	28	143	6,364	381,810	
3/3/06 12:00	108	28	136	6,052	363,120	
3/3/06 13:00	104	30	134	5,963	357,780	
3/3/06 14:00	108	28	136	6,052	363,120	
3/3/06 15:00	111	28	139	6,186	371,130	
3/3/06 16:00	113	28	141	6,275	376,470	
3/3/06 17:00	117	27	144	6,408	384,480	
				122,553	7,353,180	

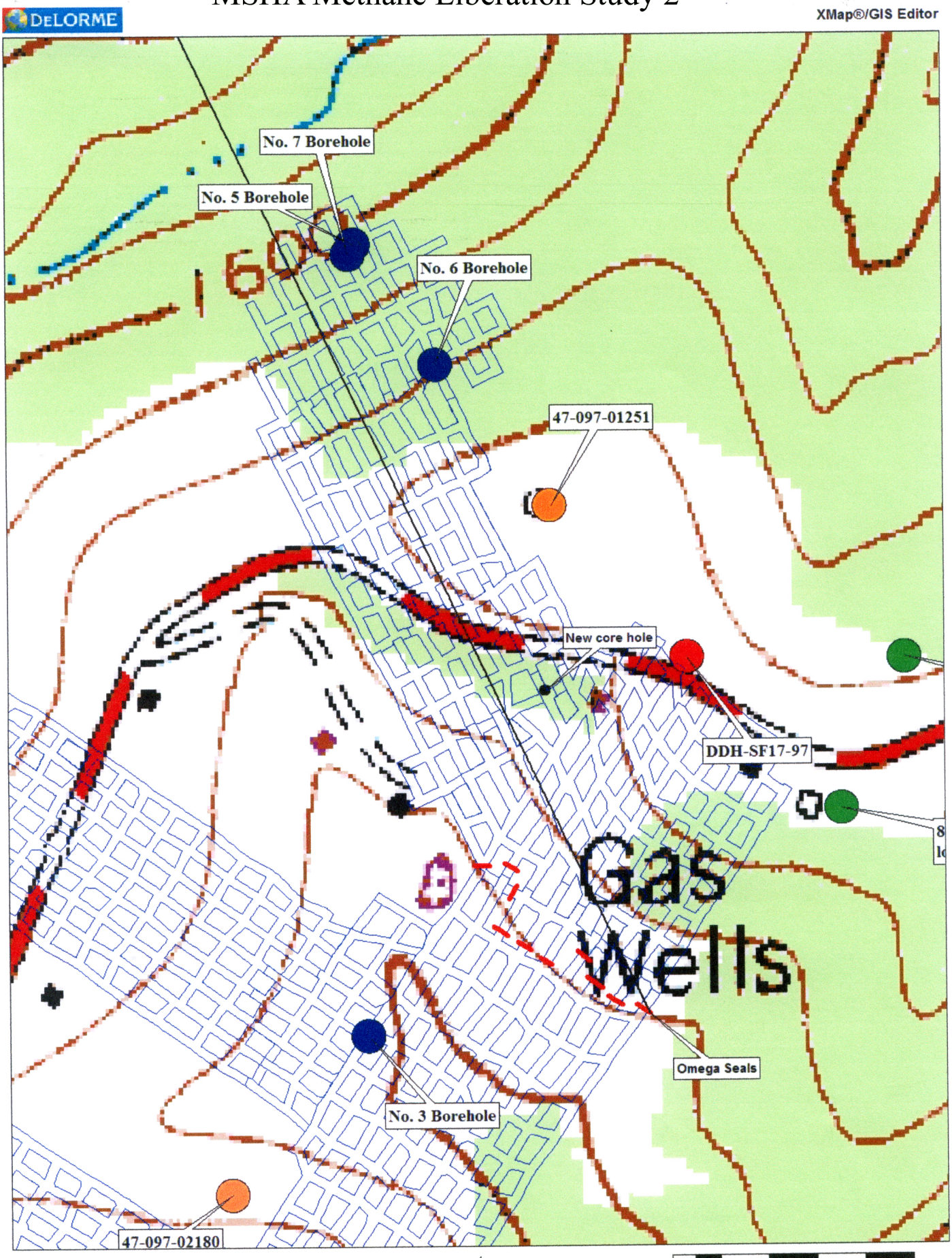
BH-5 Exhaust Quantities

BH-5	Pitot Reading (VP)			Square Rt of VP				Velocity	Quantity (Vel. X 2.42)	
Date/Time	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3	Ave. Square Rt of VP	(fpm)	(cfm)	Quantity (Total FT^3)
3/2/06 8:00	0.120	0.120	0.130	0.3464	0.3464	0.3606	0.3511	1404.50	3,399	203,933
3/2/06 9:00	0.105	0.120	0.120	0.3240	0.3464	0.3464	0.3390	1355.81	3,281	196,864
3/2/06 10:00	0.125	0.115	0.130	0.3536	0.3391	0.3606	0.3511	1404.30	3,398	203,904
3/2/06 11:00	0.120	0.120	0.130	0.3464	0.3464	0.3606	0.3511	1404.50	3,399	203,933
3/2/06 12:00	0.120	0.110	0.125	0.3464	0.3317	0.3536	0.3439	1375.50	3,329	199,723
3/2/06 13:00	0.120	0.115	0.125	0.3464	0.3391	0.3536	0.3464	1385.44	3,353	201,166
3/2/06 14:00	0.120	0.115	0.125	0.3464	0.3391	0.3536	0.3464	1385.44	3,353	201,166
3/2/06 15:00	0.100	0.100	0.115	0.3162	0.3162	0.3391	0.3239	1295.43	3,135	188,096
3/2/06 16:00	0.110	0.105	0.120	0.3317	0.3240	0.3464	0.3340	1336.15	3,233	194,008
3/2/06 17:00	0.105	0.100	0.115	0.3240	0.3162	0.3391	0.3265	1305.84	3,160	189,608
3/2/06 18:00	0.125	0.125	0.135	0.3536	0.3536	0.3674	0.3582	1432.71	3,467	208,029
3/3/06 8:00	0.150	0.140	0.160	0.3873	0.3742	0.4000	0.3872	1548.62	3,748	224,859
3/3/06 9:00	0.155	0.140	0.150	0.3937	0.3742	0.3873	0.3851	1540.22	3,727	223,640
3/3/06 10:00	0.150	0.140	0.160	0.3873	0.3742	0.4000	0.3872	1548.62	3,748	224,859
3/3/06 11:00	0.165	0.150	0.170	0.4062	0.3873	0.4123	0.4019	1607.75	3,891	233,445
3/3/06 12:00	0.165	0.155	0.170	0.4062	0.3937	0.4123	0.4041	1616.28	3,911	234,684
3/3/06 13:00	0.150	0.140	0.160	0.3873	0.3742	0.4000	0.3872	1548.62	3,748	224,859
3/3/06 14:00	0.150	0.140	0.160	0.3873	0.3742	0.4000	0.3872	1548.62	3,748	224,859
3/3/06 15:00	0.160	0.150	0.170	0.4000	0.3873	0.4123	0.3999	1599.48	3,871	232,244
3/3/06 16:00	0.160	0.150	0.170	0.4000	0.3873	0.4123	0.3999	1599.48	3,871	232,244
3/3/06 17:00	0.150	0.140	0.160	0.3873	0.3742	0.4000	0.3872	1548.62	3,748	224,859
									74,516	4,470,987

BH-7 Quantities

BH-7	Pitot Reading (VP)			Square Rt of VP				Velocity	Quantity (Vel. X 0.91)	
Date/Time	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3	Ave. Square Rt of VP	(fpm)	(cfm)	Quantity (Total FT^3)
3/2/06 8:00	0.060	0.055	0.055	0.2449	0.2345	0.2345	0.23800	952	866	51,979
3/2/06 9:00	0.050	0.055	0.055	0.2236	0.2345	0.2345	0.23088	924	840	50,425
3/2/06 10:00	0.060	0.060	0.055	0.2449	0.2449	0.2345	0.24147	966	879	52,738
3/2/06 11:00	0.060	0.060	0.060	0.2449	0.2449	0.2449	0.24495	980	892	53,497
3/2/06 12:00	0.065	0.060	0.060	0.2550	0.2449	0.2449	0.24828	993	904	54,225
3/2/06 13:00	0.060	0.060	0.060	0.2449	0.2449	0.2449	0.24495	980	892	53,497
3/2/06 14:00	0.065	0.060	0.060	0.2550	0.2449	0.2449	0.24828	993	904	54,225
3/2/06 15:00	0.060	0.050	0.055	0.2449	0.2236	0.2345	0.23436	937	853	51,184
3/2/06 16:00	0.060	0.050	0.055	0.2449	0.2236	0.2345	0.23436	937	853	51,184
3/2/06 17:00	0.045	0.050	0.050	0.2121	0.2236	0.2236	0.21978	879	800	48,000
3/2/06 18:00	0.060	0.060	0.060	0.2449	0.2449	0.2449	0.24495	980	892	53,497
3/3/06 8:00	0.075	0.060	0.070	0.2739	0.2449	0.2646	0.26113	1,045	951	57,030
3/3/06 9:00	0.070	0.055	0.060	0.2646	0.2345	0.2449	0.24801	992	903	54,166
3/3/06 10:00	0.070	0.060	0.070	0.2646	0.2449	0.2646	0.25803	1,032	939	56,354
3/3/06 11:00	0.070	0.070	0.080	0.2646	0.2646	0.2828	0.27066	1,083	985	59,113
3/3/06 12:00	0.080	0.070	0.075	0.2828	0.2646	0.2739	0.27376	1,095	996	59,789
3/3/06 13:00	0.080	0.065	0.070	0.2828	0.2550	0.2646	0.26746	1,070	974	58,412
3/3/06 14:00	0.080	0.070	0.075	0.2828	0.2646	0.2739	0.27376	1,095	996	59,789
3/3/06 15:00	0.080	0.070	0.075	0.2828	0.2646	0.2739	0.27376	1,095	996	59,789
3/3/06 16:00	0.080	0.060	0.075	0.2828	0.2449	0.2739	0.26722	1,069	973	58,360
3/3/06 17:00	0.080	0.075	0.075	0.2828	0.2739	0.2739	0.27686	1,107	1,008	60,465
									19,295	1,157,720

MSHA Methane Liberation Study 2



Mass Balance Calculations

SAGO MINE NO. 1-- JAN. 2, 2006

ESTIMATE OF THE VOLUME AND CONCENTRATION OF METHANE BEHIND THE SEALS AT OLD 2ND LEFT, AT TIME OF EXPLOSION

DETERMINED BY MASS BALANCE OF PRINCPLE COMBUSTION PRODUCTS (CO AND CO2) FROM A COMPOSITE OF AVAILABLE DATA SOURCES.

DATE: 10/31/2006

ATOMIC WEIGHTS

C	**12.011**
H	**1.0079**
O	**15.9994**

CO=	**0.0280104** kg/mole
CO2=	**0.0440098** kg/mole
CH4=	**0.0160426** kg/mole

DENSITY OF CH4 **0.68** kg/m^3 @ 1.013 bar, 59 deg. F

m^3 / ft^3 = **0.02832**

POSSIBLE VALUES FOR Q-- MAIN RETURN

	Q	
104,644	CFM	Jim & John readings 1-2-06 at 18:35
131,495	CFM	Rhyan & Doug readings 1-2-06 at 19:45
120,445	CFM	Rhyan & Doug readings 1-2-06 at 20:15
122,655	CFM	Rhyan & Doug readings 1-2-06 at 20:50
106,080	CFM	Fred Radebaugh & Jim Paul readings 1-2-06 at 21:37
219,840	CFM	Roger & Rhyan readings 1-2-06 at 14:27
101,058	CFM	From Weekly Examination Log 12-28-05
93,204	CFM	Jeff Bennett readings 1-2-06 at 8:40
111,369	CFM	Use this value for MAIN RETURN Q

POSSIBLE VALUES FOR Q-- MAIN INTAKE

	Q	
146,566	CFM	MAIN INTAKE: 12-28-05 Weekly Exam Log
172,000	CFM	INTAKE FAN: MSHA/ Alpha Eng. Vent. Simulation
185,000	CFM	ALPHA ESTIMATE for POST EXPLOSION
291,519	CFM	ALL EXHAUSTS: MSHA 1-2-06 @ 2:29 pm
185,000	CFM	Use this value for MAIN INTAKE Q

CALCULATED VALUE OF Q FOR THE REMAINING EXHAUSTS

73,631	CFM	REMAINING EXHAUSTS

TOTAL COMBUSTION PRODUCTS EXITING MAIN RETURN

CARBON MONOXIDE (CO) GENERATED	210,136.40	moles
+		
CARBON DIOXIDE (CO2) GENERATED	241,546.62	moles
ORIGINAL QUANTITY OF CH4	**451,683.02**	moles

CONVERT CH4 FROM MOLES TO WEIGHT	7,246.17	kg
CONVERT CH4 FROM WEIGHT TO VOLUME	10,656.13	m^3
CONVERT CH4 VOLUME TO CU. FT.	**376,275.86**	ft^3

MAIN RETURN (#1 Entry) AS % OF ALL EXHAUSTS	**85%**	BY CONCENTRATION
MAIN RETURN (#1 Entry) AS % OF ALL EXHAUSTS	**39.80%**	BY EXHAUST QUANTITIES (Q)

APPROX. VOLUME REMAINING EXHAUSTS	**22,463.97**	ft^3
TOTAL ESTIMATED CH4 VOLUME CONSUMED IN EXPLOSION	**398,739.83**	ft^3
AVERAGE OF TWO VOLUME ESTIMATES (Alpha, OMHS&T)	**3,033,818**	ft^3
ORIGINAL CH4 CONCENTRATIONS (Est. by Mass Balance)	**13.14%**	

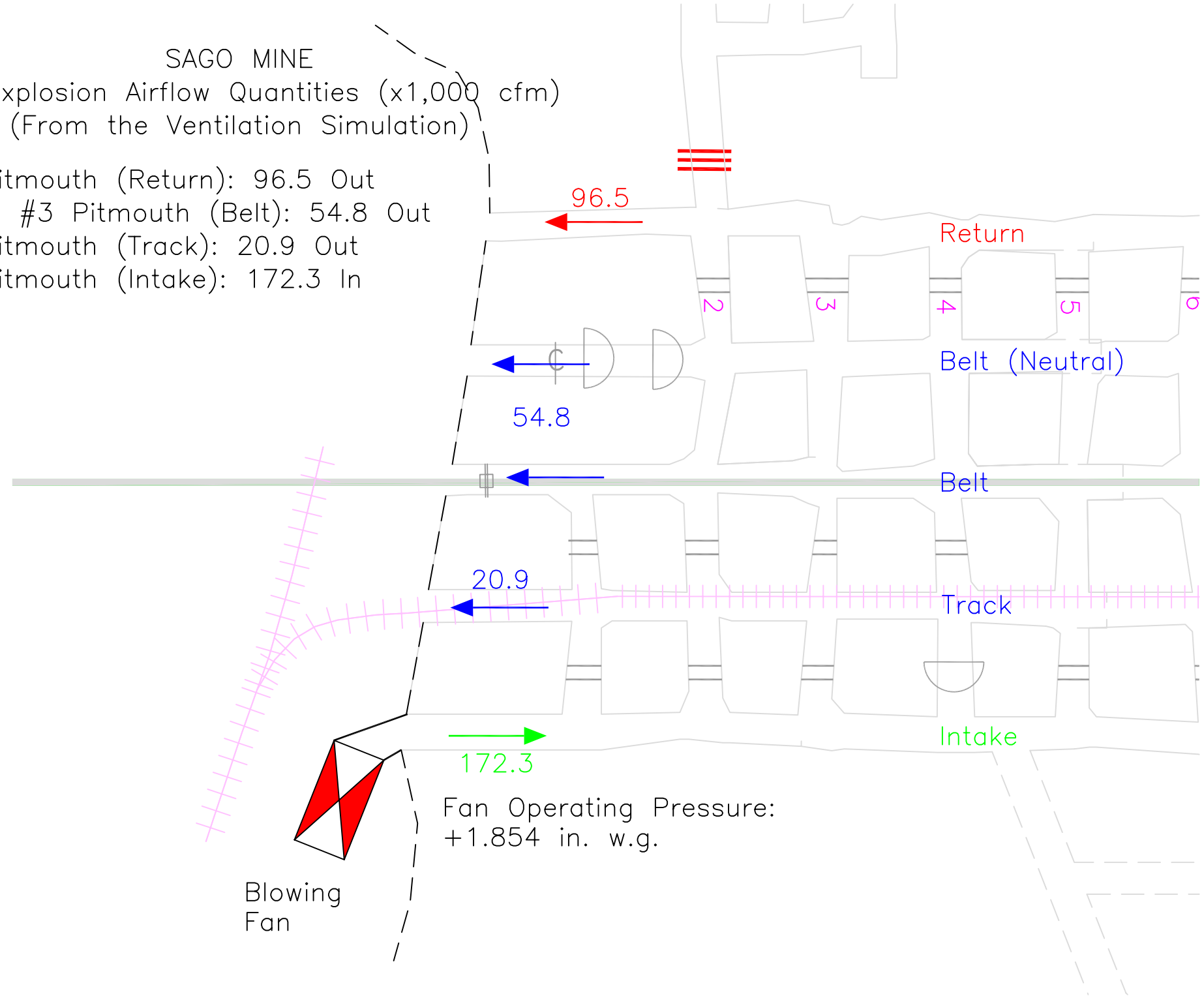
(1) Volume estimate by OMHS&T is 3,033,818 ft^3
(2) A-E recommendation 180,000 - 190,000

SAGO MINE

Pre-Explosion Airflow Quantities (x1,000 cfm)

(From the Ventilation Simulation)

#1 Pitmouth (Return): 96.5 Out
#2 & #3 Pitmouth (Belt): 54.8 Out
#4 Pitmouth (Track): 20.9 Out
#5 Pitmouth (Intake): 172.3 In

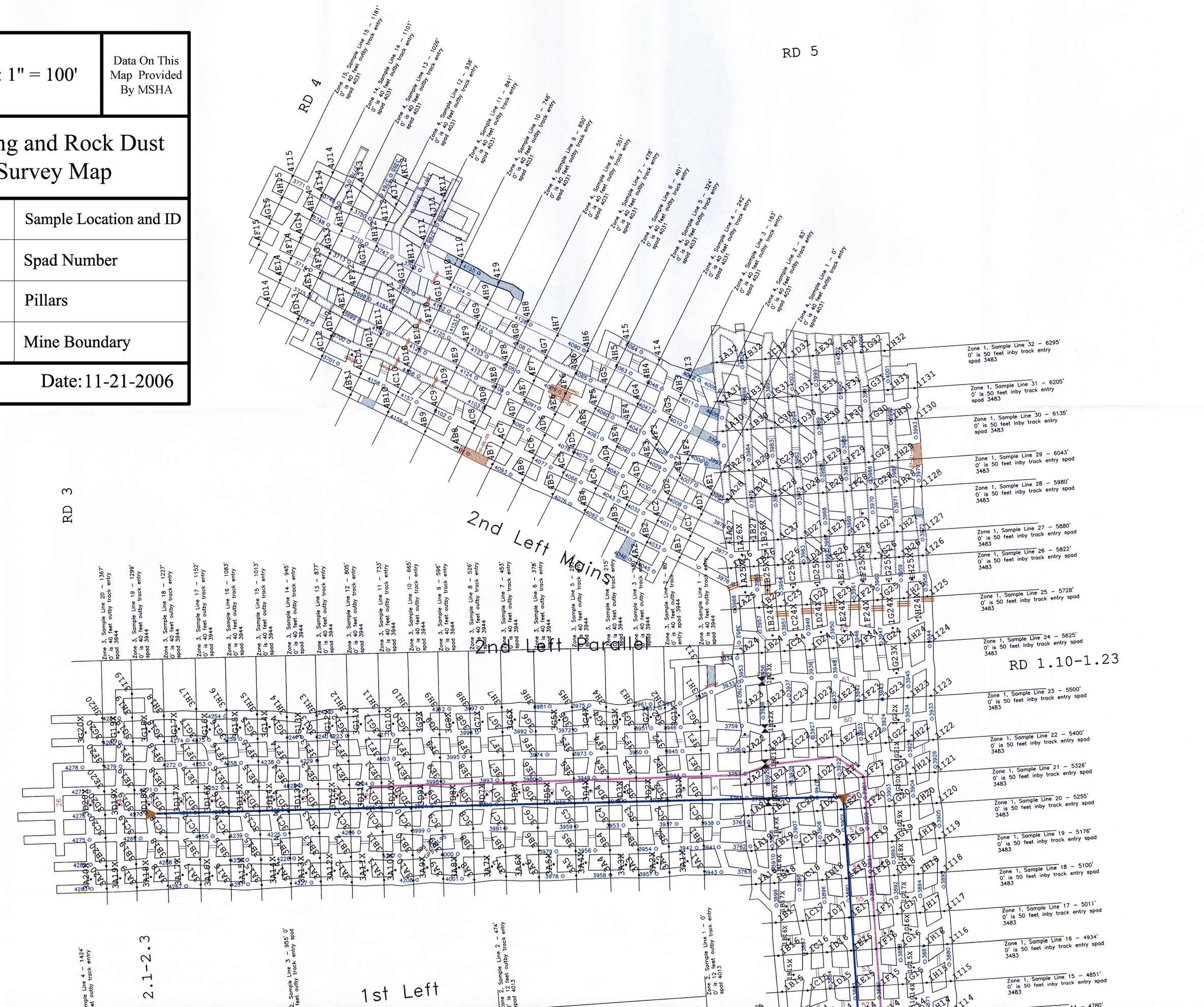


Scale : 1" = 100'	Data On This Map Provided By MSHA

Coking and Rock Dust Survey Map

●IE30	Sample Location and ID
⊙4008	Spad Number
	Pillars
	Mine Boundary

Date: 11-21-2006



Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681608	1A21	Floor	0 + 5326	79.1	Trace
681609	1A21	Floor	0 + 5326 1/2" Sample	79.0	Trace
681610	1A22	Floor	0 + 5400	78.3	Trace
681611	1A22	Floor	0 + 5400 1/2" Sample	80.2	Trace
681612	1A23	Band	0 + 5500 2/02/06 GI	80.2	Trace
681613	1A23	Band	0 + 5500 2/02/06 GI 1/2" Sample	79.9	Small
681614	1A24	Rib/Floor	0 + 5625 2/03/06 GI	76.9	Trace
681615	1A25	Floor	0 + 5728 1" Sample	77.7	Small
681616	1A25	Floor	0 + 5728 1/2" Sample	76.8	Small
681617	1A26X	Floor	0 + 5852 2/01/06 GI	70.2	Small
681618	1A26X	Floor	0 + 5852 2/01/06 GI 1/2" Sample	68.3	Small
681619	1B1	Band	0 + 00 1" Band	45.2	None
681620	1B1	Band	0 + 00 1/2" Band	45.6	None
681621	1B2	Band	0 + 520 1" Band	69.3	None
681622	1B2	Band	0 + 520 1/2" Band	71.4	None
681623	1B10	Band	0 + 4186 1" Band	74.1	None
681624	1B10	Band	0 + 4186 1/2" Band	77.8	None
681625	1B11	Band	0 + 4426 1" Band	72.0	None
681626	1B11	Band	0 + 4426 1/2" Band	73.8	None
681627	1B13	Band	0 + 4700 2/02/06 GI	78.0	None
681628	1B13	Band	0 + 4700 2/02/06 GI 1/2" Band	76.5	None
681629	1B20X	Rib/Floor	0 + 5285	73.5	Trace
681630	1B20X	Rib/Floor	0 + 5285 1/2" Sample	77.1	Trace
681631	1B21	Floor	0 + 5326	73.2	Trace
681632	1B21X	Floor	0 + 5368	74.2	Trace

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681633	1B21X	Floor	0 + 5368 1/2"	72.4	Trace
681634	1B22	Floor	0 + 5400	73.0	Trace
681635	1B22	Floor	0 + 5400 1/2"	71.1	Trace
681636	1B22X	Roof/Rib	0 + 5430 2/02/06 GI	69.7	Trace
681637	1B22X	Roof/Rib	0 + 5430 2/02/06 GI 1/2"	71.5	Trace
681638	1B23	Rib/Floor	0 + 5500 2/02/06 GI	76.6	Trace
681639	1B23	Rib/Floor	0 + 5500 2/02/06 GI 1/2"	73.2	Trace
681640	1B24	Floor	0 + 5625 2/03/06 GI	74.6	Trace
681641	1B24	Floor	0 + 5625 2/03/06 GI 1/2"	74.8	Trace
681642	1B24X	Band	0 + 5660	68.8	Trace
681867	S1B24X	Band	0 + 5660 1/2"	73.5	Small
681643	1B25	Floor	0 + 5728 1" Sample	71.4	Trace
681644	1B25	Floor	0 + 5728 1/2" Sample	72.1	Small
681645	1B26	Floor	0 + 5822 1" Sample	66.6	Large
681646	1B26	Floor	0 + 5822 1" Sample	66.8	Large
681647	1B26	Floor	0 + 5822 1/2" Sample	66.7	Large
681648	1B26X	Floor	0 + 5852	59.4	Large
681649	1B26X	Floor	0 + 5852 1/2"	58.9	Large
681650	1C1	Band	0 + 00 1" Band	47.2	None
681651	1C1	Band	0 + 00 1/2" Band	42.9	None
681652	1C2	Band	0 + 520 1" Band	57.9	None
681653	1C2	Band	0 + 520 1/2" Band	60.8	None
681654	1C5	Band	0 + 2000 1" Band	62.4	None
681655	1C5	Band	0 + 2000 1/2" Band	45.1	None
681656	1C9	Band	0 + 3946 1" Band	88.8	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681657	1C9	Band	0 + 3946 1/2" Band	88.3	None
681658	1C11	Band	0 + 4426 1" Band	62.0	None
681659	1C11	Band	0 + 4426 1/2" Band	60.4	None
681660	1C22	Rib/Floor	0 + 5400	70.5	Trace
681661	1C22	Rib/Floor	0 + 5400 1/2"	71.6	Trace
681662	1C23	Roof/Rib	0 + 5500 2/02/06 GI	72.5	Trace
681663	1C23	Roof/Rib	0 + 5500 2/02/06 GI 1/2"	70.7	Trace
681664	1C24	Rib/Floor	0 + 5625 2/03/06 GI	65.8	Trace
681665	1C24X	Band	0 + 5657	74.2	Small
681868	S1C24X	Band	0 + 5657 1/2"	74.6	Trace
681666	1C25	Floor	0 + 5728 1" Sample	56.9	Small
681667	1C25	Floor	0 + 5728 1/2" Sample	60.4	Small
681668	1D1	Band	0 + 00 1" Band	51.6	None
681669	1D1	Band	0 + 00 1/2" Band	49.9	None
681670	1D2	Band	0 + 520 1" Band	74.1	None
681671	1D2	Band	0 + 520 1/2" Band	75.7	None
681672	1D5	Band	0 + 2000 1" Band	58.9	None
681673	1D5	Band	0 + 2000 1/2" Band	64.3	None
681674	1D7	Band	0 + 2982 1" Band	49.9	None
681675	1D7	Band	0 + 2982 1/2" Band	57.7	None
681676	1D8	Band	0 + 3464 1" Band	85.1	None
681677	1D8	Band	0 + 3464 1/2" Band	78.3	None
681678	1D20	Band	0 + 5255	73.0	Trace
681679	1D20	Band	0 + 5255 1/2"	69.5	Trace
681680	1D21	Rib/Floor	0 + 5326	74.3	Trace

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681681	1D21	Rib/Floor	0 + 5326 1/2"	73.6	Trace
681682	1D22	Rib/Floor	0 + 5400	72.4	Trace
681683	1D22	Rib/Floor	0 + 5400 1/2"	70.2	Trace
681684	1D23	Rib/Floor	0 + 5500 2/02/06 GI	67.9	Trace
681685	1D23	Rib/Floor	0 + 5500 2/02/06 GI 1/2"	66.1	Trace
681686	1D24	Rib/Floor	0 + 5625	64.6	Trace
681687	1D24	Rib/Floor	0 + 5625 1/2"	64.8	Small
681688	1D24X	Band	0 + 5658	74.0	Small
681869	S1D24X	Band	0 + 5658 1/2"	74.1	Small
681689	1D25	Floor	0 + 5728 1" Sample	60.1	Small
681690	1D25	Floor	0 + 5728 1/2" Sample	59.4	Small
681691	1D25X	Rib/Floor	0 + 5770 1" Sample	51.6	Large
681692	1D25X	Rib/Floor	0 + 5770 1/2" Sample	53.1	Large
681693	1E1	Band	0 + 00 1" Band	96.3	None
681694	1E1	Band	0 + 00 1/2" Band	97.0	None
681695	1E2	Band	0 + 520 1" Band	55.4	None
681696	1E2	Band	0 + 520 1/2" Band	64.8	None
681697	1E3	Band	0 + 1050 1" Band	84.4	None
681698	1E3	Band	0 + 1050 1/2" Band	72.1	Trace
681699	1E5	Band	0 + 2000 1" Band	87.7	None
681700	1E5	Band	0 + 2000 1/2" Band	86.9	None
681701	1E6	Band	0 + 2522 1" Band	87.1	None
681702	1E6	Band	0 + 2522 1/2" Band	91.2	None
681703	1E8	Band	0 + 3464 1" Band	80.5	None
681704	1E8	Band	0 + 3464 1/2" Band	88.8	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681705	1E10	Band	0 + 4186 1" Band	87.0	None
681706	1E10	Band	0 + 4186 1/2" Band	81.2	None
681707	1E20	Rib/Floor	0 + 5255 2/02/06 GI	83.0	Trace
681708	1E20	Rib/Floor	0 + 5255 2/02/06 GI 1/2"	80.4	Trace
681709	1E22	Rib/Floor	0 + 5400	65.4	Trace
681710	1E22	Rib/Floor	0 + 5400 1/2"	63.0	Trace
681711	1E23	Rib/Floor	0 + 5500 2/02/06 GI	69.2	Small
681712	1E23	Rib/Floor	0 + 5500 2/02/06 GI 1/2"	65.7	Small
681713	1E24	Rib/Floor	0 + 5625	65.1	Small
681714	1E24	Rib/Floor	0 + 5625 1/2"	64.1	Small
681715	1E24X	Band	0 + 5665	78.7	Small
681870	S1E24X	Band	0 + 5665 1/2"	81.7	Small
681716	1E25	Floor	0 + 5728 1" Sample	57.4	Large
681717	1E25	Floor	0 + 5728 1/2" Sample	57.4	Large
681718	1E25X	Floor	0 + 5768 1" Sample	52.5	Large
681719	1E25X	Floor	0 + 5768 1/2" Sample	54.2	Large
681720	1F1	Band	0 + 00 1" Band	90.4	None
681721	1F1	Band	0 + 00 1/2" Band	90.3	None
681722	1F2	Band	0 + 520 1" Band	70.7	None
681723	1F2	Band	0 + 520 1/2" Band	72.7	None
681724	1F3	Band	0 + 1050 1" Band	89.9	None
681725	1F3	Band	0 + 1050 1/2" Band	85.5	None
681726	1F4	Band	0 + 1474 1" Band	86.0	None
681727	1F4	Band	0 + 1474 1/2" Band	87.5	None
681728	1F5	Band	0 + 2000 1" Band	76.1	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681729	1F5	Band	0 + 2000 1/2" Band	81.2	None
681730	1F6	Band	0 + 2522 1" Band	86.8	None
681731	1F6	Band	0 + 2522 1/2" Band	84.3	None
681732	1F7	Band	0 + 2982 1" Band	80.9	None
681733	1F7	Band	0 + 2982 1/2" Band	66.9	None
681734	1F8	Band	0 + 3464 1" Band	88.7	None
681735	1F8	Band	0 + 3464 1/2" Band	88.3	None
681736	1F10	Band	0 + 4186 1" Band	86.3	None
681737	1F10	Band	0 + 4186 1/2" Band	86.8	None
681738	1F13	Band	0 + 4700 1" Band	79.6	Trace
681739	1F13	Band	0 + 4700 1/2" Band	77.9	Trace
681740	1F14	Band	0 + 4780 1" Band	83.5	Trace
681741	1F14	Band	0 + 4780 1/2" Band	80.3	Trace
681742	1F15	Band	0 + 4851 1" Band	71.6	Trace
681743	1F15	Band	0 + 4851 1/2" Band	78.4	Trace
681744	1F16	Band	0 + 4934 1" Band	79.6	Trace
681745	1F16	Band	0 + 4934 1/2" Band	81.6	Trace
681746	1F17	Band	0 + 5011 1" Band	74.8	Trace
681747	1F17	Band	0 + 5011 1/2" Band	78.1	Trace
681748	1F18	Band	0 + 5100 1" Band	73.4	Trace
681749	1F18	Band	0 + 5100 1/2" Band	76.4	Trace
681750	1F19	Band	0 + 5176 1" Band	76.5	Trace
681751	1F19	Band	0 + 5176 1/2" Band	76.1	Trace
681752	1F20	Band	0 + 5255 1" Band	73.6	Trace
681753	1F20	Band	0 + 5255 1/2" Band	73.9	Trace

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681754	1F21	Band	0 + 5326 1" Band	77.5	Small
681755	1F21	Band	0 + 5326 1/2" Band	70.9	Trace
681756	1F22	Band	0 + 5400 1" Band	72.1	Small
681757	1F22	Band	0 + 5400 1/2" Band	73.8	Trace
681758	1F23	Band	0 + 5500 1" Band	67.2	Trace
681759	1F23	Band	0 + 5500 1/2" Band	68.0	Small
681760	1F24	Band	0 + 5625 1" Band	72.8	Small
681761	1F24	Band	0 + 5625 1/2" Band	73.7	Small
681762	1F24X	Band	0 + 5658 1" Band	76.3	Small
681763	1F24X	Floor	0 + 5658 2/03/06 GI 1/2"	77.7	Small
681764	1F25	Band	0 + 5728 1" Band	64.9	Small
681765	1F25	Band	0 + 5728 1/2" Band	66.9	Small
681766	1F25X	Floor	0 + 5771 1" Sample	52.5	Small
681767	1F25X	Floor	0 + 5771 1/2" Sample	53.2	None
681768	1G1	Band	0 + 00 1" Band	58.4	None
681769	1G1	Band	0 + 00 1/2" Band	59.8	None
681770	1G2	Band	0 + 520 1" Band	75.6	None
681771	1G2	Band	0 + 520 1/2" Band	76.0	None
681772	1G3	Band	0 + 1050 1" Band	56.4	None
681773	1G3	Band	0 + 1050 1/2" Band	60.4	None
681774	1G4	Band	0 + 1474 1" Band	61.8	None
681775	1G4	Band	0 + 1474 1/2" Band	54.7	None
681776	1G5	Band	0 + 2000 1" Band	66.4	None
681777	1G5	Band	0 + 2000 1/2" Band	66.6	None
681778	1G6	Band	0 + 2522 1" Band	76.2	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681779	1G6	Band	0 + 2522 1/2" Band	75.7	None
681780	1G8	Band	0 + 3464 1" Band	51.8	None
681781	1G8	Band	0 + 3464 1/2" Band	61.8	None
681782	1G9	Band	0 + 3946 1" Band	61.8	None
681783	1G9	Band	0 + 3946 1/2" Band	65.1	None
681784	1G10	Band	0 + 4186 1" Band	72.3	None
681785	1G10	Band	0 + 4186 1/2" Band	67.6	None
681871	S1G14	Band	0 + 4780 1/2"	75.6	None
681786	1G14X	Band	0 + 4813	72.6	Trace
681872	S1G14X	Band	0 + 4813 1/2"	68.4	None
681787	1G15	Band	0 + 4851	75.5	Trace
681873	S1G15	Band	0 + 4851 1/2"	75.0	Trace
681788	1G15X	Band	0 + 4886	69.6	Trace
681874	S1G15X	Band	0 + 4886 1/2"	70.8	Trace
681789	1G16	Band	0 + 4934	75.5	Trace
681875	S1G16	Band	0 + 4934 1/2"	75.2	Trace
681790	1G16X	Band	0 + 4974	64.7	Trace
681876	S1G16X	Band	0 + 4974 1/2"	63.9	Trace
681791	1G17	Band	0 + 5011	76.2	Trace
681877	S1G17	Band	0 + 5011 1/2"	72.8	Trace
681792	1G17X	Band	0 + 5046	73.6	Trace
681878	S1G17X	Band	0 + 5046 1/2"	71.7	Trace
681793	1G18	Band	0 + 5100	74.4	Trace
681879	S1G18	Band	0 + 5100 1/2"	74.1	Trace
681794	1G18X	Band	0 + 5130	63.0	Trace
681880	S1G18X	Band	0 + 5130 1/2"	69.1	Trace

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681795	1G19	Band	0 + 5176	72.3	Trace
681881	S1G19	Band	0 + 5176 1/2"	74.8	Trace
681796	1G19X	Band	0 + 5208	66.9	Trace
681882	S1619X	Band	0 + 5208 1/2"	63.2	Trace
681797	1G20	Band	0 + 5255	72.1	Trace
681883	S1G20	Band	0 + 5255 1/2"	72.2	Trace
681798	1G20X	Band	0 + 5287	68.1	Small
681884	S1G20X	Band	0 + 5287 1/2"	67.5	Small
681799	1G21	Band	0 + 5326	67.5	Small
681800	1G21	Band	0 + 5326	67.3	Small
681801	1G21X	Band	0 + 5361	67.4	Small
681802	1G21X	Band	0 + 5361 1/2"	66.3	Small
681803	1G22	Band	0 + 5400	66.3	Small
681885	S1G22	Band	0 + 5400 1/2"	66.6	Small
681804	1G23	Band	0 + 5500	59.4	Large
681886	S1G23	Band	0 + 5500 1/2"	61.8	Small
681805	1G24X	Rib/Floor	0 + 5658	72.3	Large
681806	1G24X	Rib/Floor	0 + 5658 1/2"	74.1	Large
681807	1G25X	Floor	0 + 5768 1" Sample	56.9	Large
681808	1G25X	Floor	0 + 5768 1/2" Sample	5 4.4	Large
681809	1H1	Band	0 + 00 1" Band	64.0	None
681810	1H1	Band	0 + 00 1/2" Band	66.0	None
681811	1H2	Band	0 + 520 1" Band	46.3	None
681812	1H2	Band	0 + 520 1/2" Band	55.4	None
681813	1H3	Band	0 + 1050 1" Band	70.8	None
681814	1H3	Band	0 + 1050 1/2" Band	67.9	None
681815	1H4	Band	0 + 1474 1" Band	54.1	None
681816	1H4	Band	0 + 1474 1/2" Band	45.2	None
681817	1H5	Band	0 + 2000 1" Band	62.9	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681818	1H5	Band	0 + 2000 1/2" Band	45.6	None
681819	1H6	Band	0 + 2522 1" Band	68.4	None
681820	1H6	Band	0 + 2522 1/2" Band	68.0	None
681821	1H7	Band	0 + 2982 1" Band	70.4	None
681822	1H7	Band	0 + 2982 1/2" Band	85.7	None
681823	1H9	Band	0 + 3946 1" Band	78.4	None
681824	1H9	Band	0 + 3946 1/2" Band	74.1	None
681825	1H10	Band	0 + 4186 1" Band	52.8	None
681826	1H10	Band	0 + 4186 1/2" Band	64.3	None
681827	1H15	Band	0 + 4851 1" Band	77.4	None
681828	1H15	Band	0 + 4851 1/2" Band	76.9	Trace
681887	S1H15X	Band	0 + 4891 1/2"	77.6	Trace
681829	1H18	Band	0 + 5100 1" Sample	75.4	Trace
681830	1H18	Band	0 + 5100 1/2" Sample	74.5	Trace
681831	1H19	Band	0 + 5176 1" Sample	75.8	Small
681832	1H19	Band	0 + 5176 1/2" Sample	76.1	Trace
681833	1H20	Band	0 + 5255 1" Sample	72.6	Small
681834	1H20	Band	0 + 5255 1/2" Sample	71.9	Trace
681835	1H21	Rib/Floor	0 + 5326 1" Sample	77.1	Small
681836	1H24	Floor	0 + 5625 2/02/06 GI	75.6	Small
681837	1H24	Floor	0 + 5625 2/02/06 GI 1/2"	74.4	Small
681838	1H24X	Floor	0 + 5655	86.1	Small
681839	1H24X	Floor	0 + 5655 1/2"	82.3	Small
681840	1H25	Floor	0 + 5728 2/02/06 GI	64.8	Large
681841	1H25	Floor	0 + 5728 2/02/06 GI 1/2 "	66.3	Large
681842	1H25X	Floor	0 + 5760 1" Sample	66.3	Large
681843	1H25X	Floor	0 + 5760 1/2" Sample	66.4	Large
681844	1I2	Band	0 + 520 1" Band	63.0	None
681845	1I2	Band	0 + 520 1/2" Band	59.9	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #1(a): ***Sampling Area:*** ***Mains*** ***Collected 1/30/06 - 2/03/06 by Clay*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681846	1I3	Band	0 + 1050 1" Band	56.4	None
681847	1I3	Band	0 + 1050 1/2" Band	59.5	None
681848	1I4	Band	0 + 1474 1" Band	55.9	None
681849	1I4	Band	0 + 1474 1/2" Band	46.5	None
681850	1I5	Band	0 + 2000 1" Band	44.9	None
681851	1I5	Band	0 + 2000 1/2" Band	48.5	None
681852	1I6	Band	0 + 2522 1" Band	69.3	None
681853	1I6	Band	0 + 2522 1/2" Band	67.4	None
681854	1I18	Band	0 + 5100 1" Band	74.4	Trace
681855	1I18	Rib/Floor	0 + 5100 1/2" Sample	73.6	Trace
681856	1I19	Rib/Floor	0 + 5176 1" Sample	75.4	Trace
681857	1I19	Rib/Floor	0 + 5176 1/2" Sample	75.0	Trace
681858	1I20	Rib/Floor	0 + 5255 1" Sample	72.7	Trace
681859	1I20	Rib/Floor	0 + 5255 1/2" Sample	73.2	Trace
681860	1I21	Rib/Floor	0 + 5326 1" Sample	78.2	Trace
681861	1I21	Rib/Floor	0 + 5326 1/2" Sample	77.9	Trace
681862	1I22	Rib/Floor	0 + 5400 1" Sample	77.8	Trace
681863	1I24	Floor	0 + 5625	79.3	Trace
681864	1I24	Floor	0 + 5625 1/2"	77.0	Trace
681865	1I25	Floor	0 + 5728	65.5	Small
681866	1I25	Floor	0 + 5728 1/2"	64.1	Small

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SURVEY #1(b): ***Sampling Area:*** ***Mains*** ***Collected 2/16/06 by Cook/Hicks*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681888	1A25X	Band	0 + 5748 JC	92.0	Trace
681889	1A26	Band	0 + 5822 JC	70.0	Large
681890	1A27	Band	0 + 5880 JC	69.1	Large
681891	1A28	Band	0 + 5980 JC	62.4	X-Large
681892	1A29	Band	0 + 6043 JC	60.6	X-Large
681893	1A30	Band	0 + 6135 JC	56.3	X-Large
681894	1B25X	Band	0 + 5748 JC	66.3	Small
681895	1B27	Band	0 + 5880	58.7	X-Large
681896	1B28	Band	0 + 5980 JC	58.5	X-Large
681897	1B29	Band	0 + 6043 JC	54.0	X-Large
681898	1B30	Band	0 + 6135 JC	60.0	X-Large
681899	1C25X	Band	0 + 5748 JC	63.4	Large
681900	1C27	Band	0 + 5880 JC	50.9	X-Large
681901	1C28	Band	0 + 5980 JC	51.3	X-Large
681902	1C29	Band	0 + 6043 JC	58.1	X-Large
681903	1C30	Band	0 + 6135 JC	54.6	X-Large
681904	1D26	Band	0 + 5822	50.1	Large
681905	1D27	Band	0 + 5880	56.3	X-Large
681906	1D28	Band	0 + 5980	57.2	X-Large
681907	1E26	Band	0 + 5822	59.2	Large
681908	1E27	Band	0 + 5880	59.3	X-Large
681909	1F26	Band	0 + 5822 JC	54.3	X-Large
681910	1F27	Band	0 + 5880	54.6	X-Large
681911	1F28	Band	0 + 5980	56.9	X-Large
681912	1G26	Band	0 + 5822	56.9	X-Large
681913	1G27	Band	0 + 5880	50.8	X-Large
681914	1G28	Band	0 + 5980	53.3	X-Large
681915	1H26	Band	0 + 5822 JC	59.3	X-Large
681916	1H28	Band	0 + 5980 JC	45.0	Large

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #2: ***Sampling Area:*** ***1st Left*** ***Collected 1/30/06 by Sparks*** ***Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681917	2F1	Roof & Ribs	0 + 00	87.3	None
681918	2F1	Roof & Ribs	0 + 00 1/2" Sample	93.6	None
681919	2G2	Ribs & Floor	0 + 474	89.8	None
681920	2G2	Ribs & Floor	0 + 474 1/2" Sample	86.0	None
681921	2H4	Band	0 + 1424	58.5	None
681922	2H4	Band	0 + 1424 1/2" Sample	66.4	None
681923	2H5	Ribs & Floor	0 + 1898	47.7	None
681924	2H5	Ribs & Floor	0 + 1898 1/2" Sample	36.8	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #3: ***Sampling Area:*** ***2nd Left Collected 1/30/06 - 2/03/06 by Ison/Sturgill Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681925	3A1X	Floor	0 + 40	85.7	Trace
681926	3A1X	Floor	0 + 40 1/2"	85.8	Trace
681927	3A6X	Floor	0 + 408 0" to 1/4" deep	71.4	Trace
681928	3A6X	Floor	0 + 408 0" to 1/4" deep	70.1	None
681929	3A13X	Floor	0 + 908 0" to 1/4" deep off floor	65.9	None
681930	3A13X	Floor	0 + 908 0" to 1/4" deep off floor	65.6	None
681931	3A14	Floor	0 + 945 0" to 3/8" deep	64.7	None
681932	3A14	Floor	0 + 945 1/2"	66.2	None
681933	3A14X	Floor	0 + 973 0" to 1/4" deep on mine floor	64.6	None
681934	3A14X	Floor	0 + 973 1/2"	61.8	None
681935	3A15	Floor	0 + 1030 0" to 1/4" deep on mine floor	59.7	None
681936	3A15	Floor	0 + 1030	61.1	None
681937	3A15X	Floor	0 + 1045 0" to 1/4" deep on mine floor	59.8	None
681938	3A15X	Floor	0 + 1045 0" to 1/4" deep on mine floor	59.4	None
681939	3A16X	Floor	0 + 1125 0" to 3/8" deep on mine floor	89.1	Trace
681940	3A16X	Floor	0 + 1125 0" to 3/8" deep on mine floor	89.4	None
681941	3B8	Floor	0 + 526 0" to 1/4" deep	81.7	None
681942	3B8	Floor	0 + 526 1/2"	83.1	None
681943	3B13	Roof & Floor	0 + 877 0' to 1/3" off mine floor	71.9	None
681944	3B13	Roof & Floor	0 + 877 0" to 1/3' deep off bottom	71.6	None
681945	3B14	Floor	0 + 945 0" to 1/3" deep off mine floor	83.9	None
681946	3B14	Floor	0 + 945 1/2"	75.1	None
681947	3B15	Floor	0 + 1013 0" to 1/4" deep on mine floor	91.5	None
681948	3B15	Floor	0 + 1013	91.7	None
681949	3B16	Floor	0 + 1083 0" to 3/8" deep on mine floor	66.3	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #3: ***Sampling Area:*** ***2nd Left Collected 1/30/06 - 2/03/06 by Ison/Sturgill Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681950	3B16	Floor	0 + 1083 1/2"	55.2	None
681951	3C6	Floor	0 + 378	70.1	None
681952	3C6	Floor	0 + 378 1/2"	73.5	None
681953	3C7	Floor	0 + 453	69.0	None
681954	3C7	Floor	0 + 453 1/2"	65.8	None
681955	3C8	Floor	0 + 526	68.7	None
681956	3C8	Floor	0 + 526 1/2"	70.6	None
681957	3C13	Floor	0 + 877	71.6	None
681958	3C13	Floor	0 + 877 1/2"	68.4	None
681959	3C15	Floor	0 + 1013	75.0	None
681960	3C15	Floor	0 + 1013 1/2"	73.9	None
681961	3C16	Roof & Floor	0 + 1083	73.7	None
681962	3C16	Roof & Floor	0 + 1083 1/2"	73.7	None
681963	3C16X	Roof & Floor	0 + 1125	50.7	None
681964	3C16X	Roof & Floor	0 + 1125 1/2"	51.0	None
681965	3C17	Floor	0 + 1152	69.3	None
681966	3C17	Floor	0 + 1152 1/2"	75.2	None
681967	3D1	Ribs & Floor	0 + 00	82.5	Trace
681968	3D1	Ribs & Floor	0 + 00 1/2"	82.7	Trace
681969	3D12X	Ribs & Floor	0 + 845 2/01/06 GI	67.8	None
681970	3D12X	Ribs & Floor	0 + 845 2/01/06 GI 1/2"	60.0	None
681971	3D13X	Floor	0 + 908 1/31/06	74.6	None
681972	3D13X	Floor	0 + 908 1/31/06 GI 1/2"	71.3	None
681973	3E17	Floor	0 + 1152 1/31/06 GI	75.5	None
681974	3E17	Floor	0 + 1152 1/31/06 GI 1/2"	75.5	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #3: ***Sampling Area:*** ***2nd Left Collected 1/30/06 - 2/03/06 by Ison/Sturgill Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
681975	3G1	Ribs	0 + 00 1/30/06 Intake GI	78.0	None
681976	3G1	Ribs	0 + 00 1/30/06 Intake GI 1/2"	78.7	None
681977	3G1X	Ribs & Floor	0 + 40 1/30/06 Intake GI	71.2	Trace
681978	3G1X	Ribs & Floor	0 + 40 1/30/06 Intake GI 1/2"	72.4	None
681979	3G2	Ribs & Floor	0 + 80 1/30/06 Intake GI	71.7	None
681980	3G2	Ribs & Floor	0 + 80 1/30/06 Intake GI 1/2"	70.2	Trace
681981	3G2X	Ribs & Floor	0 + 110 1/30/06 Intake GI	76.3	None
681982	3G2X	Ribs & Floor	0 + 110 1/30/06 Intake GI 1/2"	76.4	None
681983	3G3	Ribs & Floor	0 + 150 1/30/06 Intake GI	72.0	None
681984	3G3	Ribs & Floor	0 + 150 1/30/06 Intake GI 1/2"	74.8	None
681985	3G3X	Ribs & Floor	0 + 180 1/30/06 Intake GI	85.9	None
681986	3G4	Ribs & Floor	0 + 215 1/30/06 Intake GI	69.4	None
681987	3G4	Floor	0 + 215 1/30/06 Intake GI 1/2"	71.5	None
681988	3G4X	Floor	0 + 265 1/30/06 Intake GI	76.5	None
681989	3G4X	Floor	0 + 265 1/30/06 Intake GI	76.0	None
681990	3G5	Floor	0 + 293 1/30/06 Intake GI	69.7	None
681991	3G5	Ribs & Floor	0 + 293 1/30/06 Intake GI 1/2"	72.7	None
681992	3G5X	Ribs & Floor	0 + 343 1/30/06 Intake GI	64.4	None
681993	3G5X	Ribs & Floor	0 + 343 1/30/06 Intake GI 1/2"	66.1	None
681994	3G6X	Floor	0 + 408 1/30/06 Intake GI	61.6	None
681995	3G6X	Floor	0 + 408 1/30/06 Intake GI 1/2"	70.7	Trace
681996	3H1	Ribs & Floor	0 + 00 1/30/06 Intake GI	74.7	Trace
681997	3H1	Ribs & Floor	0 + 00 1/30/06 Intake GI 1/2"	73.1	None
681998	3H2	Ribs & Floor	0 + 80 1/30/06 Intake GI	64.7	None
681999	3H2	Ribs & Floor	0 + 80 1/30/06 Intake GI 1/2"	71.7	Trace

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #3: ***Sampling Area:*** ***2nd Left Collected 1/30/06 - 2/03/06 by Ison/Sturgill Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
682000	3H3	Ribs & Floor	0 + 150 1/30/06 Intake GI	66.8	None
682001	3H3	Ribs & Floor	0 + 150 1/30/06 Intake GI 1/2"	67.1	None
682002	3H4	Floor	0 + 215 1/30/06 Intake GI	67.2	None
682003	3H4	Floor	0 + 215 1/30/06 Intake GI 1/2"	68.1	None
682004	3H5	Ribs & Floor	0 + 293 1/30/06 Intake GI	69.9	None
682005	3H5	Ribs & Floor	0 + 293 1/30/06 Intake GI 1/2"	68.5	None
682006	3H6	Ribs & Floor	0 + 378 1/31/06 Intake GI	59.4	None
682007	3H6	Ribs & Floor	0 + 378 1/31/06 Intake GI 1/2"	60.2	None

Sago Mine Explosion Investigation

Sago Mine - Wolf Run Mining Company - Mine ID# 4608791

SURVEY #4: ***Sampling Area:*** ***2nd Left Mains Collected 2/01-16/06 by Sparks/Hicks Rec. 2/17/06 from Cook/Hicks***

Lab No.	Bag No.	Sample Type	Location in Mine	Dust Analysis	Coke Content
682008	4B1	Ribs & Floor	0 + 00 1" Sample	73.3	X-Large
682009	4B1	Ribs & Floor	0 + 00 1/2" Sample	74.1	X-Large
682010	4B2	Floor	0 + 83	71.8	Large
682011	4B2	Floor	0 + 83 1/2"	75.5	X-Large
682012	4B4	Floor	0 + 242 2/01/06 GI	71.0	X-Large
682013	4B4	Floor	0 + 242 2/01/06 GI 1/2"	76.7	X-Large
682014	4C1	Floor	0 + 00 1" Sample	73.7	Large
682015	4C1	Floor	0 + 00 1/2" Sample	72.8	Large
682016	4C2	Floor	0 + 83 1" Sample	70.5	Large
682017	4C2	Floor	0 + 83 1/2" Sample	71.5	Large
682018	4C5	Floor	0 + 324	73.1	Large
682019	4C5	Floor	0 + 324 1/2"	72.4	Large
682020	4C6	Floor	0 + 401	76.6	Large
682021	4C6	Floor	0 + 401 1/2"	71.8	Large
682022	4D2	Band	0 + 83	52.1	Large
682023	4E1	Band	0 + 00	55.7	X-Large
682024	4E2	Band	0 + 83	55.8	X-Large
682025	4G2	Band	0 + 83	53.2	X-Large

APPENDIX 5

The Investigation

(5.5) Cause of Explosion

(5.5-2) Lightning: Linkage to the Explosion

- **Lightning Detection – STRIKEnet Report LA15034**
- **Forensic Survey of Poplar Tree**
- **CO Monitoring Correlation**
  - **Time Differential in CO Monitor's Computer at Sago Mine**
  - **Pyott Boone Data**
- **Results From Analysis of Seismic Data for the Jan. 2, 2006 event near Sago, WV**
- **Map of Resident Interviews**
- **Lightning Detection Networks – Krider (Attachment A, B, C, D, E and F)**

STRIKEnet

VAISALA Reliable

STRIKEnet Report LA105304

Reference:	Sago 01-02-06	**Start Time**	01/02/2006 05:00:00 EST
Ordered by:	Monte Hieb	**End Time**	01/02/2006 07:00:00 EST
	WV Office of MHS&T	**Center Latitude**	38.9408
	142 Industrial Drive	**Center Longitude**	-80.2028
	Oak Hill, WV 25901 USA	**Location**	LAT/LON
		Search Radius	5.00 mi

Details for all strikes detected within the search area.

Date/Time	Latitude	Longitude	kA	Bearing	Range
01/02/2006 06:26:35.522 EST	38.897	-80.231	+38.8	206.8	3.4
01/02/2006 06:26:35.680 EST	38.926	-80.233	+101.0	237.8	1.9
01/02/2006 06:38:51.838 EST	38.975	-80.123	-12.6	61.4	4.9
01/02/2006 06:38:51.846 EST	38.980	-80.138	+85.7	51.8	4.4

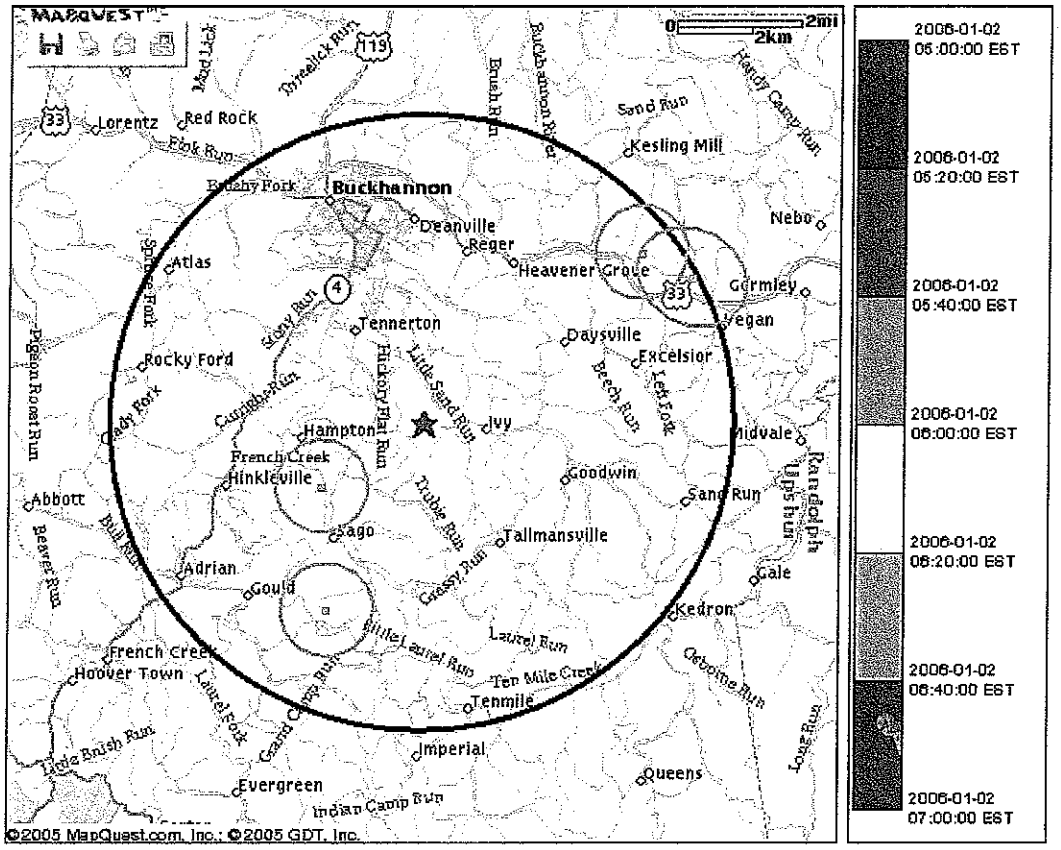
01/05/2006 20:24:39.526 GMT STRIKEnet Page 2 of 2

STRIKEnet

STRIKEnet Report 105610 Redo of 105304

Reference:	Sago 01-02-06	**Start Time**	01/02/2006 05:00:00 EST
Ordered by:	Monte Hieb	**End Time**	01/02/2006 07:00:00 EST
	WV Office of MHS&T	**Center Latitude**	38.9408
	142 Industrial Drive	**Center Longitude**	-80.2028
	Oak Hill, WV 25901 USA	**Location**	LAT/LON
		Search Radius	5.00 mi

99% confidence ellipses for all strikes detected within the search area.



Median strike location accuracy is 500 meters. Lightning data provided by the U.S. NLDN® and CLDN.

888 - 854 - 2359

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Vaisala's U.S. National Lightning Detection Network®

Vaisala's U.S. NLDN® is the most reliable lightning information system monitoring cloud-to-ground lightning activity across the continental United States, 24 hours a day, 365 days a year.

Key Applications for NLDN Lightning Information

- Weather forecasting: Help predict severe weather for public warning
- Electric power utilities: Pre-position field crews for approaching storm threats and to improve engineering and design with lightning analysis
- Air traffic control: Re-route aircraft around hazardous thunderstorms
- Airports: Suspend high-risk activities like fueling during lightning threats
- Insurance and arson: Investigate lightning as the cause of property damage or fire
- Power-sensitive manufacturing and processing operations: Prepare for storm-caused power outages by switching to back-up power early
- Hazardous materials handling: Warn personnel working near explosives and flammable materials to evacuate
- Forestry: Dispatch crews to suspected fire starts for more successful initial attack
- Golf and outdoor recreation: Warn players to seek safety from storms
- Launch facilities: Monitor for safest weather conditions for shuttle and satellite launches

How the NLDN works

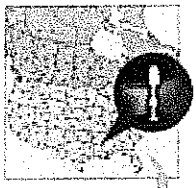
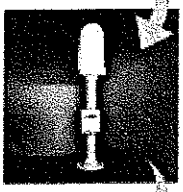
Step 1: Network of lightning sensors
U.S. NLDN consists of more than 100 remote, ground-based Vaisala IMPACT ESP Lightning Sensors

Step 2: Lightning detection
Vaisala IMPACT ESP sensors instantly detect the electromagnetic signals given off when lightning strikes the earth's surface

Step 3: Data collection from sensors
Vaisala IMPACT ESP sensors send raw data via satellite to the Network Control Center in Tucson, Arizona

Step 4: Lightning data analysis
Within seconds, the NCC's central analyzers process information on location, time, polarity, and amplitude of each stroke

Step 5: Lightning information delivery
Lightning information is sent to customers across the country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- Vaisala STRIKEnet® Confidence Ellipse Map: Add 99% confidence ellipses to your point plot map. These ellipses indicate a 99% certainty that the recorded lightning event contacted the ground within the bounds of the ellipse.
- Vaisala STRIKEnet® Strike Details Report: Includes the date, time (to nearest second), latitude, longitude, peak current (kA), bearing and range from the search center point for each detected strike.

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Surveying West Virginia
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Ben R. Singleton, PS
Dwayne A. Hall, PS
Michael H. Brown, PS
Damon L. Wilkewitz, PS

January 14, 2006

Monte Hieb, PE
Office of Miner's Health Safety and Training
142 Industrial Drive
Oak Hill, West Virginia 25901-0714

Re: Forensic Survey of lightning strike at the C. R. Rutherford farm, Sago, Upshur County.

Dear Mr. Hieb:

I have enclosed with this letter several copies of a map we have prepared depicting the effects of a lightning strike discharged into a 25" yellow poplar on Monday morning, January 2, on the C. R. Rutherford farm.

As we discussed on the site, we separated the density of our location by a 50 foot radius around the tree. Outside of the 50 foot radius, we located every wood shard or splinter that was over 1foot in length and an inch in width. Inside of the 50' radius, we located every wood shard or splinter that was over 2 feet in length and an inch in diameter. I estimated that, outside of the radius, we located about 60% of the wood shards or splinters, and inside of the radius we located about 40%. This is a very rough estimate only. Within the 50 foot radius there were significantly more small splinters than outside of it.

We transferred elevations and coordinates from Permanent Monument 3 at the mine using survey grade GPS receivers. In the interest of time, because of the pending snow storm, we did not orient our GPS survey to the mine control, since we found in our efforts on January 2 that the mine control orientation, though not in agreement with the grid north orientation of the West Virginia Coordinate System, was not off by a factor that would be worth correcting for over the distance to the lightning strike (my memory, and Ben's, was that this disagreement between the mine control and the State Plane grid orientation was a little over 20" of arc). This displacement was corrected for in our work on January 2.

We oriented our two traverse points on the site to a magnetic meridian, tied to the GPS control point near the site, then adjusted this for the declination between magnetic north and grid north in the area (8°24' west), based upon isogonic data provided on the National Geodetic Survey's website.

P.O. Box 438 Birch River, WV 26610
Ph: 1-800-482-8606 Fax: (304) 649-8608
E-mail: marshall@alleghenysurveys.com

80 U.S. Highway 33 East Weston, WV 26452
Ph: (304) 269-6200 Fax: (304) 269-7262
E-mail: alleghenyweston@citynet.net

This method gave us a more reliable tie to the mine horizontally and vertically, without requiring the time and expense necessary to perform a full-blown static GPS survey to our control. If it is determined that this is necessary in the future for reasons we cannot yet anticipate, then we can tie the control at the site to the control at the mine with two or three additional static sessions.

You will notice that, per your instruction, we located all of the trees, with the exception of small saplings, within the 50' radius, and trees over 12" in diameter outside of the radius. Also, although the map depicts shards and splinters of uniform length and width, we depict the width throughout the shard as its width at the widest point. Most of the shards were tapered at each end, and many, perhaps 10% or so, were broken.

I hope that this survey meets the needs of whoever is able to utilize it in the on-going investigation. We set some fairly arbitrary criteria in the survey because of the pending snow storm, and we did so without any knowledge of what use our efforts might be put to. Let's hope that, if needed, it works.

Cordially,

M. W. Robinson

Marshall W Robinson, PS

Enc.: five (5) copies of forensic survey map.

Map of Forensic Survey

depicting

the results of a lightning discharge into a 24" Yellow Poplar tree on the C.R. Rutherford farm near Sago, Upsher County at 6:26:35 am EST near the Sago Mine

Prepared for Doug Conaway, Director
West Virginia Office of Miners'
Health, Safety and Training
West Virginia Department of Commerce

8°24' W
GRID
MAGNETIC

Notes:

A. This map depicts the various wood shards and splinters in their proximity to a 24" yellow poplar struck by a high-intensity lightning strike. The length and width of each shard is depicted uniformly. It is noted that the actual width of each shard varies somewhat, normally tapering to some resemblance of a point on each end. Some, perhaps as many as 10% of the shards, were broken at some point along their length.
B. Inside the 50' radius from the poplar, only shards greater than 2' long and 0.1' in width were located. It is estimated that those located accounted for 40% to 50% of the total number of shards within the 50' limit.
C. Outside of the 50' radius, shards greater than 1' in length and 0.1' in width were located. It is estimated that those located accounted for 60% of the total number of shards outside of the 50' limit.
D. The Vertical Datum upon which this survey is based is that of the Sago Deep Mine, based upon GPS observations taken at Permanent Monument #3 at the mine and a GPS control point north of the survey site that was tied to the stations of this survey.
E. The Horizontal Orientation of this survey is Grid North, based upon an application of 8°24' W applied to a magnetic meridian established on the site at Survey Station #1.

GPS Control Point
N 35°36'00" E
157.04'
Approximate fence location
Survey Station #1
S 04°25'20" W
171.46'
24" Yellow Poplar
50' Radius
Blow out
Survey Station #42
S 31°39'30" E
5452.75'
PM #3 at Sago Mine

1630 1635 1640 1645 1650 1650 1645 1640 1635 1630 1625 1620 1615 1610 1605 1600 1595 1590 1625 1620 1615 1610 1605 1600 1595 1590

LEGEND

- Tree
- Branch
- Shard
- 1590 — 5' Index Contour
- 1' Contour Line
- Survey Station

0' 10' 20' 30'

Scale: 1 inch = 10 feet
Contour Interval = 1 foot

Marshall W. Robinson, PS
11/16/06
Date

Birch River Office
40 Powell Creek Road
P.O. Box 438
Birch River, WV 26610

Surveying and Mapping Services Performed By:
Allegheny Surveys, Inc.
1-800-482-8606
Surveying West Virginia since 1988.

Weston Office
80 U.S. Highway 33 East
Weston, WV 26452

PARTY CHIEF: Marshall Robinson, PS	DRAWING NO: treeshards.dwg
FIELD CREW: Ben Singleton, PS; Jerry Robinson; Robert Darling	PROJECT NO: 04-09-M-06
	PREPARED: January 14, 2006
SURVEYED: January 13, 2006	DRAWN BY: Stacey Brown

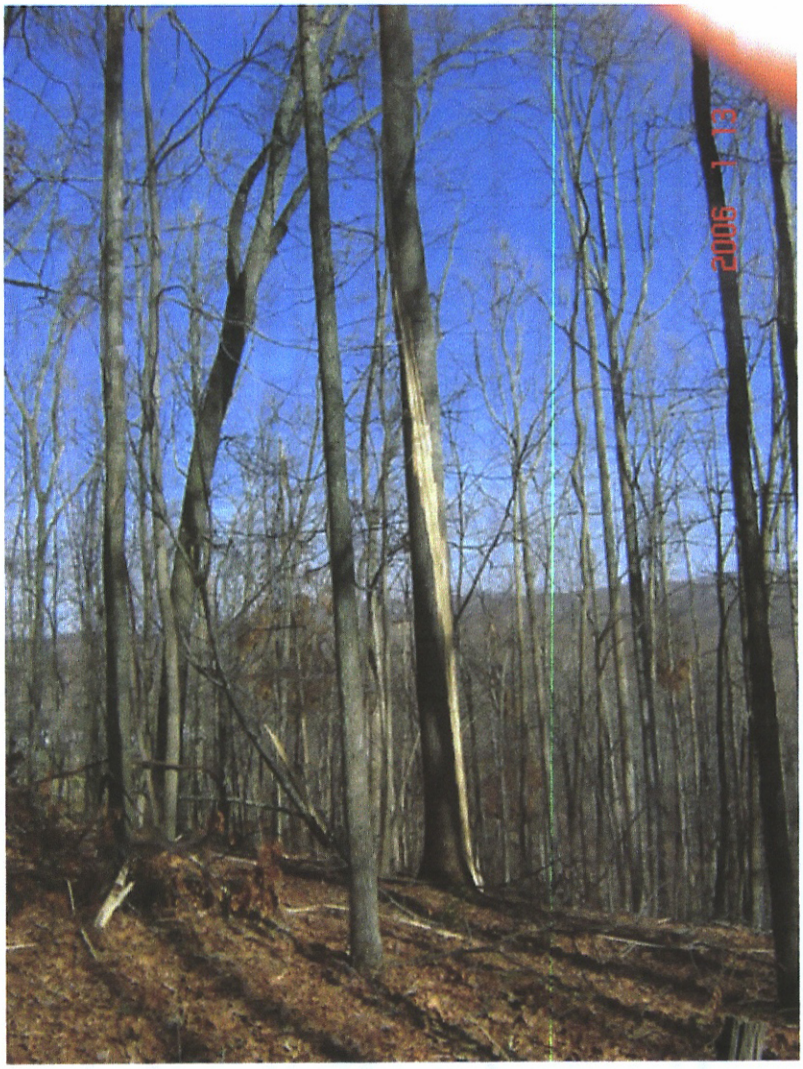

Photo 1: Damage To Lightning Struck Tree

Photo 2 and 3: Survey of Fragments From Lightning Struck Tree

Photo 4: Broken Tree Top of Lightning Struck Tree

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January 14, 2006

Monte Hieb, PE
Office of Miner's Health Safety and Training
142 Industrial Drive
Oak Hill, West Virginia 25901-0714

Re: Time differential in CO monitor's computer at Sago.

Dear Mr. Hieb:

This will document for you my efforts this past Wednesday to determine a common time when two simultaneous lightning strikes, the CO monitor's register of a spike in CO levels, and the Morgantown seismic base station's detection of seismic activity in Upshur County, all occurred. The time of the lightning strike and the seismic activity were both pegged very accurately to Universal Time, almost certainly using GPS receivers. The CO monitor was pegged to the clock on its computer, which was not considered to be accurate. My assignment was to determine the time differential between the CO monitor's computer clock and Universal Time as logged by an active GPS receiver. Our receivers, when you called, were in the office of my former partner, Bruce Hager, in Danville. You and I both agreed that there would be no significant time delay caused by synchronization over the phone, so, after calling the Sago Mine and speaking with John Scott of your organization to let him know of our discussion, I called Bruce Hager's office and had his senior party chief to set up the GPS receiver outside and allow it to gather enough satellite data so that the GPS receiver's clock would be updated by the satellite signals. This is a process that normally takes less than a minute of data. Once the GPS receiver had corrected its own clock, it was brought inside where a call was placed to me by the party chief. (I called a GPS service provider in Louisiana that specializes in the particular GPS unit we have (Trimble 4000 SSI) to make sure that, if the receiver remained on, it would maintain its clock accuracy when disconnected from its antenna, and the individual I spoke with confirmed this).On my end of the line I had a Hewlett-Packard 48GX data collector equipped with a digital clock that is utilized in performing astronomic observations, where highly accurate time is a necessity. Once we "pegged" the HP's clock to the GPS receiver over the phone, I called the Sago Mine and spoke to John Scott again. Mr. Scott told me the computer was still purging itself of the CO data, and I would receive a call when its download was complete. At about 5:37 or 5:38 I received a call from an individual whose last name was Hedrick. I do not recall his first name.

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In determining the differential between the computer for the CO Monitor and my HP 48, I asked Mr. Hedrick to tell me "mark" when the computer clock read the next even minute. This minute was 5:39:00 PM on Wednesday. Mr. Hedrick gave me a count-down from about 10 seconds before 5:39:00. When he said "mark" my HP read 5:34:04 EST. This means that there was a 4 minute, 56 second positive difference between the computer's clock and Eastern Standard Time as determined by the GPS receiver's corrected clock.

I hope this information helps you in your investigations into the tragedy at Sago. I applaud your efforts, and wish you the best of luck.

Cordially,

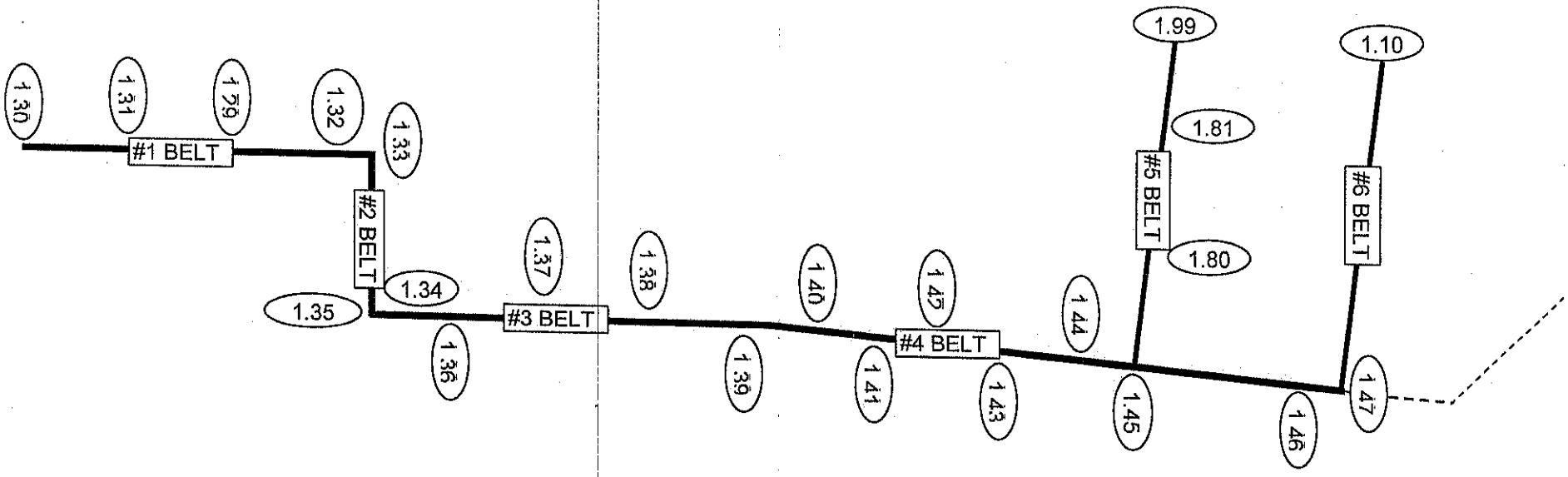
M. W. Robinson

Marshall W. Robinson, PS

PYOTT BOONE CO MONITOR PRINTOUT - SAGO

1/1/2006	9:42:27 Station	1	1	NO. 1 BELT (Belt Boss) Belt Start
1/1/2006	9:42:57 Station	1	1	NO. 1 BELT (Belt Boss) Run
1/1/2006	9:44:02 Station	1	2	NO. 2 BELT (Belt Boss) Belt Start
1/1/2006	9:45:46 Station	1	3	NO. 3 BELT (Belt Boss) Belt Start
1/1/2006	9:47:26 Station	1	4	NO. 4 BELT (Belt Boss) Belt Start
1/1/2006	9:48:58 Station	1	4	NO. 4 BELT (Belt Boss) STOP - Sequence
1/1/2006	9:49:04 Station	1	3	NO. 3 BELT (Belt Boss) STOP - Sequence
1/1/2006	9:49:10 Station	1	2	NO. 2 BELT (Belt Boss) STOP - Sequence
1/1/2006	9:49:16 Station	1	1	NO. 1 BELT (Belt Boss) STOP - Sequence
1/2/2006	5:27:16 Station	1	1	NO. 1 BELT (Belt Boss) Belt Start
1/2/2006	5:27:46 Station	1	1	NO. 1 BELT (Belt Boss) Run
1/2/2006	5:28:45 Station	1	2	NO. 2 BELT (Belt Boss) Belt Start
1/2/2006	5:30:35 Station	1	3	NO. 3 BELT (Belt Boss) Belt Start
1/2/2006	5:32:17 Station	1	4	NO. 4 BELT (Belt Boss) Belt Start
1/2/2006	6:09:50 Station	1	99	1 LEFT SECTION ALARME (CO Monitor) - Taken off scan
1/2/2006	6:10:01 Station	1	99	1 LEFT SECTION ALARME (CO Monitor) - Initializing
1/2/2006	6:10:01 Station	1	99	1 LEFT SECTION ALARME (CO Monitor) - Placed on scan
1/2/2006	6:10:06 Station	1	99	1 LEFT SECTION ALARME (CO Monitor) - Alarm (26 ppm)
1/2/2006	6:25:35 Station	0	6	User "muffie" supervisor privilege timed out. Defaulting to "public
1/2/2006	6:31:23 Station	1	30	PITT MOUTH (CO Monitor) - Warning (10 ppm)
1/2/2006	6:31:24 Station	1	30	PITT MOUTH (CO Monitor) - Maximum CO value obtained during alarm condition was (10 ppm) - Pit mouth
1/2/2006	6:31:31 Station	1	46	CO Monitor #57 Blk 4 Belt (CO Monitor) - Alarm (51 ppm)
1/2/2006	6:31:41 Station	1	45	49 BRAKE NO.4 BELT (CO Monitor) - Alarm (107 ppm)
1/2/2006	6:31:43 Station	1	44	46 BRAKE NO. 4 BELT (CO Monitor) - Alarm (107 ppm)
1/2/2006	6:31:45 Station	1	100	2 LEFT SECTION ALARM (CO Monitor) - Communications Dead
1/2/2006	6:31:49 Station	1	99	1 LEFT SECTION ALARME (CO Monitor) - Alarm Latch Set (26 ppm)
1/2/2006	6:31:49 Station	1	99	1 LEFT SECTION ALARME (CO Monitor) - Warning Latch Set (26 ppm)
1/2/2006	6:31:57 Station	1	4	NO. 4 BELT (Belt Boss) STOP - Power Loss - Sequence
1/2/2006	6:32:01 Station	1	5	NO.5 BELT (Belt Boss) Communications Dead
1/2/2006	6:32:01 Station	1	6	Belt Boss #6 drive (Belt Boss) Communications Dead
1/2/2006	6:32:02 Station	1	34	7 BREAK No. 2 BELT (CO Monitor) - Communications Dead
1/2/2006	6:32:02 Station	1	48	CO Monitor 2 Blk's outby 6 tail (CO Monitor) - Communications Dead
1/2/2006	6:32:05 Station	1	3	NO. 3 BELT (Belt Boss) STOP - Power Loss
1/2/2006	6:32:06 Station	1	47	CO Monitor Tail #4 Belt (CO Monitor) - Communications Dead
1/2/2006	6:51:10 Station	1	1	NO. 1 BELT (Belt Boss) STOP - Sequence
1/2/2006	6:51:18 Station	1	2	NO. 2 BELT (Belt Boss) STOP - Sequence
1/2/2006	7:16:34 Station	1	43	37 BRAKE NO.4 BELT (CO Monitor) - Warning (10 ppm)
1/2/2006	7:19:19 Station	1	43	37 BRAKE NO.4 BELT (CO Monitor) - Alarm (15 ppm)
1/2/2006	7:30:59 Station	1	82	1 Block outby 7 drive (CO Monitor) - Warning (5 ppm)
1/2/2006	7:31:07 Station	1	82	1 Block outby 7 drive (CO Monitor) - Maximum CO value obtained during alarm condition was (5 ppm)
1/2/2006	7:31:07 Station	1	82	1 Block outby 7 drive (CO Monitor) - Warning Cleared (4 ppm)
1/2/2006	7:31:25 Station	1	82	1 Block outby 7 drive (CO Monitor) - Warning (5 ppm)
1/2/2006	7:34:05 Station	1	82	1 Block outby 7 drive (CO Monitor) - Alarm (10 ppm)
1/2/2006	7:38:35 Station	1	81	22 Blk #5 Belt (CO Monitor) - Warning (5 ppm)
1/2/2006	7:41:52 Station	1	81	22 Blk #5 Belt (CO Monitor) - Alarm (10 ppm)
1/2/2006	8:10:47 Station	1	80	14 BRAKE 5 BELT (CO Monitor) - Warning (5 ppm)
1/2/2006	8:14:59 Station	1	99	1 LEFT SECTION ALARME (CO Monitor) - Alarm Latch Reset (107 ppm)
1/2/2006	8:14:59 Station	1	99	1 LEFT SECTION ALARME (CO Monitor) - Warning Latch Reset (107 ppm)
1/2/2006	8:15:01 Station	1	80	14 BRAKE 5 BELT (CO Monitor) - Alarm (10 ppm)
1/2/2006	8:45:29 Station	1	3	NO. 3 BELT (Belt Boss) Communications Dead

Sago Mine CO Monitor Schematic



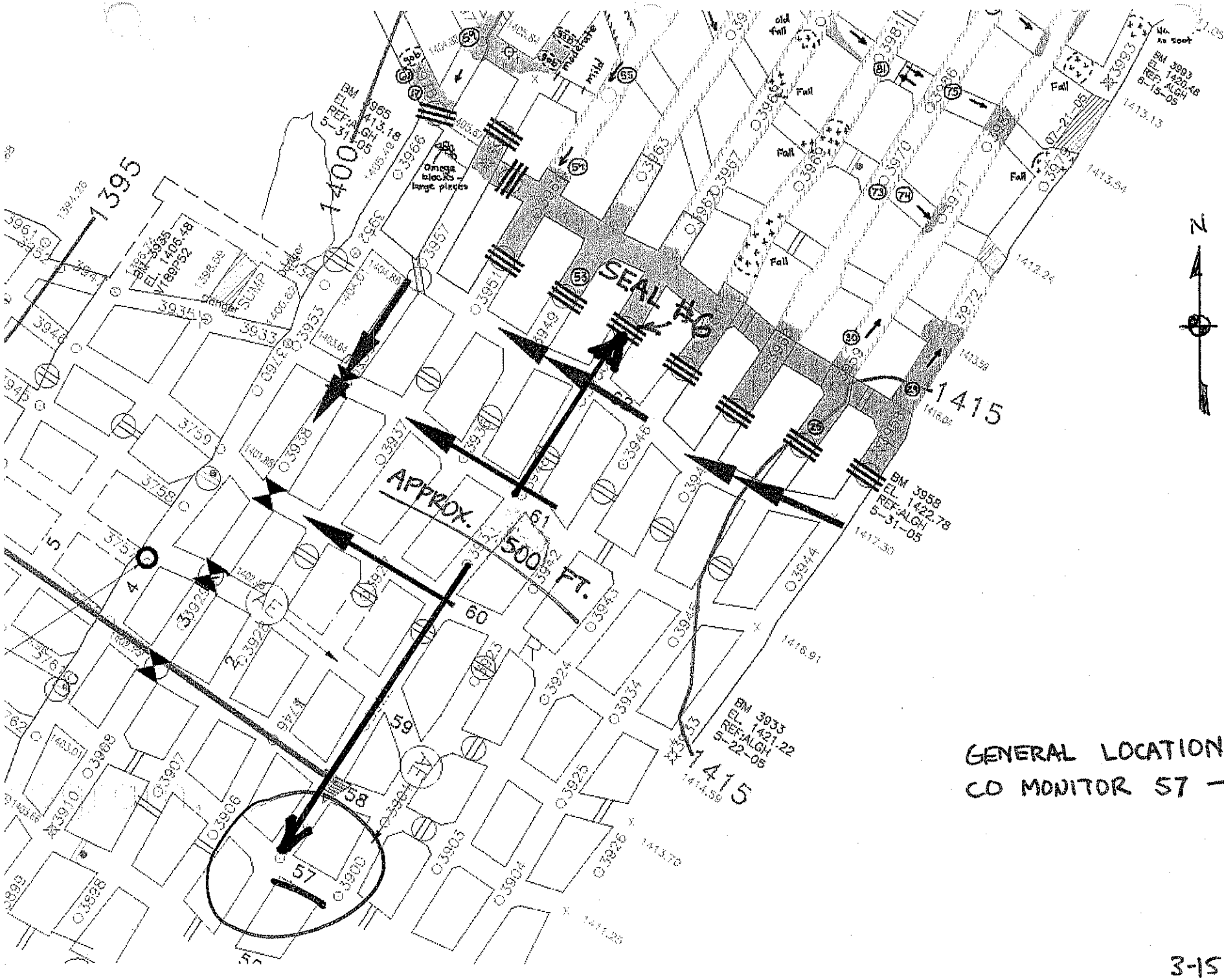
ID	Location
1.29	17th Break, Motor Spur
1.30	Pit Mouth
1.31	9th Break, #1 Belt
1.32	21st Break, #1 Belt
1.33	Tail, #1 Belt
1.34	7th Break, #2 Belt
1.35	Tail, #2 Belt
1.36	11th Break, #3 Belt
1.37	22nd Break, #3 Belt

ID	Location
1.38	31st Break, #3 Belt
1.39	38th Break, #3 belt
1.40	8th Break, #4 Belt
1.41	17th Break, #4 Belt
1.42	27th Break, #4 Belt
1.43	37th Break, #4 Belt
1.44	46th Break, #4 Belt
1.45	49th Break, #4Belt
1.46	57th Break, #4 Belt

ID	Location
1.47	Tail, #4 Belt
1.80	14th Break, #5 Belt
1.81	22nd Break, #5 Belt
1.99	1st Left Section Alarm
1.100	2nd Left Section Alarm

Last Update 1/20/06

0001822-A



GENERAL LOCATION OF CO MONITOR 57 —

3-15-06

Results from Analysis of Seismic Data for the January 2, 2006 event near Sago, WV

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Introduction

The author examined regional seismic network recordings for the time interval around 6:30 AM, EST January 2, 2006 to determine if the event at the Sago mine was seismically recorded.

A small amplitude signal was identified on records at broadband station MCWV, near Mont Chateau, WV, the nearest seismic station to the mine. This station is part of the U.S. Geological Survey Advanced National Seismic System (ANSS) which is designed to record world-wide seismic activity as well as to monitor shocks in all regions of the U.S. The signal was also recorded at larger distances by three stations to the south: FWV, ELN and BLA. These more distant stations use short period sensors and are operated by Virginia Tech as part of the ANSS.

The following is a summary of the results pertaining to the location and time of the event that generated the seismic signals.

Data

Figures 1 through 4 show the data recorded at stations MCWV, FWV, ELN and BLA respectively. The signals have been bandpass-filtered using a 3 pole Butterworth prototype with corner frequencies 1.0 and 5.0 Hz. The signal/noise ratios of these data are small, however, measurement of arrival times for P and S waves was possible. The estimated arrival times are given below in Table 1, *in Eastern Standard Time.*

The coordinates of the recording stations are as follows:

BLA:	**37.2113 deg N**	**80.4202 deg W**
ELN:	**37.2805 deg N**	**80.7517 deg W**
FWV:	**37.5810 deg N**	**80.8118 deg W**
MCWV:	**39.6582 deg N**	**79.8457 deg W**

Results

Figure 5 shows the epicenter estimated using the arrival time data in Table 1. The locations were determined using the velocity model in Table 2, in conjunction with the computer program **Hypoellipse**. Table 3 gives hypocenter and origin time estimates for 3 cases.

The first case assumes that the focal depth of the source is near the ground surface, consistent with a mining-related source, but not necessarily located near the Sago mine. Latitude, longitude and origin time are treated as unknowns to be determined from the arrival time data. The origin time estimate in this case is 06:26:38.29 EST with standard error 1.65 seconds. The 68% confidence ellipse for the epicenter determined from the seismic data includes the Sago mine location (Figure 5). A 68% confidence interval for the origin time is 06:26:36.60 to 06:26:39.94 EST, assuming no systematic bias due to uncertainty associated with the velocity model in Table 2 or in phase arrival time measurement.

The second case is a completely un-constrained location, in which the latitude, longitude, focal depth and origin time are treated as unknowns to be determined. The computed epicenter is very near the Sago Mine location in this case (figure 5). The estimated focal depth is shallow (2.5 km) but very poorly determined (68% confidence: 0 to 34 km). The 68% confidence interval for the origin time is 06:26:35.35 - 06:26:41.21 EST.

The third case assumes that the source occurred at the Sago mine, (Latitude 38.9407°N; Longitude 80.2030°W) with zero focal depth. The only free parameter to be determined is the origin time. The 68% confidence interval for the origin time is 06:26:36.46 - 06:26:40.00 EST.

Conclusions

The seismic signal recorded on January 2, 2006 at approximately 06:26 EST was caused by an underground disturbance at or near the Sago mine. Assuming that the source was at the Sago mine, a 68% confidence interval for the origin time is 06:26:36.46 - 06:26:40.00 EST. Simply put, the event most likely occurred within a 4 second interval centered at 06:26:38.2 AM. This estimate assumes no systematic error in phase arrival time determination, and/or bias in the seismic wave velocity model used for analysis. It is possible that the origin time estimate is slightly late, due to the very emergent nature of the P and S wave arrivals because of low signal/noise ratios at all the recording stations.

Table 1

Station	P arrival*			S arrival*		
	Hour	Minute	Second	Hour	Minute	Second
MCWV	06	26	52.6	06	27	3.5
FWV	06	27	5.1	06	27	24.1
ELN	06	27	9.0	06	27	32.7
BLA	06	27	9.7	06	27	32.2

*** All times are Eastern Standard Time.**

Table 2

P wave velocity (km/sec)	S wave velocity (km/sec)	Layer thickness (km)
5.63	3.43	5.7
6.05	3.52	9.0
6.53	3.84	36.0
8.18	4.78	-

Table 3

	Latitude	Longitude	Focal Depth	Origin Time*	Standard Error of Origin Time	Azimuth of Error Ellipse Semi-Major Axis	Major Axis Length	Minor Axis Length
Depth constrained	38.9243°N	80.1169°W	0 km (fixed)	06:26:38.29	1.65 s	286°	23 km	4.4 km
Depth unconstrained	38.9465°N	80.1920°W	2.45 km	06:26:38.28	2.93 s	289°	23 km	4.0 km
Depth and location constrained	38.9407°N (fixed)	80.2030°W (fixed)	0 km (fixed)	06:26:38.23	1.77 s			

*** All times are Eastern Standard Time.**

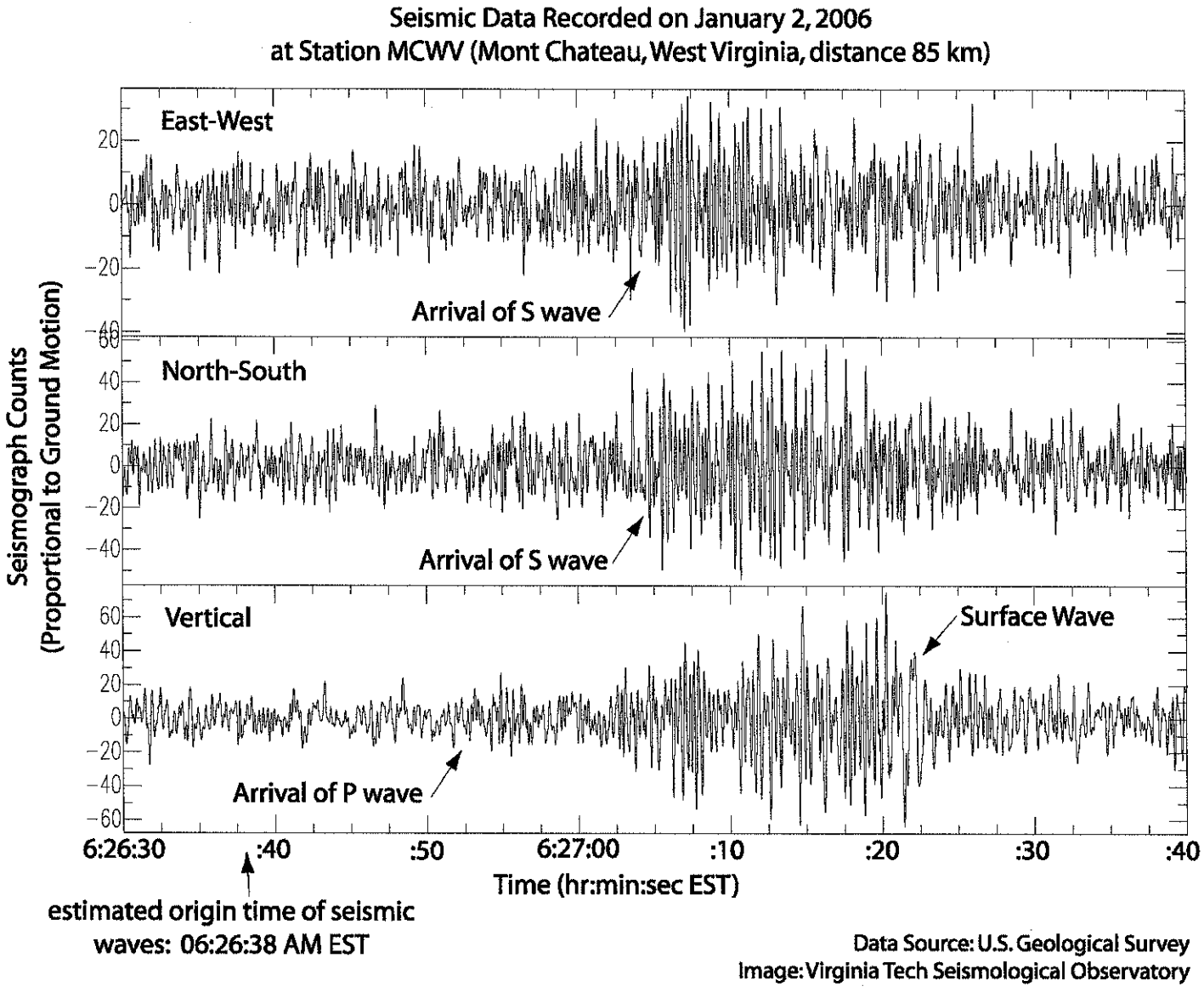


Figure 1. Waveforms recorded at station MCWV, 85.4 km from the assumed epicenter at 38.94065 degrees N, 80.20295 degrees W.

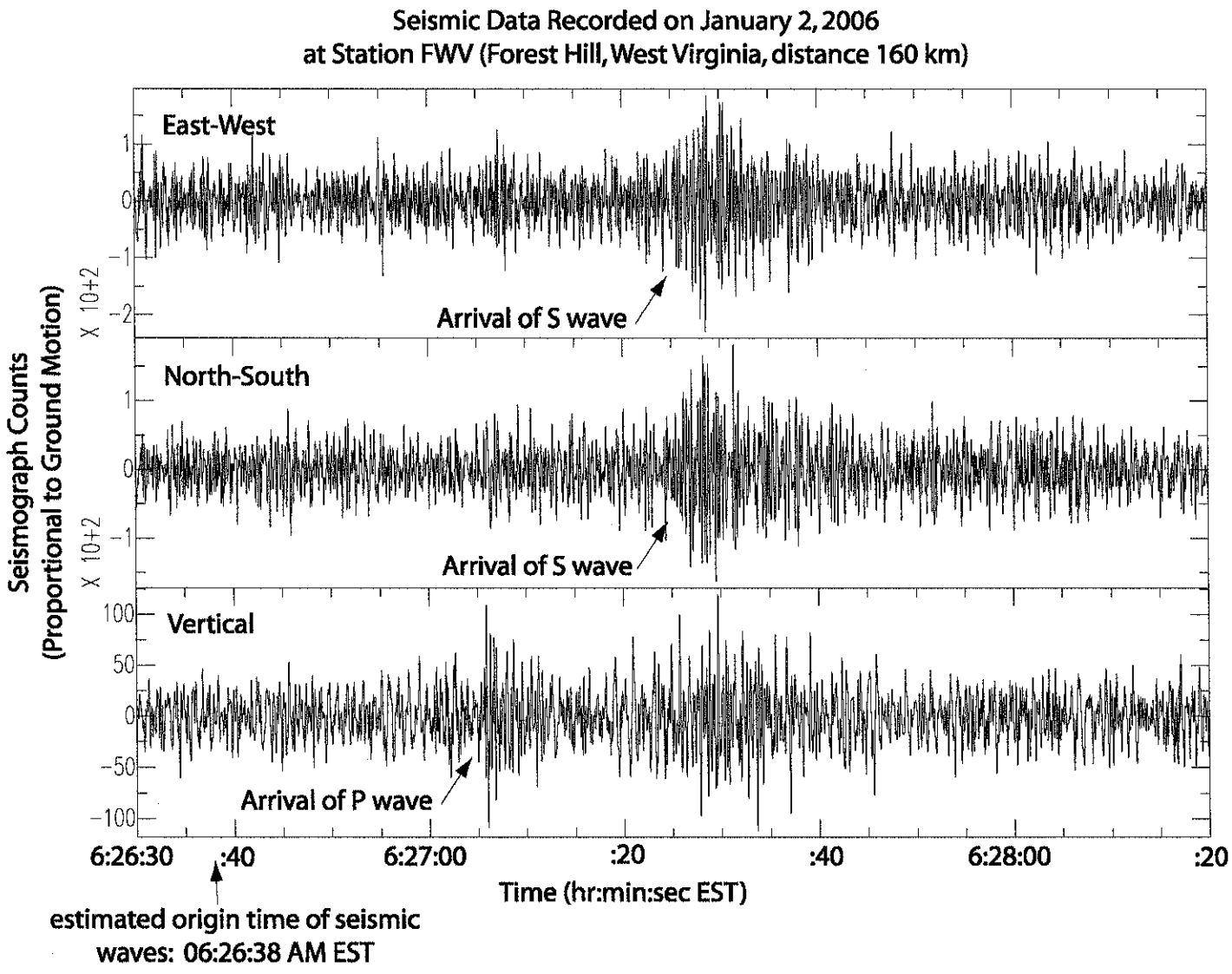


Figure 2. Waveforms recorded at station FWV, 160.1 km from the assumed epicenter at 38.94065 degrees N, 80.20295 degrees W.

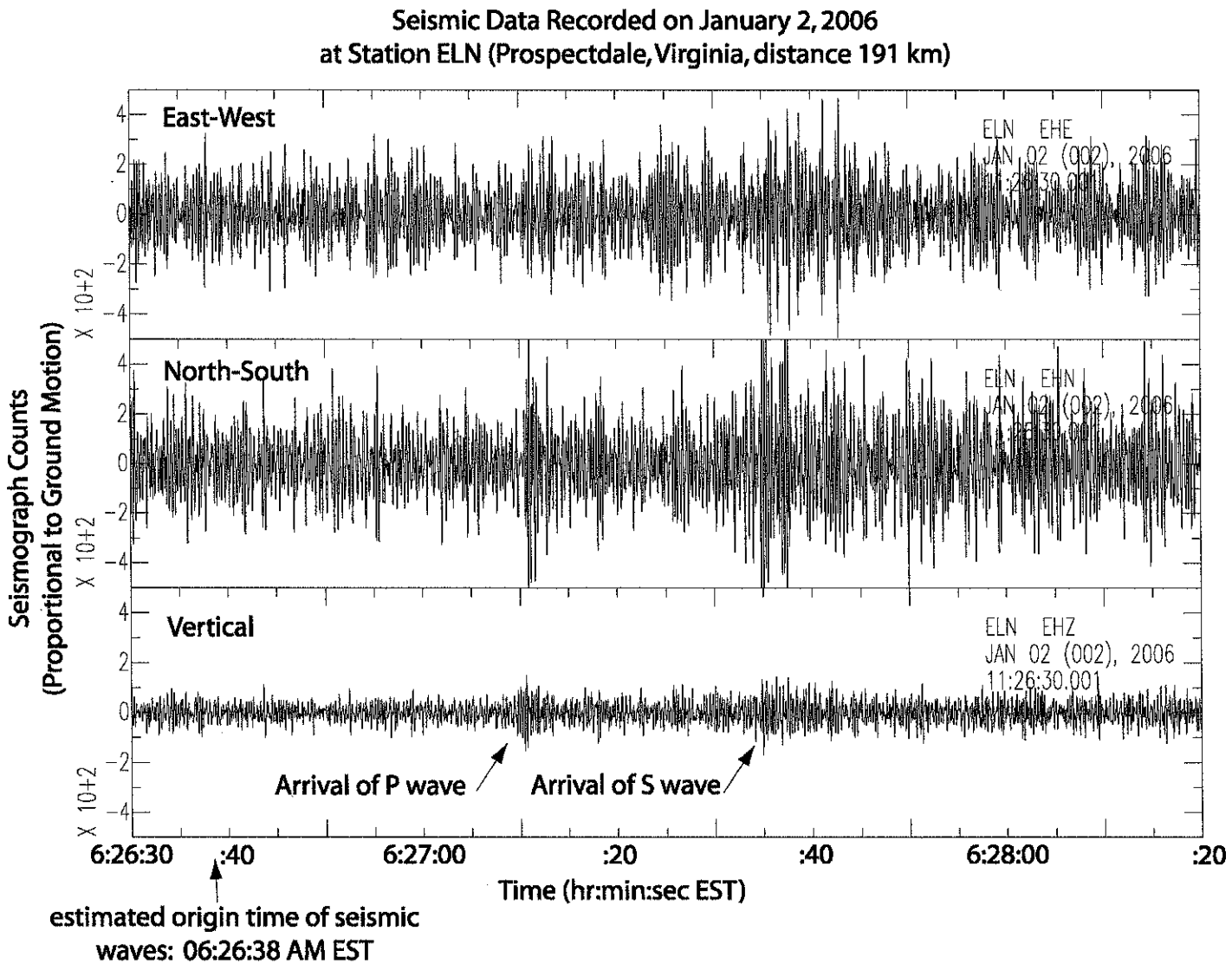


Figure 3. Waveforms recorded at station ELN, 190.5 km from the assumed epicenter at 38.94065 degrees N, 80.20295 degrees W.

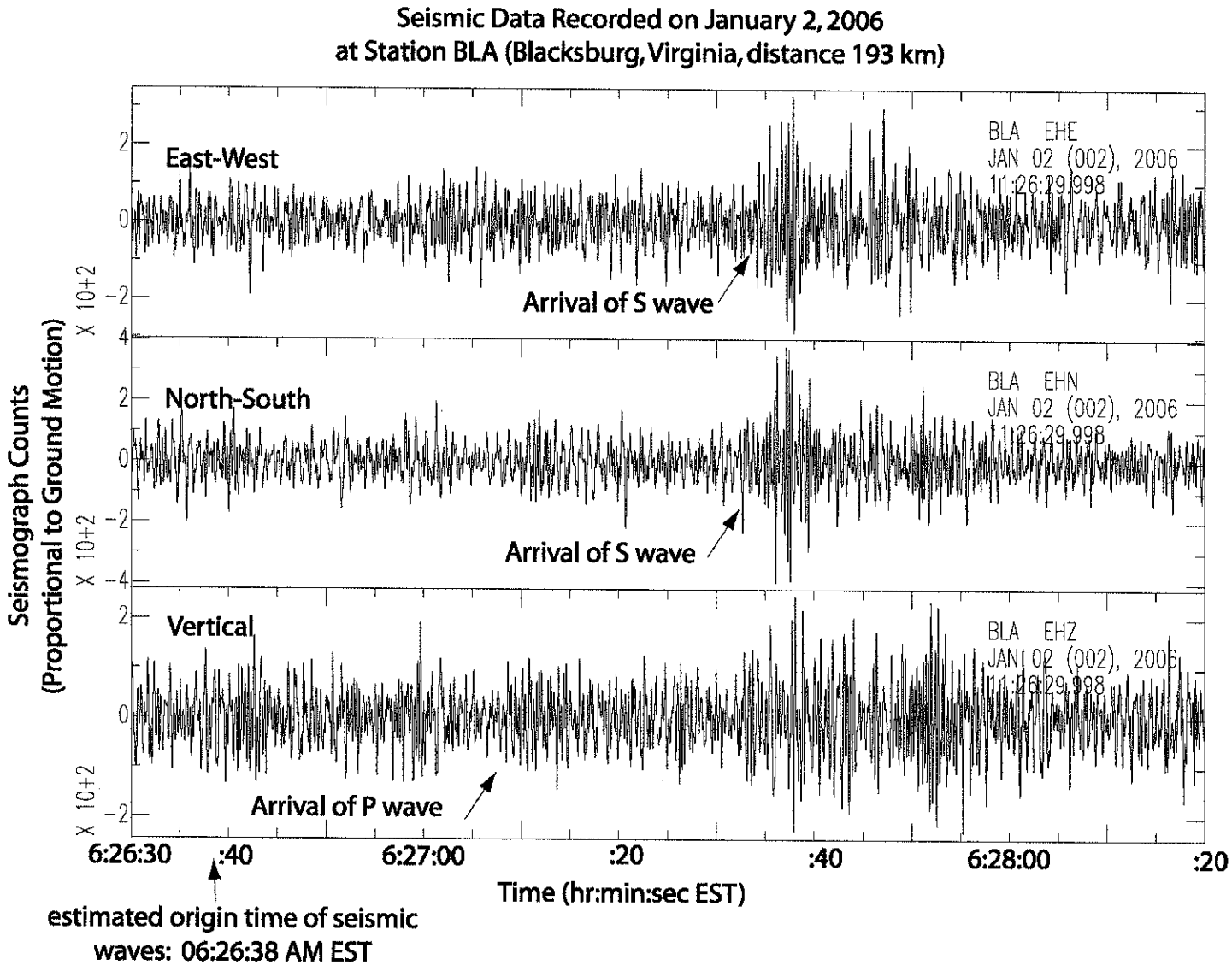


Figure 4. Waveforms recorded at station BLA, 192.9 km from the assumed epicenter at 38.94065 degrees N, 80.20295 degrees W.

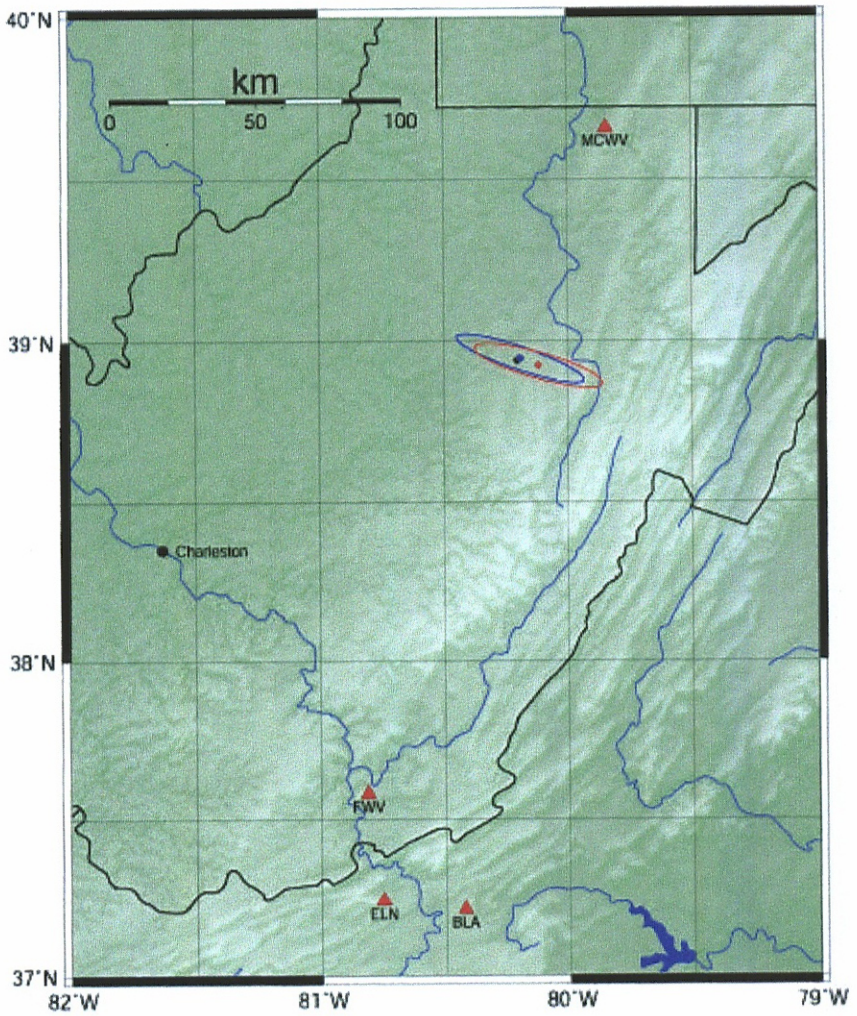
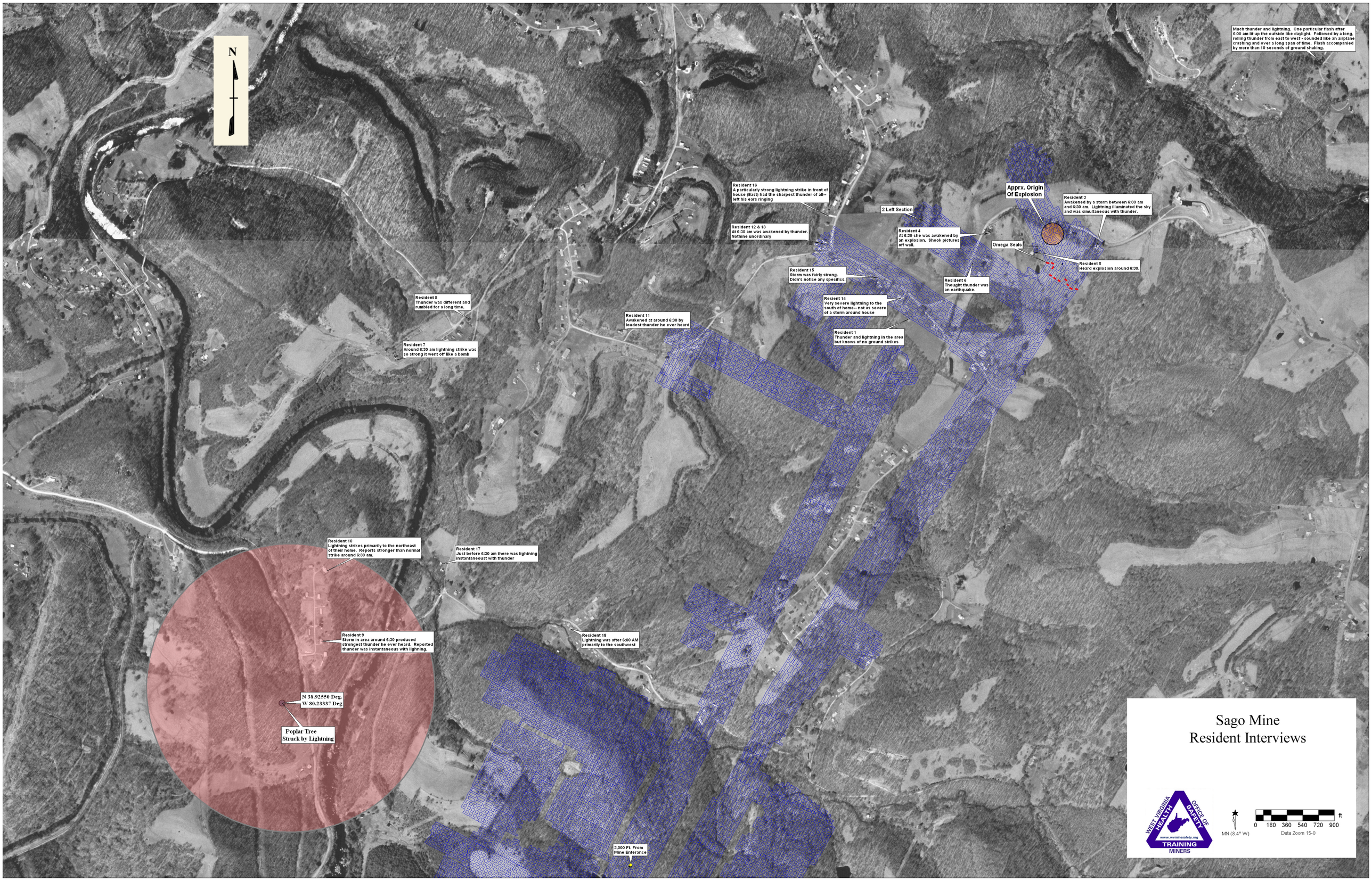


Figure 5. Map showing as a black diamond the assumed location of the Sago mine event (38.94065 degrees N, 80.20295 degrees W). The red diamond shows the epicenter determined using the arrival time data in Table 1 with focal depth fixed at the ground surface. The red line indicates 68% confidence ellipse for the epicenter location. The blue diamond is the epicenter estimated with the depth unconstrained. The blue line shows the corresponding 68% confidence ellipse. Seismic stations used in the location are indicated by the red triangles.


N
Much thunder and lightning. One particular flash after 6:00 am lit up the outside like daylight. Followed by a long, rolling thunder from east to west - sounded like an airplane crashing and over a long span of time. Flash accompanied by more than 10 seconds of ground shaking.
Resident 16
A particularly strong lightning strike in front of house (East) had the sharpest thunder of all-- left his ears ringing
Apprx. Origin Of Explosion
Resident 3
Awakened by a storm between 6:00 am and 6:30 am. Lightning illuminated the sky and was simultaneous with thunder.
2 Left Section
Resident 12 & 13
At 6:30 am was awakened by thunder. Nothine unordinary
Resident 4
At 6:30 she was awakened by an explosion. Shook pictures off wall.
Omega Seals
Resident 5
Heard explosion around 6:30.
Resident 15
Storm was fairly strong. Didn's notice any specifics.
Resident 6
Thought thunder was an earthquake.
Resident 8
Thunder was different and rumbled for a long time.
Resient 14
Very severe lightning to the south of home-- not as severe of a storm around house
Resident 11
Awakened at around 6:30 by loudest thunder he ever heard
Resident 1
Thunder and lightning in the area but knows of no ground strikes
Resident 7
Around 6:30 am lightning strike was so strong it went off like a bomb
Resident 10
Lightning strikes primarily to the northeast of their home. Reports stronger than normal strike around 6:30 am.
Resident 17
Just before 6:30 am there was lightning instantaneoust with thunder
Resident 9
Storm in area around 6:30 produced strongest thunder he ever heard. Reported thunder was instantaneous with lighning.
Resident 18
Lightning was after 6:00 AM primarily to the southwest
N 38.92550 Deg.
W 80.2333° Deg
Poplar Tree
Struck by Lightning
3,000 Ft. From Mine Entrance
Sago Mine
Resident Interviews
WEST VIRGINIA HEALTH OFFICE OF SAFETY
www.wvminesafety.org
TRAINING
MINERS
MN (8.4° W)
0 180 360 540 720 900 ft
Data Zoom 15-0

Attachment A.

List of All NLDN Stroke Locations Within 30 km of the Point-of Origin of the Sago Explosion in the Interval from 06:00 to 06:30 AM EST on January 2, 2006

Date	Time	Lat	Lon	Mult	Ip	CG/CL	50% Ell	99% Ell	Eccen.	Chi	Azimuth	Range	Risetime	PTZ
1/2/2006	11:00:09.220	38.813	-80.292	0	12.5 kA	G	0.4	1.0	1	1	208.5 deg	16.1 km	6.2	12.2
1/2/2006	11:00:29.178	38.667	-80.296	0	-16.6 kA	G	0.4	1.0	1	1	194.9 deg	31.4 km	4	30.2
1/2/2006	11:00:37.822	39.026	-80.55	0	26.9 kA	G	0.4	1.0	1	1	287.5 deg	31.5 km	5.8	30.2
1/2/2006	11:00:38.369	39.068	-80.49	0	-8.3 kA	G	0.4	1.0	1	1	299.8 deg	28.6 km	3.6	12.2
1/2/2006	11:01:22.485	38.993	-80.53	0	-6.4 kA	G	0.5	1.3	1.2	1	281.7 deg	28.9 km	3.8	15.4
1/2/2006	11:01:41.294	38.939	-80.522	0	-13.3 kA	G	1	2.6	2.5	1	269.5 deg	27.6 km	3.8	22
1/2/2006	11:02:03.614	38.675	-80.28	0	-8.1 kA	G	0.5	1.3	1.2	1	192.8 deg	30.2 km	5.6	30.2
1/2/2006	11:02:51.230	38.69	-80.224	0	-45.1 kA	G	0.4	1.0	1	1	183.8 deg	27.8 km	10	29.8
1/2/2006	11:02:51.264	38.686	-80.216	0	-15.3 kA	G	0.4	1.0	1	1	182.3 deg	28.3 km	5.4	30.2
1/2/2006	11:02:51.265	38.69	-80.221	0	-12.6 kA	G	0.8	2.1	2	1	183.2 deg	27.8 km	5.8	30.2
1/2/2006	11:02:51.275	38.698	-80.216	0	-5.6 kA	G	0.5	1.3	1.2	1	182.4 deg	26.9 km	4.6	14.4
1/2/2006	11:04:01.373	38.711	-80.21	0	-60.5 kA	G	0.4	1.0	1	1	181.3 deg	25.5 km	12	30.2
1/2/2006	11:04:01.415	38.709	-80.212	0	-11.9 kA	G	0.4	1.0	1	1	181.6 deg	25.7 km	5.8	12.6
1/2/2006	11:04:01.455	38.715	-80.216	0	-15.8 kA	G	0.4	1.0	1	1	182.6 deg	25.1 km	6.6	27.8
1/2/2006	11:04:01.490	38.685	-80.192	0	-25.1 kA	G	0.4	1.0	1	1	178.1 deg	28.4 km	3.6	13.2
1/2/2006	11:04:12.644	38.96	-80.451	0	23.9 kA	G	0.7	1.8	1.7	1	275.8 deg	21.5 km	4.2	30.2
1/2/2006	11:04:12.649	38.943	-80.465	0	-33.9 kA	G	0.4	1.0	1	1	270.6 deg	22.7 km	8.8	30.2
1/2/2006	11:05:30.441	38.73	-80.18	0	-6 kA	G	1.2	3.1	3	1	175.2 deg	23.4 km	5.4	29
1/2/2006	11:06:16.239	38.706	-80.182	0	-36.6 kA	G	0.4	1.0	1	1	176 deg	26.1 km	9.2	30.2
1/2/2006	11:06:16.294	38.694	-80.174	0	-7.5 kA	G	5.4	13.9	6.8	3	174.7 deg	27.5 km	4.4	15.2
1/2/2006	11:06:16.325	38.703	-80.216	0	-11.8 kA	G	0.4	1.0	1	1	182.5 deg	26.4 km	5	21.2
1/2/2006	11:06:16.348	38.72	-80.205	0	-9.2 kA	G	0.4	1.0	1	1	180.4 deg	24.5 km	5.8	24.2
1/2/2006	11:07:26.446	38.712	-80.172	0	-48.8 kA	G	0.4	1.0	1	1	174 deg	25.5 km	7.6	30.2
1/2/2006	11:07:26.466	38.709	-80.165	0	-12.9 kA	G	0.4	1.0	1	1	172.6 deg	26 km	4.4	23.2
1/2/2006	11:07:26.493	38.704	-80.176	0	-18.7 kA	G	0.4	1.0	1	1	174.8 deg	26.4 km	4.8	20.6
1/2/2006	11:08:29.431	38.949	-80.387	0	-88.7 kA	G	0.4	1.0	1	1	273.2 deg	16 km	11.2	23.4
1/2/2006	11:08:29.446	38.941	-80.379	0	-15.3 kA	G	0.4	1.0	1	1	270.2 deg	15.2 km	3.6	28.2
1/2/2006	11:09:23.004	38.708	-80.184	0	-23.7 kA	G	0.4	1.0	1	1	176.3 deg	25.9 km	4.8	30.2
1/2/2006	11:09:23.016	38.704	-80.182	0	-7.1 kA	G	0.8	2.1	2	1	175.9 deg	26.3 km	4.8	30.2
1/2/2006	11:09:23.072	38.739	-80.223	0	-15.3 kA	G	0.7	1.8	1.7	1	184.3 deg	22.5 km	9.6	30.2
1/2/2006	11:10:32.004	38.704	-80.238	0	-20.8 kA	G	0.4	1.0	1	1	186.5 deg	26.5 km	6	23.8
1/2/2006	11:10:32.020	38.715	-80.244	0	-12.7 kA	G	0.4	1.0	1	1	188.1 deg	25.3 km	4.8	17
1/2/2006	11:10:32.071	38.718	-80.179	0	-5.9 kA	G	0.5	1.3	1.2	1	175.2 deg	24.8 km	4.4	22.4
1/2/2006	11:10:32.103	38.719	-80.179	0	-8.9 kA	G	2.8	7.2	5.6	5	175.1 deg	24.7 km	5.2	16.6
1/2/2006	11:10:32.104	38.741	-80.183	0	-8.6 kA	G	3	7.7	5	2	175.4 deg	22.2 km	6.6	30.2
1/2/2006	11:10:32.428	38.77	-80.139	0	-15.6 kA	G	0.4	1.0	1	1	163.8 deg	19.7 km	5.2	14.6
1/2/2006	11:12:16.538	38.861	-80.397	0	14 kA	G	1	2.6	2.5	1	242.4 deg	19 km	3.2	30.2
1/2/2006	11:12:16.545	38.847	-80.413	0	-27.8 kA	G	0.4	1.0	1	1	240.1 deg	20.9 km	8.4	30.2
1/2/2006	11:12:16.567	38.843	-80.409	0	-8.3 kA	G	0.5	1.3	1.2	1	238.6 deg	20.8 km	6.4	11
1/2/2006	11:13:08.031	38.744	-80.182	0	-19.1 kA	G	0.4	1.0	1	1	175.2 deg	21.9 km	3.8	30.2
1/2/2006	11:13:08.032	38.743	-80.177	0	-17.6 kA	G	0.4	1.0	1	1	174.2 deg	22.1 km	4.6	30.2
1/2/2006	11:13:08.244	38.979	-80.31	0	-16 kA	G	1.4	3.6	3.5	1	295.1 deg	10.2 km	8.2	30.2
1/2/2006	11:13:08.245	38.996	-80.317	0	-10.8 kA	G	0.4	1.0	1	1	302 deg	11.6 km	12	30.2
1/2/2006	11:14:27.708	38.836	-80.081	0	-35.8 kA	G	2.7	7.0	5.4	4	137.7 deg	15.7 km	23.2	30.2
1/2/2006	11:14:27.763	38.736	-80.171	0	6.3 kA	G	6.9	17.8	17.2	1	173.1 deg	22.9 km	5.8	21.2
1/2/2006	11:15:13.769	38.877	-80.357	0	20.5 kA	G	1.8	4.6	4.5	1	242.1 deg	15.1 km	4.4	13.4
1/2/2006	11:15:13.770	38.877	-80.357	0	-133.9 kA	G	0.4	1.0	1	1	242.3 deg	15.1 km	12	24
1/2/2006	11:15:13.784	38.875	-80.357	0	-35.9 kA	G	0.4	1.0	1	1	241.3 deg	15.1 km	4.4	16.4
1/2/2006	11:15:13.809	38.862	-80.373	0	-5.4 kA	G	0.5	1.3	1.2	3	239.3 deg	17.1 km	2.8	16
1/2/2006	11:15:14.106	38.859	-80.383	0	-8.1 kA	G	0.6	1.5	1.5	1	239.8 deg	18 km	3.8	16
1/2/2006	11:15:22.844	38.746	-80.162	0	-34.8 kA	G	0.4	1.0	1	1	170.6 deg	21.8 km	10.2	21.8

Attachment A

1/2/2006	11:15:23.106	38.747	-80.163	0	-11.1 kA	G	0.4	1.0	1	1	170.8 deg	21.8 km	7.2	15
1/2/2006	11:17:13.030	38.816	-80.043	0	-14.2 kA	G	0.4	1.0	1	1	134.9 deg	19.5 km	5	26.4
1/2/2006	11:17:13.081	38.818	-80.043	0	-9.3 kA	G	0.4	1.0	1	1	134.4 deg	19.4 km	4.6	13.8
1/2/2006	11:17:13.093	38.817	-80.044	0	-7.5 kA	G	0.7	1.8	1.7	1	134.8 deg	19.5 km	4	12.6
1/2/2006	11:17:13.119	38.819	-80.044	0	-10.9 kA	G	0.4	1.0	1	1	134.4 deg	19.2 km	4.8	12.2
1/2/2006	11:17:14.728	38.759	-80.146	0	-9.1 kA	G	0.4	1.0	1	1	166.3 deg	20.8 km	5.2	20
1/2/2006	11:18:11.419	38.748	-80.127	0	-17.9 kA	G	0.4	1.0	1	1	162.9 deg	22.4 km	5.2	18.4
1/2/2006	11:18:11.444	38.749	-80.116	0	-14.9 kA	G	0.4	1.0	1	1	160.6 deg	22.5 km	5	12.4
1/2/2006	11:18:11.452	38.756	-80.126	0	-4.8 kA	G	1.3	3.4	3.2	1	162 deg	21.6 km	3.6	22.4
1/2/2006	11:19:55.232	38.759	-79.984	0	-45.4 kA	G	0.4	1.0	1	1	136.7 deg	27.7 km	7.2	29.2
1/2/2006	11:19:55.266	38.763	-79.999	0	-6.8 kA	G	0.6	1.5	1.5	1	138.2 deg	26.5 km	4.2	19.6
1/2/2006	11:19:55.304	38.751	-79.971	0	-10 kA	G	0.4	1.0	1	1	136.4 deg	29.1 km	4.6	21.8
1/2/2006	11:19:55.469	38.761	-80.109	0	-7.9 kA	G	0.5	1.3	1.2	1	157.7 deg	21.5 km	4.8	18
1/2/2006	11:21:23.816	38.771	-80.068	0	8.8 kA	G	0.4	1.0	1	1	148.1 deg	22.1 km	8.8	30.2
1/2/2006	11:22:15.389	38.783	-80.073	0	-9.4 kA	G	0.5	1.3	1.2	1	147.3 deg	20.8 km	4.8	21.8
1/2/2006	11:22:15.425	38.78	-80.074	0	-19.5 kA	G	0.4	1.0	1	1	148 deg	21.1 km	7	20
1/2/2006	11:22:15.581	38.781	-80.076	0	8.3 kA	G	0.4	1.0	1	1	148.3 deg	20.9 km	5.2	19
1/2/2006	11:23:24.002	38.771	-79.976	0	-21.6 kA	G	0.4	1.0	1	1	133.8 deg	27.2 km	6	26.8
1/2/2006	11:26:35.523	38.897	-80.231	0	38.8 kA	G	0.4	1.0	1	1	206.8 deg	5.4 km	7	26.2
1/2/2006	11:26:35.680	38.926	-80.233	0	101 kA	G	0.4	1.0	1	1	238.5 deg	3 km	14.2	25.8
1/2/2006	11:29:42.455	38.878	-80.089	0	19.3 kA	G	0.4	1.0	1	1	124.9 deg	12.1 km	5.8	16
1/2/2006	11:29:42.939	39.034	-80.089	0	-17 kA	C	0.4	1.0	1	1	43.6 deg	14.3 km	6.6	10.6

Attachment A

VAISALA

ATTACHMENT B

Sago Mine Incident Summary

01/25/06

On 2 January 2006, an explosion occurred at Sago Mine. Seismic recordings from the region suggest a blast time of approximately 06:26:38 EST (11:26:38Z). The NLDN recorded two large positive cloud-to-ground (CG) strokes about 2 seconds before this time. These two events were within 2 km of the position of the mine provided to us by the Charleston Gazette which received the latitude and longitude from the West Virginia Department of Environmental Protection.

The first stroke occurred at 11:26:35.523Z and had an estimated peak current of about +39 kA. Twenty-one (21) NLDN sensors within a range of 1000 km were in very close agreement about the time, location, and peak current of this stroke (Chi-square value of 0.9, with a normal range of (0.5 – 5) – smaller is better). The estimated location uncertainty (50% confidence) was better than 400 meters, and the 99% location uncertainty was better than 1.1 km. The second event occurred at 11:26:35.680, with a peak current of about +101 kA, with the same location uncertainty as the first strokes and a chi-square of 1.2. Twenty-three (23) NLDN sensors were in very close agreement about this stroke.

The time interval between these two strokes was 157 milliseconds, clearly showing that these are two separate events. Both events' waveform characteristics and peak current values are consistent with CG strokes. Investigation of all detected discharges from the closest 3 sensors indicates that there were no other CG strokes associated with this incident. . The closest sensor was about 95 km away. Of the twelve (12) sensors within 500 km, all were operational during this period. Only 2 of the 32 sensors within 1000 km were not reporting data during this time.

The map below was provided to the customer. Images showing the consistency of the sensor data for each stroke are also provided. For each reporting sensor, the timing data are represented as yellow circles intersecting at the strike location, and azimuth data are represented as red lines from sensors to strike location.

VAISALA

ATTACHMENT B

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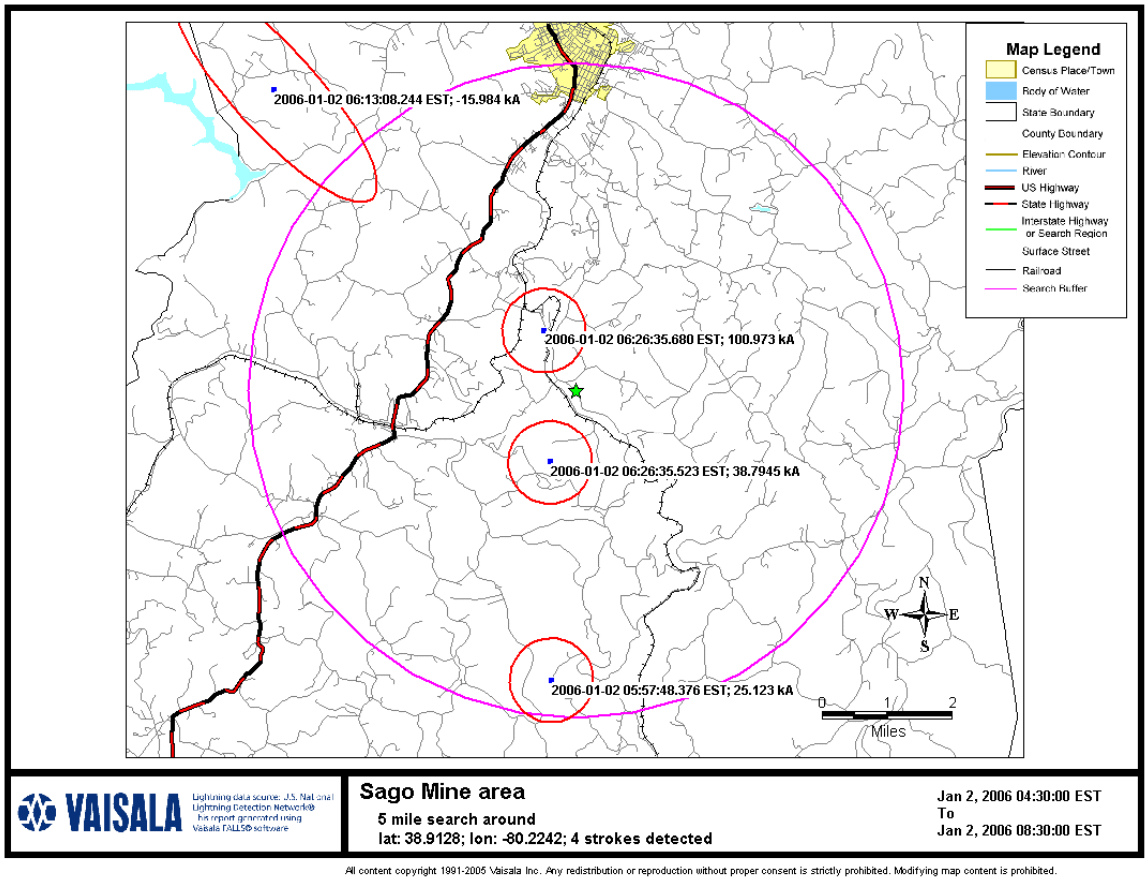

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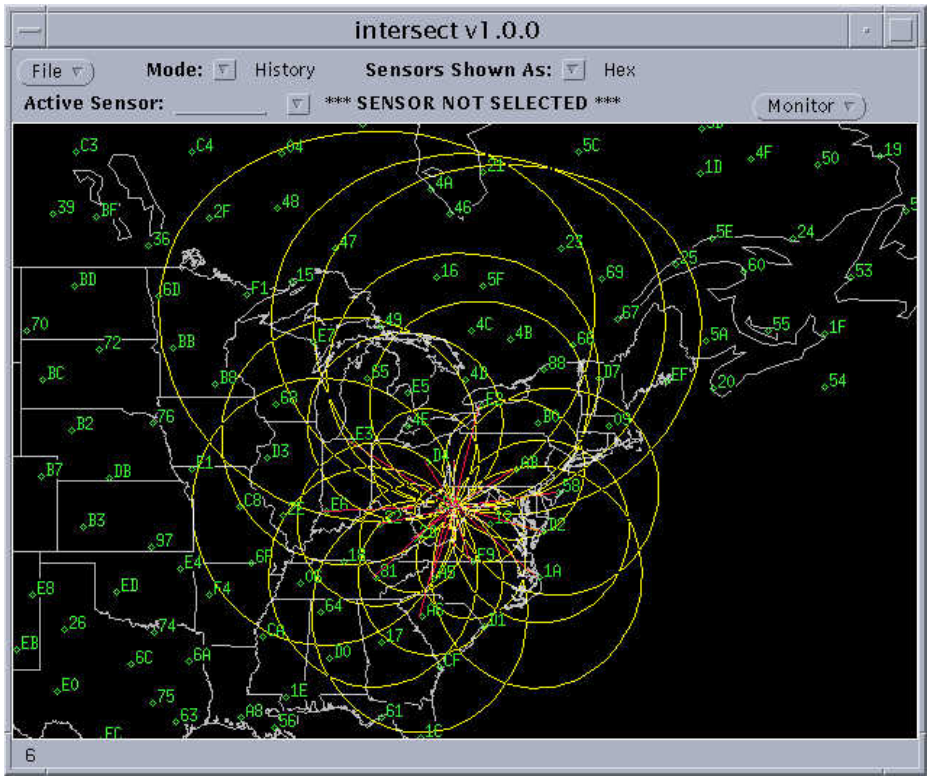
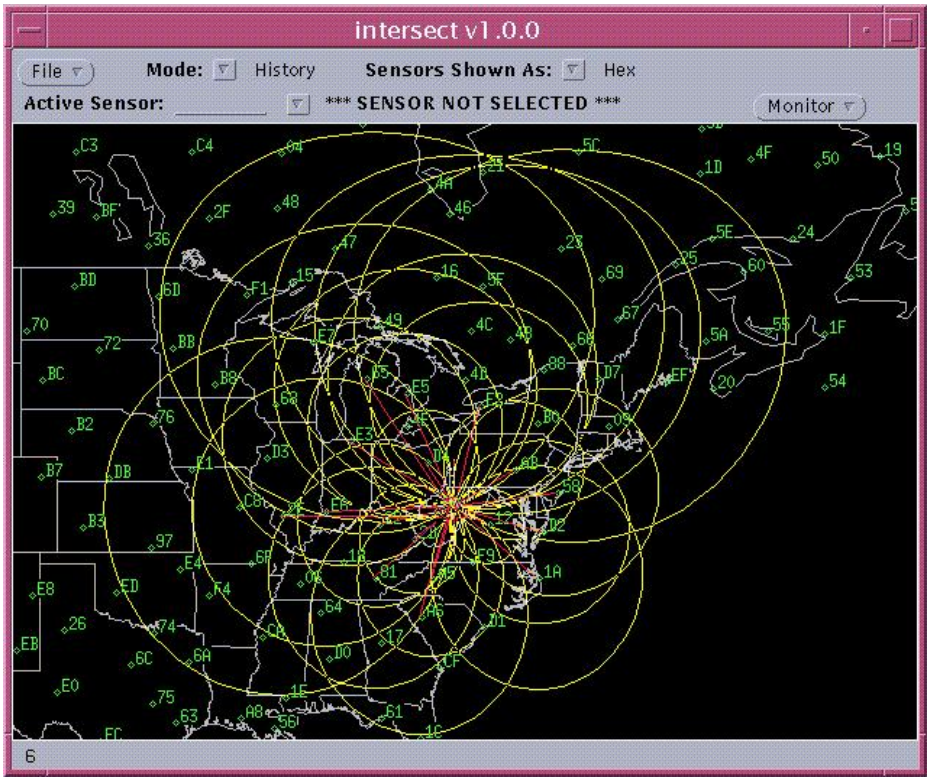
ATTACHMENT B





ATTACHMENT C **MEMO**

TO: Doug Conaway
FROM: Monte Hieb
DATE: January 12, 2006
SUBJECT: Timing of explosion corresponds to lightning strike

Yesterday with the help of John Scott, Marshall Robinson (Allegheny Land Surveying), and Kevin Hedrick (MSHA) it was determined that the time of the explosion January 2, 2006 at Sago Mine occurred at **6:26:35 am**.

This determination was made by comparing the time on the CO monitoring computer at Sago to a GPS clock (precise actual time). The Sago CO computer clock was determined to be running 4 minutes 56 seconds (00:04:56) ahead of the GPS clock.

John Scott advised that the first spike on the **CO computer log** for January 2, 2006 was 51 ppm which occurred at 6:31:31 am. Subtracting the time correction places the actual time of this event at **06:26:35 am**.

This corresponds precisely with the timing of two nearly simultaneous **lightning strikes** approx. 2 miles apart, located on the attached map. The strongest of these, recorded by Vaisala (StrikeNet), was reported to be a +101.0 kA hit at LAT 38.926, LONG -80.233 at **06:26:35.680 am** on January 2, 2006. This is the location where Sago engineer Kermit Melvin and myself found the lightning-struck tree last Friday (see Photo 1).

A second, smaller strike of +38.8 kA occurred nearly simultaneously nearby at LAT 38.897, LONG -80.231 at 06:26:35.522 am. This one left no obvious physical damage on the ground or treetops, but prevalent minor tree damage from prior early snows last fall may have obscured evidence of a minor strike.

The 06:26:35 am timeframe for the explosion also seems to be corroborated by a subtle **seismic event** recorded by a USGS seismic station located at WVGES at Mont Chateau and detected by Martin Chapman, a geophysicist at the University of Virginia. He places the time at approximately **06:26:38 am +/- 3 sec**. The proof for this has not yet been independently verified.

Unless evidence is uncovered in the future which casts doubt on the facts as stated above, there is convincing circumstantial evidence that the explosion at Sago Mine on January 2, 2006 was directly related to one or both of the lightning strikes recorded at 06:26:35 am, both of which occurred on the opposite side of the Buckhannon River from Sago Mine.

ATTACHMENT C

Notably, a 12 kvA powerline passes within about 500 feet of the +110 kA lightning strike location (see map, attached). This line begins at the Allegheny Power substation on French Creek and supplies the power to the Sago preparation plant and Sago Mine.

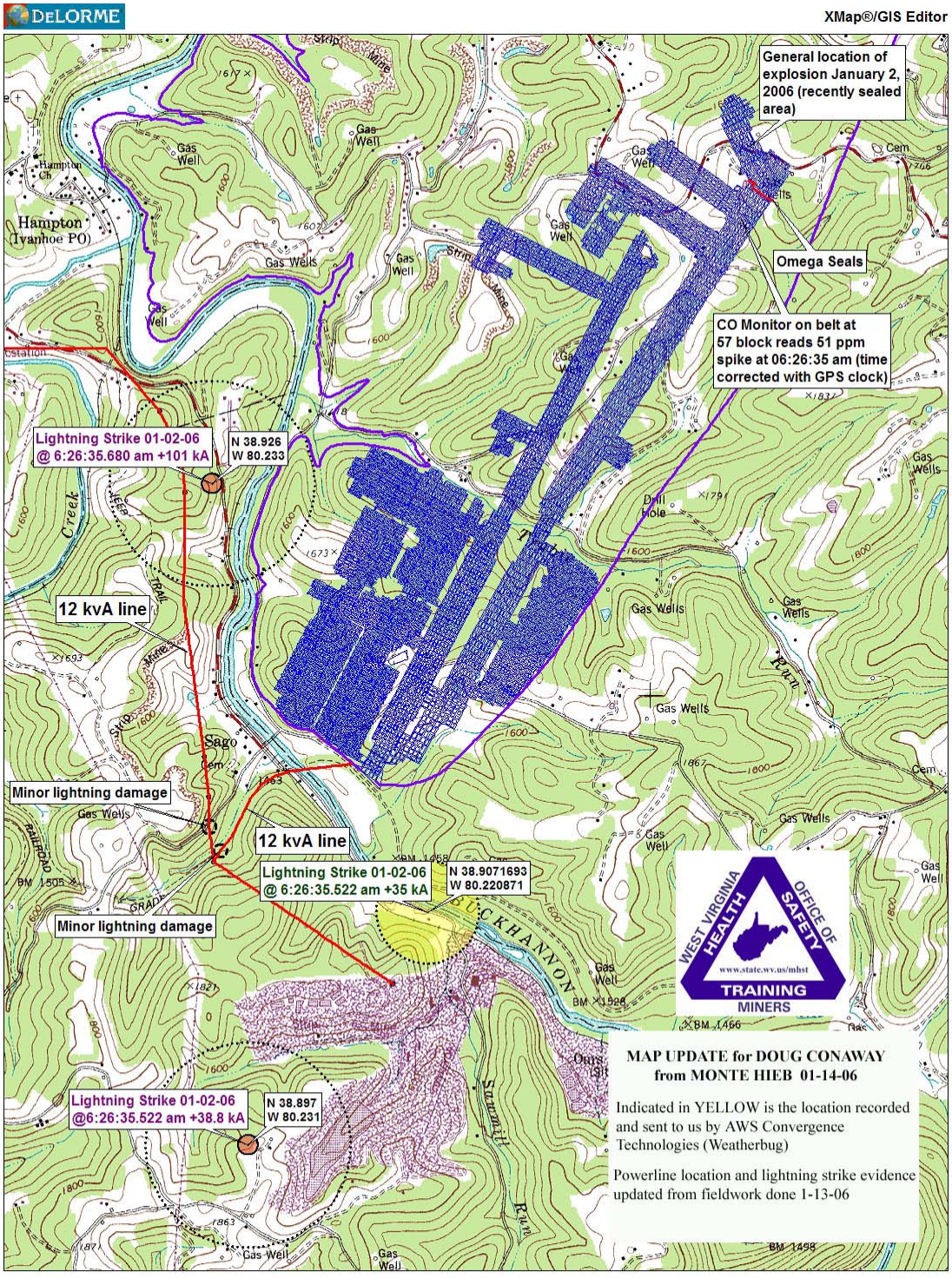
Because of these findings, it is suggested that we begin taking a look at the conductive and grounding systems of the 12 kvA transmission line to explore the possibility that a power surge may have entered Sago Mine by such means. Pipelines, phone communication lines, and other similar structures at this location should also be examined.

Photo 1. Poplar tree very recently hit by lightning and in close proximity to +110 kA hit recorded by

ATTACHMENT C

Vaisala (StrikeNet) at LAT 38.926, LONG -80.233 at **06:26:35.680 am** on January 2, 2006, Photo by Kermit Melvin, January 6, 2006.

ATTACHMENT C



2705 E Medina Rd Tucson AZ 85706-7155 Telephone 520.806.7300 Fax 520.741.2848 Toll Free 800.283.4557

ATTACHMENT D

Sensor	*Range (km)*	*95% Angle Error (degrees)*
Spencer, WV	95	2
Charlottesville, VA	177	4
Orville, OH	250	2
Pikeville, KY	255	3
Danville,VA	272	2
New Buffalo, PA	327	3
Lenior, NC	361	4
Lexington, KY	383	2
Wallops Island, VA	428	3
Windsor (Canadian)	440	Timing Only
Egg Harbor, NJ	485	2
Sanborn, NY	488	4

Table 3: Angle Error by Sensor

VAISALA Lightning data source: U.S. National Lightning Detection Network® This report generated using Vaisala FALLS® software

Vaisala Faultfinder ®

ATTACHMENT D

Detection Efficiency Performance Analysis
Sago Mine 01/02/06

Detection efficiency and location accuracy were examined for an area centered on 38.9128 -80.2242 for January 2, 2006. Lightning events within 50 kilometers were examined to verify network performance. The numerical results are summarized in Table 1 below. Detection Efficiency and Location Accuracy projections were examined for this region. Median location accuracy is projected to be 0.5 kilometers, and the flash detection efficiency is expected to be at least 90 percent. Average stroke detection efficiency should have been at least 70 percent, with higher values for high peak current strokes. Sensors within 500 kilometers of the point of interest were checked to ensure they were operating normally. Reported network-relative detection efficiency values for each sensor are provided in Table 2. Table 3 provides the 95% angle error in degrees for each sensor that provided angle information. Based on this analysis, the network appears to have been functioning normally.

ANSR	*Avg Ip-*	*Avg Ip+*	*Avg Chi**	*Avg SM**	*Median SM**	*Count*	*Positive count*	*Neg count*	*Small Pos count*
8	*-18.8*	*36.0*	*1.0*	*0.95*	*0.4*	*391*	*89*	*302*	*13*

Table 1: QC Information
(* Note that small postive events are excluded from Chi Squared and SM statistics)

Sensor	*Range (km)*	*D.E*
Spencer, WV	95	53.8
Charlottesville, VA	177	71.7
Orville, OH	250	73.1
Pikeville, KY	255	73.3
Danville,VA	272	64.5
New Buffalo, PA	327	49.1
Lenior, NC	361	46.4
Lexington, KY	383	58.4
Wallops Island, VA	428	30.7
Windsor (Canadian)	440	38.7
Egg Harbor, NJ	485	25.5
Sanborn, NY	488	32.1

Table 2: Detection Efficiency by Sensor

VAISALA Lightning data source: U.S. National Lightning Detection Network®
This report generated using Vaisala FALLS® software

Vaisala Faultfinder ®

ATTACHMENT D

Glossary of Terms

ANSR - Average Number of Sensors Reporting - this provides an estimate of detection efficiency

Avg Ip- - Average negative peak current.

Avg Ip+ - Average positive peak current.

Avg Chi - Average Chi-squared value. Chi-squared values are calculated for each event, and provide a measure of the level of agreement among the sensors participating in a lightning event. The average of this parameter provides an overall estimate of how well the network is performing. Values of less than one (1.0) suggest that random error is less than assumed; very large values indicate that errors are larger than expected.

Avg SM - Average Semi-major axis - This statistic provides an overall estimate of location accuracy. However, this statistic can be significantly affected by a few very large values. See Median SM.

Median SM - Median Semi-major axis - It is the value at which half of the semi-major axis values are above, and half below. This statistic provides a better estimate of location accuracy than Avg SM because it is less sensitive to a small number of events with large values.

Small Pos Count - Number of positive events with peak current value of less than 10 kA.

95% Angle Error - 95% of “eligible” events seen by a sensor will had an angle error that was smaller than this value. Eligibility is based on an event being part of a valid location, with sufficient signal strength to provide a reasonable azimuth.

2705 E Medina Rd Tucson AZ 85706-7155 Telephone 520.806.7300 Fax 520.741.2848 Toll Free 800.283.4557

ATTACHMENT E

WDT Report of April 3, 2006, by Mark Sessing

The Nearest Occurrence of Lightning to Lat 38.9401, Lon -80.2025

For the Period
5:00 AM EST January 2, 2006 to
7:00 AM EST January 2, 2006

Prepared by

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Meteorologist
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For

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Date Prepared: April 3, 2006

Powered by WDT

INTRODUCTION

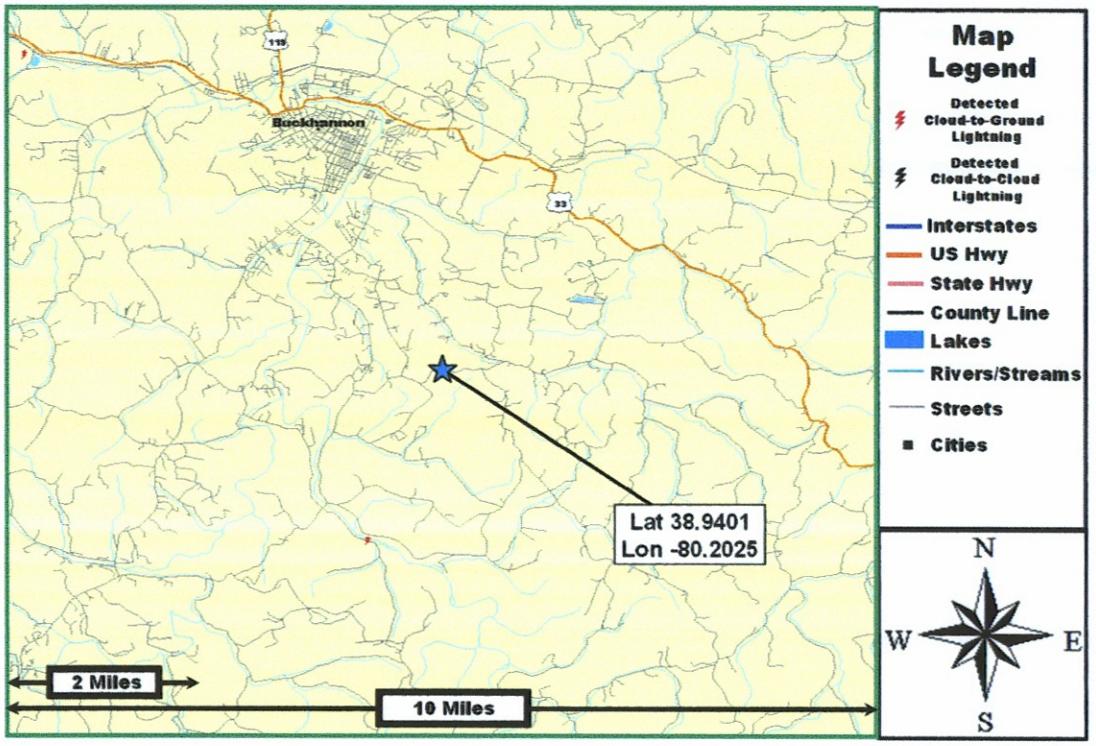
This report describes the identified cloud-to-cloud and cloud-to-ground lightning activity within a 10 mile by 10 mile (100 mi^2) area centered on Lat 38.9401, Lon -80.2025. Expert meteorologists at Weather Decision Technologies, Inc. (WDT) have carefully examined the archived record of cloud-to-cloud and cloud-to-ground lightning strikes within this area of interest for the time period 5:00 AM EST January 2, 2006 to 7:00 AM EST January 2, 2006 to determine the closest lightning strike(s) to the location of interest. This report describes the results of our investigation.

LIGHTNING ANALYSIS/CONCLUSION

The purpose of this investigation is to determine the closest lightning strike(s) to the location of interest. The source of lightning data for this investigation is the United States Precision Lightning Network (USPLN) which is maintained and operated by WDT and TOA systems Inc. The USPLN lightning data archive consists of identified cloud-to-cloud lightning strikes and cloud-to-ground lightning strikes since May 28, 2004, and the location accuracy of cloud-to-ground lightning data detected by USPLN is 250 meters (.076 miles).

An examination of the lightning strikes during the 24-hour period of interest reveals that no cloud-to-cloud lightning strikes and two cloud-to-ground lightning strikes occurred during the time period of interest within the 10 mile by 10 mile (100 mi^2) area centered on the location of interest (Figure 1).

Figure 1. Map centered on the location of interest. The identified cloud-to-ground lightning strikes are depicted with red "bolts". The light blue star depicts the location of interest. The area extent is 10 miles by 10 miles (100 mi^2). (Lightning data source: USPLN)



Appendix 1. Cloud-to-ground lightning strikes for the period of 5:00 AM EST January 2, 2006 to 7:00 AM EST January 2, 2006 within the 10 mile view shown above. Time is in 24-hour Eastern Standard Time (EST) format. Heading is relative to due north from the location of interest. For example, 90 degrees = east, 180 degrees = south, 270 degrees = west, 0 degrees = north. (Lightning data source: USPLN)

Date (mm/dd/yy)	Time (hhmmss)	Latitude (Degrees)	Longitude (Degrees)	Magnitude (Amps)	Heading (Degrees)	Range (Miles)
01/02/06	62635	38.907	-80.221	35000	203	2.5
01/02/06	63851	39.007	-80.288	-35800	315	6.5

ATTACHMENT F.

Single Sensor NLDN Reports Near the Time of the Sago Incident

HexID	Time	nanoseconds	mult	Azi	SS	RT	PTZ	Type	Located Event Time	Lat	Lon	Peak Current	Azimuth (mine entrance)	Range, km (mine entrance)
E2	11:26:22	460001468	1	193	22.3	5.2	30.2	IES	11:26:22.455	31.266	-81.681	-49 kA	188	860
D4	11:26:22	826447486	1	147.6	16.4	5.4	18.8	IES	11:26:22.823	32.786	-77.462	-23kA	161	725
AB	11:26:25	670742869	1	241.1	23	4.2	19.6	IES	11:26:25.670	37.933	-81.817	-150kA	231	176
58	11:26:25	672722578	1	258.5	-55.6	22	30.2	IES	11:26:25.670	37.933	-81.817	-150kA	231	176
58	11:26:25	682949542	1	263.1	-24.9	8.4	28.2	IES						
22	11:26:25	691889047	1	85.1	-61.4	5.4	22.2	IES						
AB	11:26:25	693128943	1	239.9	-33.9	11.8	30.2	IES						
2D	11:26:27	474915146	1	57.7	-145.5	6.4	26.2	IES	11:26:27.474	38.313	-81.376	-23kA	236	120
22	11:26:27	475384831	1	75.4	-62.8	4.4	26.4	IES	11:26:27.474	38.313	-81.376	-23kA	236	120
AB	11:26:27	475962400	1	239.5	-28.7	4.6	30.2	IES	11:26:27.474	38.313	-81.376	-23kA	236	120
2D	11:26:27	543472290	1	57.4	-116.4	5.8	18.2	IES	11:26:27.543	38.285	-81.374	-20kA	235	122
22	11:26:27	543947219	1	76.9	-51.5	4.6	18.6	IES	11:26:27.543	38.285	-81.374	-20kA	235	122
AB	11:26:27	544529557	1	238.4	-25	4.8	15.4	IES	11:26:27.543	38.285	-81.374	-20kA	235	122
22	11:26:32	276832699	1	79.8	-33.9	4	14.4	IES	11:26:32.275	38.216	-81.313	-13kA	230	122
22	11:26:32	318519592	1	76.7	-42.3	6	20.8	IES	11:26:32.317	38.227	-81.301	-17kA	231	121
AB	11:26:32	319076299	1	238.8	-23.4	5	18.8	IES	11:26:32.317	38.227	-81.301	-17kA	231	121
58	11:26:32	319646716	1	266.2	17.3	6	19	IES	11:26:32.317	38.227	-81.301	-17kA	231	121
59	11:26:35	512344956	1	82.7	-21.6	2	20.6	IES						
59	11:26:35	518452286	1	80.5	21	3.2	12.8	IES						
59	11:26:35	523181452	1	85.6	341.6	7	26.2	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
12	11:26:35	523466825	1	296.5	135.4	7.6	24.6	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
D4	11:26:35	523712873	1	144.9	123	5.8	27.2	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
2D	11:26:35	523723006	1	60.2	119.1	7.2	21	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
F9	11:26:35	523776888	1	349.6	73.5	7.6	26.4	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
AB	11:26:35	523973703	1	239.9	77	6.6	30.2	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
A5	11:26:35	524073362	1	17.5	61	6.6	22.6	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
22	11:26:35	524154543	1	67	69.3	5.6	22.6	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
D2	11:26:35	524309158	1	292.3	44.3	6.4	30.2	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
4E	11:26:35	524349650	1	---	45.5	4.4	45.2	LPAT	11:26:35.522	38.897	-80.231	+38kA	199	2
58	11:26:35	524501562	1	269.7	43.4	6.6	30.2	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
E2	11:26:35	524507641	1	197.4	48	5.2	30.2	IES	11:26:35.522	38.897	-80.231	+38kA	199	2
AB	11:26:35	674764990	1	239.7	-22.2	3.8	22.6	IES		(Closest event to blast time)				
59	11:26:35	680472373	1	83.5	-217.6	3.8	30.2	IES						
12	11:26:35	680686950	1	296.6	356.2	14.2	25.8	IES	11:26:35.680	38.926	-80.233	+101kA	322	2
D4	11:26:35	680917263	1	144.4	308.7	13.2	30.2	IES	11:26:35.680	38.926	-80.233	+101kA	322	2
2D	11:26:35	680943608	1	58.7	247	12.6	30.2	IES	11:26:35.680	38.926	-80.233	+101kA	322	2

Attachment F

HexID	Time	nanoseconds	mult	Azi	SS	RT	PTZ	Type	Located Event Time	Lat	Lon	Peak Current	Azimuth (mine entrance)	Range, km (mine entrance)
AB	11:26:35	681183218	1	239.9	213.1	12.6	30.2	IES	11:26:35.680	38.926	-80.233	+101kA	322	2
A5	11:26:35	681298851	1	15.5	135.2	11.8	29	IES	11:26:35.680	38.926	-80.233	+101kA	322	2
22	11:26:35	681372284	1	66.2	152.7	9.8	30.2	IES	11:26:35.680	38.926	-80.233	+101kA	322	2
D2	11:26:35	681528568	1	292.1	130.8	11.2	30	IES	11:26:35.680	38.926	-80.233	+101kA	322	2
4E	11:26:35	681556350	1	---	116.6	8.8	48.8	LPAT:	11:26:35.680	38.926	-80.233	+101kA	322	2
E2	11:26:35	681713461	1	197.2	137.8	10.2	30.2	IES	11:26:35.680	38.926	-80.233	+101kA	322	2
58	11:26:35	681716084	1	270.8	123.9	10.8	30.2	IES	11:26:35.680	38.926	-80.233	+101kA	322	2
59	11:26:35	683898448	1	80.1	-16.5	3.8	30.2	IES						
59	11:26:35	684713840	1	78.5	-18.2	3.2	30.2	IES						
59	11:26:35	686345934	1	74.7	-19.2	2.4	30.2	IES						
59	11:26:35	687035560	1	79.9	-19	4.2	17.4	IES						
59	11:26:35	737348318	1	79	21.1	2.2	12.2	IES						
D4	11:26:35	738289237	1	142.9	20.7	3.8	19.4	IES						
59	11:26:35	739481329	1	79	20.8	2.6	16.2	IES						

Red Indicates uncorrelated events which have azimuths consistant with the Sago blast point
Green Indicates located events associated with Sago investigation
Unshaded rows indicate event is associated with other located lightning events

Sensor Summary:

0x59	Spencer,WV	97.5 km
0x12	Charlottesville	176.4 km
0xD4	Orville, OH	247.7 km
0x2D	Pikesville, KY	257.4 km
0xF9	Danville, VA	273.4 km
0xAB	New Buffalo,P	323 km
0xA5	Lenoir, NC	363.4 km
0x22	Lexington, KY	384.6 km
0xD2	Wallops Islanc	426.3 km
0x4E	Windsor, ON	437.7 km
0x58	Egg Harbor, N	481.7 km
0xE2	Sanborn, NY	483.2 km

Attachment F

APPENDIX 5

The Investigation

(5.5) Cause of Explosion

(5.5-3) How Lightning May Have Entered The Mine

- **Electrical System – Map Showing Conductors and Resistivity Test Locations**
- **Description of Pump Cable Lengths and Associations**
- **Description of Gas Lines and Wells**
  - **Summary of Possible Paths**
  - **Map of Gas Lines and Wells**
- **Water Samples Old 2nd Left Section**
- **Map of Telephone Lines**
- **Geophysical Log to Core Hole SF 52-06**

Apprx. Origin Of Explosion
Wire Mesh
Location Of Resistivity Tests
Pre-Explosion Seal Locations
High Voltage Line
Underground Communication Line
Underground Track
Rigid Rail Conveyor Belt (Chain Hung)
Belt Power Center
2 Left Section
Apprx. Origin Of Explosion
Omega Seals
N 38.92550 Deg.
W 80.23337 Deg
Verizon 1981 Telephone Line
Verizon 1970's Telephone Line
Struck by Lightning
12KV Power Line
Neutral Ground Bed (On Surface)
Neutral Ground Bed (On Surface)
Neutral Ground Lead
Neutral Ground Bed (On Surface)
Main 12 KV Elect. Line
Power To Mine
High Voltage Line
Step-Down Transf To 480 Vt.
Main Substation
Elect. Power To Charging Station & Belt Drive
Underground Communication Line (Grounded To Track)
Verizon Telephone Line To Sago Mine (Aerial)
Step-Down Transf To 240 Vt.
Battery Charging Station
Elect. Transformer To Outside
Pit Pump
Underground Track
Rigid Rail Conveyor Belt (Chain Hung)
Office & Dispatch
Stacker Belt Drive
Verizon Telephone Line To Prep-Plant (Buried)

Map Showing Potential Electrical Conductors Of The Mine And Resistivity Tests Near The Explosion Origin

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MN (8.4° W)

0 180 360 540 720 900 ft

Data Zoom 15-0

State of West Virginia

Office of Miner's Health, Safety and Training
Region One
205 Marion Square
Fairmont, WV 26554

May 25, 2006

In conjunction with the ongoing investigation of the mine disaster that occurred at the Anker WV Mining Company, Sago Mine on January 02, 2006 this is a report of the findings of the examinations conducted of a pump cable located in the old 2 Left area of the Sago mine.

John Collins, District Inspector, conducted the examinations of the cable on Monday February 13, 2006 and Thursday May 25, 2006. Other examinations of the cable, including the removal of the cable coupler, removal of the ends at each cable break and the removal of the inline starting box for testing purposes have also been conducted by MSHA and/or the WV OMHST.

Due to the amount of water being made in the face area of the old 2nd Left section this cable was used to power an electrical de-watering pump located near the stopped working face of the #6 entry. Mining advancement had been stopped on the old 2nd Left section and retreat mining operations consisting of mining the lower coal seam was being conducted. As the section was moved back additional cable would be added to allow use of the pump.

The cable is a Tiger Brand, 6/3 cable, Lead Cured, 600-2000 volt, 3-C 6 AGW, Type G-GC, P-7K-184035-MSHA*CPE, FT1, FT5-50C. This information was taken from the pieces of cable and the information is embedded in a repeated pattern manner on the cable.

Upon inspection of the cable it was found to be separated into four (4) pieces. Location and condition as described.

The #1 piece of cable which is the out-by piece with the cable coupler attached measured approximately 199 feet 6 inches in length. The coupler had an identification tag attached identifying the coupler as pump #13. It was discovered that this coupler had previously been used to power a pump #13 located near the old 2nd Left belt conveyor drive. This pump had been taken out of service and the coupler and some of the pump cable was added to the pump cable of the pump which is located in the face area of old 2nd Left. The coupler was located on the mine floor in the (old track) #5 entry near the out-by right side corner of the crosscut located near spad 4028.

During retreat mining the section power center had been located just out-by spad 4028 and the pump cable coupler had been connected. Pieces of wire and one (1) cable hanger are located attached to the roof screen near the coupler location which could have been used to hang the coupler. The mine floor is dry in this area at this time but was wet during the time of mining.

Approximately (65) feet of slack cable was located looped back into the crosscut right at this location. The cable then extended in-by located on the mine floor for one crosscut with approximately (41) feet of slack cable located in the crosscut left at spad 4041. This slack cable was located along the out-by rib of the left crosscut between the #4 and #5 entries. The slack cable was twisted and sort of entangled with a piece of old power cable located in this crosscut. The pump cable appeared not to have been placed at this location in any type of organized manner. This piece of cable has three (3) permanent splices, and one (1) repaired place. No cable hangers or wire was found attached to the cable and no other damage was observed. It appears that the #1 piece of cable had been torn apart creating cable piece #2. The ends of cable #1 and #2 matched as if at one time being connected using the embedded cable information (MSHA/CPE) as a pattern match and evidence of the two (2) damaged ends matching. Evidence shows that the cable was pulled into at this location. The out-by end of the break is broken in a female manner and the in-by end of the break is broken in a male manner. When the slack cable of cable piece #1 was pulled out of the left crosscut and extended in-by in the #5 entry and the out-by end of cable piece #2 that was looped in-by back over itself was pulled out-by in the #5 entry the two (2) cables connection matched.

The #2 piece of cable which would be the second piece in-by the coupler, measured approximately 188 feet in length. The cable was located on the mine floor with the out-by end looped back in-by and against a wall where bottom mining had been stopped. The in-by area of the cable located near spad 4089 has crib blocks entangled in with the cable. The crib blocks are located both on top of and under the cable. The cable begins near spad 4041 and extends in-by in the #5 entry for a distance of 2 and ½ crosscuts. The in-by end of the #2 cable has evidence that the cable was pulled apart where as the conductor ends are broken at uneven lengths. Also, two (2) large damaged areas located near the in-by end show pull inthat the conductors are protruding out the side of the cables outer insulation. Two (2) small damaged areas with exposed insulated conductors also exist near this location. The #2 piece of cable has four (4) pieces of tie wire and metal spads still attached which would have been used to hang the cable. The in-by end of cable #2 matches the out-by end of cable #3 inthat the embedded pattern matches. (Out-by 184035 and in-by P-7k) and when pulled together in the #5 entry the cables connection matched.

The #3 piece of cable begins near spad 4089 and extends in-by in the #5 entry to just in-by spad 4105 a distance of approximately 1 and ¼ crosscuts or approximately 100 feet. The in-by end of the #3 cable looped back in-by for a distance of twenty-seven (27) feet. The #3 cable is located on the mine floor entangled with crib blocks both on top and under the cable. A large piece of white ventilation curtain which has evidence of being exposed to heat is entangled in the cable. There are two (2) nylon type hangers still

attached to the #3 cable near the in-by end which are burnt and very brittle. The in-by end of the #3 cable shows it was pulled apart at a permanent splice. No other splices were found.

Two (2) damaged areas exist in the #3 cable near the out-by end. One (1) area is small and has exposed insulated conductors. The other damaged area is 3 and ¼ inches long with exposed conductors that have the outer insulation burnt away. The insulation is burnt away on one phase conductor wire which is contacting the ground monitor wire which has the insulation burnt away at the same location and is contacting another phase conductor wire which also has the insulation burnt away. This condition would create a phase-to-phase condition if the cable were energized. The in-by end of cable #3 matches the out-by end of cable #4 and when pulled together in the #5 entry the cables connection match.

The #4 piece of cable begins just in-by spad 4105 and extends in-by in the #5 entry for a distance of four (4) crosscuts to spad 3698. The cable then extends through the crosscut right into the #6 entry and in-by for one (1) crosscut to spad 3713 where the cable passes through the crosscut right into the #7 entry at spad 3710. The cable is now installed in the #7 entry and extends in-by for two (2) crosscuts to the next to last open crosscut where it turns left and passes through into the #6 entry and connects to the starting box. It is believed that the cable then extends from the starting box in-by to the pumps located near the face in the last open crosscut of the #6 entry.

Due to the water being roofed from the starting box in-by, the exact location of the cable and pump is not known. The total length of the #4 cable would be approximately eleven (11) breaks or approximately 850 feet. Several repair places and splices exist in the #4 cable but all are in good repair and do not appear to have been damaged by the explosion. Most of the cable is still hung in-by elevation 1375 which is the approximate water roofed elevation at the time of the explosion. Part of the cable is still submerged in the #5 entry from spad 4125 in-by for a distance of two (2) crosscuts where the bottom mined area still holds water.

The total length of the pump cable is approximately 1,337 feet covering an approximate distance in the mine of 1, 250 feet.

On February 13, 2006 a written request was submitted to Anker WV Mining Company for information concerning this cable and pump. A copy of the request and response is attached.

Based upon evidence found during the examinations of the cable in question it was not found that the cable had been cut with an axe or that several breaks of cable had been dragged back and placed at a location during the time the cable was being used to provide power to the pump in the face of the #6 entry of old 2nd Left.

It is further believed that said cable was one continuous cable extending from the cable coupler near spad 4028 in-by to the pump located in the face of #6 entry of old 2nd Left at

the time of the explosion on January 2, 2006. I found no evidence that the power cable was or could have been energized at that time.

A request has been submitted for Anker WV Mining Company to recover the de-watering pump located in the face of #6 entry of the old 2nd Left working section.

The investigation as of this date is still ongoing and any information or findings are of a preliminary nature at this time.

_____

John Collins, District Inspector

JAC/jc

Copy: file

Possible Method That Gas Lines Can Act As A Conductor To Origin Of Explosion

This method considers that lightning utilizes the gas lines and wells as a conductor path and possible coupling with Sago Mine. Further testing is required to measure the continuity of these possible paths.

Path One: (Depicted in dark blue on the attached map.)

Lightning Would Need To:

- Travel from the lightning location 1,500 ft over or through the ground to the Trubie Run gas line.
- Travel along Trubie Run gas line for 1.37 miles. This line is primarily steel, but has several breaks that are repaired by splicing plastic line at the breaks. The longest break observed to date is 25 feet. In these locations the electricity would have to travel over or through the ground and then re-connect to the steel line.
- After traveling 1.65 miles (summation of the above), lightning would need to then travel north for 1.24 miles to the ECA Meter to CNR Line.
- The lightning would need to travel west for 1,100 feet to the Roessing No.3 Well.
- From there the lightning would need to travel down the Roessing Well casing and through the strata approximately 125 feet to the sealed mine workings.
- The total distance of travel is 3.58 miles.

Photo 1:
Location Where Trubie Run Gas Line
Crosses Another Company's Gas Line

Photo 2:
A Twenty Five Foot Break In Trubie Run Steel Gas Line
And Spliced Together With Plastic Gas Line

Photo 3:
A Two Foot Break In Trubie Run Gas Line
And Spliced With Plastic Gas Line

Photo 4:
Break In Trubie Run Gas Line
And Spliced With Plastic Gas Line

Path Two: (Depicted in dashed dark blue on the attached map.)

Lightning Would Need To:

- Travel from the lightning location 1,500 ft over or through the ground to the Trubie Run gas line.
- Then travel along Trubie Run gas line for 2,356 feet and go to ground, crossing the Buckhannon River.
- The lightning would then contact Well No. 1374 and travel east along the associated gas line for 1.73 miles to and down the Roessing No.3.
- From there the lightning would need to travel through the strata approximately 125 feet to the sealed mine workings.
- The total distance of travel is 2.60 miles.

Map of Gas Wells and Lines

In The Vicinity of Sago Mine
Upshur County, WV

- Gas Well Location
- Gas Line Location
- Gas Meter Location
- 1313 Gas Well ID
- Gas Line Lightning Path 1
- Gas Line Lightning Path 2
- Possble Lightning Ground Path

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MN (8.4° W)

0 180 360 540 720 900 ft
Data Zoom 15-0

N

Koon 2188
1313
Gas Well
Strip Mine
1600
1617
ECA-Meter to CNR Line
ECA-Roessing No.3 47-097-01251
Old Plugged Well (8" Casing Exposed)
Ross-Roessing No.2 47-097-1230
Gas Well
Omega Seals
Apprx. Origin Of Explosion
Wells
1262
Gas Well
1688
47-097-01154
ECA-Tenney No. B1 47-097-02180
1374
1120
Gas Wells
1607
Gas Well
Strip Mine
ECA-Roessing No. 1
Possible Gound Path of Lightning
A.L. Burner 1
1819
1600
2379
911067
1600
ECA Meter to CNR Line
1220
Gas
House Gas Only
1418
Possible Ground Path of Lightning
Trubie Run Gas Line
Trubie Run Line Crosses Buckhannon River (Appx. 1,500 Ft. From Lightning Strike
Isolated
Suder? Isolated
N 38.92550 Deg. W 80.23337 Deg
Poplar Tree Struck by Lightning
1600
1673
Trubie
C&A 447
1791
Drill Hole
650386
Trubie Run Gas Line Crosses And Touches Another Companies Gas Line
910356-P1
C&A 4071
910369-PI
0230
Gas Wells
Gas Wells
650398
Cem
1724
1112
Gas W
1600
Sago
Cem
1463
1573
1421
Gas Well
2992
XBM 1458
Gas Well

Verizon Aerial
1981

Verizon Underground
Mid 1970's

1981 Ground 1

38.92550 Deg.
W 80.23337 Deg

70's Ground 1

Poplar Tree
Struck by Lightning

70's Ground 2

70's Ground 3

Rutheford
Drop Line

70's Ground 4

70's Ground

2-3 Pairs Bridged
Btw 70's Line and
1981 Line

1981 Ground

Seperate Ground
For Each Line

2-3 Pairs Bridged
Back To Original Line

Seperate Ground
For Each Line

Seperate Ground
For Each Line

Seperate Ground
For Each Line

70's Ground

Seperate Ground
For Each Line

Verizon 1981
Aerial

Office

Verizon Telephone Line & Underground Communication Line
Are Attached To A Common Pole But Have Independent Junction Boxes.

Verizon 70's
Underground

Network Of Verizon's Telephone Communication Lines

LEGEND

70'S Line — Buried Line

1981 Line — Aerial Line

Grounded Junction Box

Location of Bridged Lines

Underground Communication Line

Common Power Pole

MN (8.4° W)

0 100 200 300 400 500 ft

Data Zoom 15-0

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CENTRAL TESTING, INC.
P.O. Box 481
Summersville, WV 26651
304-872-6974

Analysis for ... WV OFFICE OF M.H.S. & T.
142 INDUSTRIAL DRIVE
OAK HILL, WV 25901

I.D. Number ... 516352
Sample Date ... 3/2/2006
Site I.D. ... SAMPLE #1
END OF OLD 2ND LEFT
Permit Number . SAGO
MINE
Outlet Number ... SAMPLE#1
Sample Type ... GRAB
Sample by ... MONTE HIEB
Date Received. 3/4/2006
Analyzed/By... 3/7/2006-SD,KH,CS

LABORATORY ANALYSIS PERFORMED	ANALYSIS RESULTS	METHOD	MDL
Specific Conductance	476.0 UMHO/CM	2510 B	1.50
pH (Laboratory Analysis)	8.02 Std. Unit		
Total Alkalinity	161.0 mg/l	2320	1.0
Total Hot Acidity	< 1.0 mg/l	2310 B	1.0
Total Suspended Solids	< 1.5 mg/l	2540 D	1.5
Hardness (Calculated)	54.0 mg/l	2340 C	
Total Calcium	8.217 mg/l	3111 B	0.02
Total Magnesium	8.140 mg/l	3111 B	0.02
Sulfates	19.0 mg/l	375.4	1.0
Total Iron	0.20 mg/l	3111 B	0.01
Total Manganese	0.04 mg/l	3111 B	0.01
Total Aluminum	< 0.03 mg/l	3111 D	0.03
Total Dissolved Solids	274.0 mg/l	2540 C	5.0

Respectfully

Janis L. Reger
CENTRAL TESTING, INC.

CENTRAL TESTING, INC.
P.O. Box 481
Summersville, WV 26651
304-872-6974

Analysis for ... WV OFFICE OF M.H.S. & T.
142 INDUSTRIAL DRIVE
OAK HILL, WV 25901

I.D. Number ... 516353
Sample Date ... 3/2/2006
Site I.D. ... SAMPLE #2
Permit Number . SAGO MINE
Outlet Number ... SAMPLE#2
Sample Type ... GRAB
Sample by ... MONTE HIEB
Date Received. 3/4/2006
Analyzed/By... 3/7/2006-SD,KH,CS

LABORATORY ANALYSIS PERFORMED	ANALYSIS RESULTS	METHOD	MDL
Specific Conductance	418.0 UMHO/CM	2510 B	1.50
pH (Laboratory Analysis)	8.23 Std. Unit		
Total Alkalinity	231.0 mg/l	2320	1.0
Total Hot Acidity	< 1.0 mg/l	2310 B	1.0
Total Suspended Solids	< 1.5 mg/l	2540 D	1.5
Hardness (Calculated)	43.7 mg/l	2340 C	
Total Calcium	7.821 mg/l	3111 B	0.02
Total Magnesium	5.863 mg/l	3111 B	0.02
Sulfates	4.0 mg/l	375.4	1.0
Total Iron	0.06 mg/l	3111 B	0.01
Total Manganese	0.03 mg/l	3111 B	0.01
Total Aluminum	0.04 mg/l	3111 D	0.03
Total Dissolved Solids	256.0 mg/l	2540 C	5.0

Respectfully

Janis L. Reger
CENTRAL TESTING, INC.

GEOLOGICAL LOGGING SYSTEMS

P.O. Box 848, Industrial Park, Bluefield VA 24605 276-322-5467

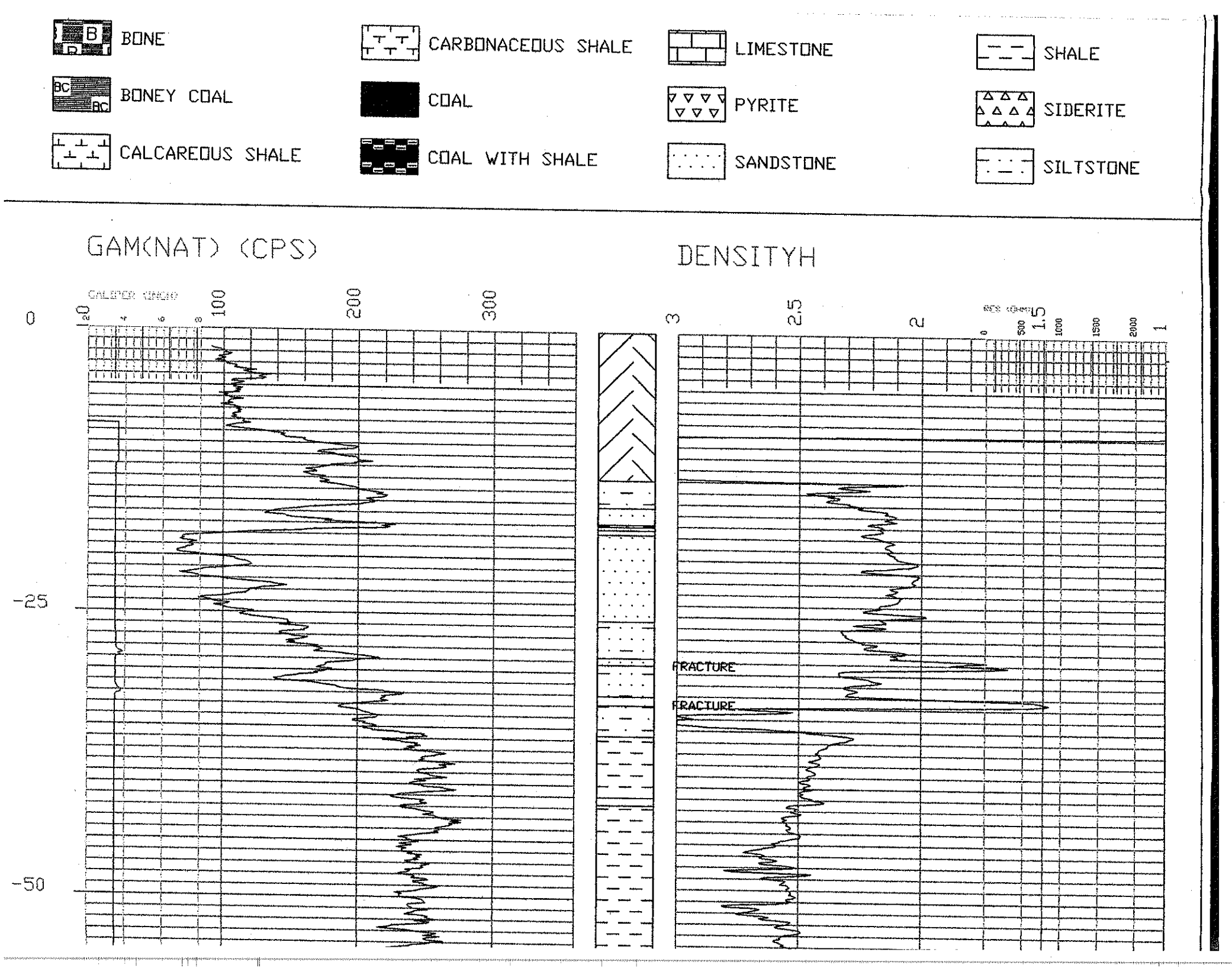
GEOPHYSICAL LOG TO CORE HOLE SF 52-06 (excerpt) (data attached)

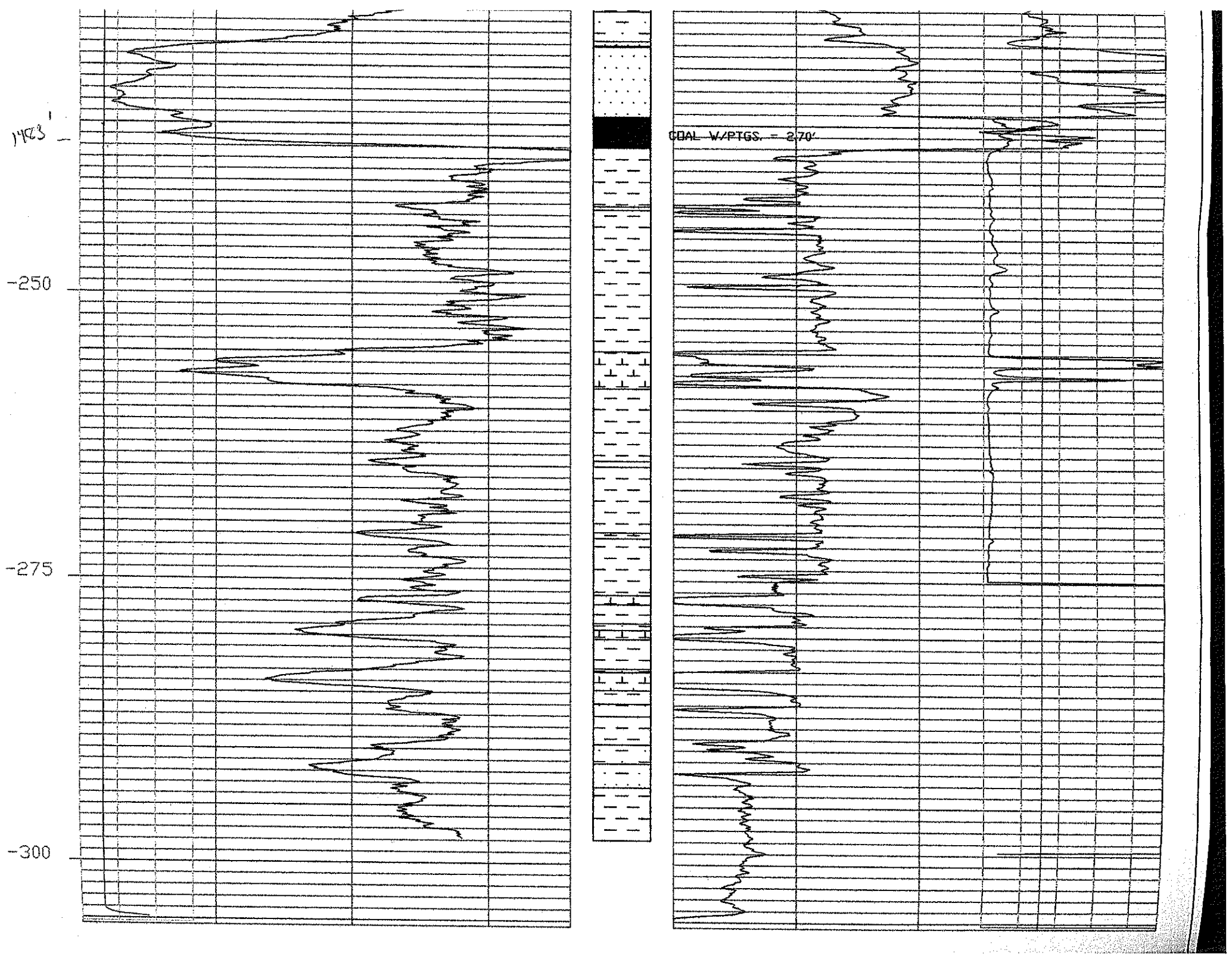
DIGITAL LOG

Company	: ICG SAGO				
Well	: SF52-06	~1720 EL		**Other Services:**	
Location/Field	: -			OPEN	
County	: UPSHUR			CORE	
State	: WEST VIRGINIA			0033CH	
Section	: -	**TOWNSHIP**	: -	**RANGE**	: -
Date	: 04/26/06	**Permanent Datum**	: -	**Elevations**	
Depth Driller	: 286.00	**Elev. Perm. Datum**	: -	**KB**	: -
Log Bottom	: 305.50	**Log Measured From**	: GL	**DF**	: -
Log Top	: 1.61	**Drl Measured From**	: GL	**GL**	: -
Casing Diameter	: 3.0	**Logging Unit**	: 03	**Latitude**	
Casing Thickness	: .25	**Field Office**	: BLUEFIELD	**Longitude**	
Casing Type	: STEEL	**Recorded By**	: R. ST.PETER		
Bit Size	: 2.85	**Borehole Fluid**	: WATER	**File**	: PROCESSED
Magnetic Decl.	: -8.4	**RM**	: -	**Type**	: 0033CH
Matrix Density	: 2.7	**RM Temperature**	: -	**Log**	: 1"-10'
Fluid Density	: -	**Matrix Delta T**	: 50	**Plot**	: -
Neutron Matrix	: SANDSTONE	**Fluid Delta T**	: -	**Thresh**	: 25000
Remarks	: -				
	-				

Electric Log Interpretation Is Empirical In Nature. Extreme Hole Conditions Will Make Completely Accurate Interpretations Difficult.

All Services Provided Subject To Standard Terms And Conditions.


BONE
BONEY COAL
CALCAREOUS SHALE
CARBONACEOUS SHALE
COAL
COAL WITH SHALE
LIMESTONE
PYRITE
SANDSTONE
SHALE
SIDERITE
SILTSTONE
GAM(NAT) (CPS)
DENSITYH
0
-25
-50
100
200
300
3
2,5
2
1,5
1
FRACTURE
FRACTURE


1483'
-250
-275
-300
COAL W/PTGS. = 2.70'

ID

Density probe

Date of Log: 04/26/06
Company: LOG SAGO
Field: -
Probe: 0033CH, 453
Well SF52-06
From 90 to 275 FT

Depth FT	GAM(NAT) CPS	DENSITYH G/CC	RES(MG) OHM-M	CALIPER INCH
90.2	162.4	2.30	656.0	3.4
90.7	153.2	2.06	761.2	3.5
91.2	169.2	2.15	598.3	3.4
91.7	151.6	2.35	854.1	3.5
92.2	174.0	1.33	500.4	4.0
92.7	152.0	1.89	424.6	3.3
93.2	105.6	2.07	1569.3	3.3
93.7	119.6	2.09	1577.2	3.3
94.2	142.4	2.14	1264.3	3.4
94.7	155.4	2.16	1026.9	3.4
95.2	130.4	2.15	1059.6	3.4
95.7	125.2	2.11	1032.3	3.4
96.2	107.4	2.09	1088.4	3.4
96.7	112.0	2.11	1121.5	3.4
97.2	132.4	2.16	1032.6	3.4
97.7	146.0	2.20	1045.8	3.3
98.2	148.0	2.14	1026.2	3.4
98.7	85.2	2.09	1390.3	3.3
99.2	77.2	2.08	1398.6	3.4
99.7	71.2	2.06	1305.9	3.3
100.2	80.4	2.07	1106.2	3.3
100.7	79.2	2.06	1233.0	3.4
101.2	68.8	2.05	1163.6	3.3
101.7	70.4	2.05	1202.2	3.3
102.2	81.6	2.09	1205.4	3.4
102.7	90.0	2.07	1256.7	3.3
103.2	81.6	2.11	1074.2	3.3
103.7	86.0	2.08	1183.9	3.3
104.2	73.2	2.08	1550.0	3.4
104.7	72.4	2.07	1360.9	3.3
105.2	74.0	2.07	1214.7	3.4
105.7	68.0	2.03	1159.0	3.3
106.2	81.2	2.03	1270.0	3.4
106.7	84.4	2.05	1088.1	3.3
107.2	129.6	2.16	819.5	3.4
107.7	99.2	2.07	1387.0	3.4
108.2	99.2	2.09	1701.0	3.3
108.7	101.2	2.11	1392.6	3.4
109.2	96.8	2.12	1205.8	3.3
109.7	116.4	2.09	1148.6	3.3
110.2	140.0	2.14	1173.7	3.3
110.7	177.2	2.18	887.7	3.4
111.2	204.0	2.26	697.8	3.3
111.7	150.4	2.18	980.9	3.4
112.2	130.8	2.17	1029.9	3.3
112.7	154.4	2.17	1086.1	3.3

113.2	137.2	2.23	1083.7	3.4
113.7	128.0	2.15	1074.0	3.4
114.2	129.6	2.18	1193.3	3.3
114.7	136.0	2.20	1154.6	3.4
115.2	165.2	2.26	1051.0	3.4
115.7	145.2	2.20	1052.3	3.3
116.2	134.0	2.14	1196.2	3.4
116.7	137.2	2.17	1138.3	3.4
117.2	166.4	2.27	1108.4	3.3
117.7	160.4	2.24	1136.9	3.4
118.2	122.8	2.25	1193.0	3.3
118.7	112.8	2.17	1294.6	3.4
119.2	112.8	2.15	1521.0	3.3
119.7	89.6	2.14	1578.9	3.4
120.2	110.4	2.14	1461.3	3.4
120.7	151.2	2.22	1199.2	3.4
121.2	160.4	2.29	1070.8	3.4
121.7	156.4	2.18	1053.3	3.3
122.2	116.4	2.11	1185.0	3.3
122.7	113.8	2.15	1086.2	3.3
123.2	92.8	2.08	1162.6	3.4
123.7	79.2	2.09	1664.6	3.3
124.2	57.2	2.05	1786.6	3.4
124.7	41.2	2.06	1597.5	3.4
125.2	57.6	2.07	1360.2	3.4
125.7	70.0	2.14	1041.0	3.3
126.2	92.0	2.13	887.3	3.4
126.7	90.0	2.10	906.0	3.4
127.2	104.8	2.11	928.9	3.3
127.7	101.2	2.08	955.2	3.3
128.2	79.6	2.10	944.4	3.3
128.7	78.4	2.08	939.5	3.4
129.2	80.4	2.09	1027.6	3.4
129.7	72.8	2.10	1314.1	3.3
130.2	63.2	2.12	1798.7	3.4
130.7	59.2	2.08	2059.1	3.4
131.2	62.4	2.10	1885.1	3.4
131.7	122.4	2.34	769.6	3.4
132.2	163.6	2.24	348.6	3.3
132.7	155.2	2.18	481.4	3.4
133.2	129.6	2.09	729.1	3.4
133.7	83.6	2.08	656.2	3.4
134.2	82.4	2.09	1322.1	3.4
134.7	94.4	2.12	933.5	3.3
135.2	97.2	2.10	235.0	3.3
135.7	78.8	2.04	612.2	3.4
136.2	106.8	2.13	824.7	3.4
136.7	120.8	2.18	492.2	3.4
137.2	133.2	2.20	423.2	3.3
137.7	97.6	2.10	646.2	3.4
138.2	71.6	2.08	499.1	3.3
138.7	75.6	2.13	500.6	3.4
139.2	93.6	2.26	600.6	3.4
139.7	177.6	2.55	408.3	3.4
140.2	314.0	2.63	235.4	3.3
140.7	250.0	2.56	223.5	3.3

141.2	252.0	2.52	419.8	3.3
141.7	269.6	2.64	351.4	3.4
142.2	306.0	2.55	292.6	3.4
142.7	263.2	2.59	241.4	3.4
143.2	305.6	2.65	199.9	3.4
143.7	301.6	2.55	152.4	3.4
144.2	268.0	2.54	123.2	3.3
144.7	271.2	2.45	250.0	3.3
145.2	282.0	2.46	252.1	3.4
145.7	286.0	2.67	132.3	3.4
146.2	284.8	2.72	134.2	3.4
146.7	260.0	2.37	258.5	3.4
147.2	206.0	2.35	310.7	3.4
147.7	109.6	2.35	328.9	3.4
148.2	210.0	2.40	375.6	3.3
148.7	234.0	2.39	479.7	3.3
149.2	198.0	2.39	556.9	3.3
149.7	194.0	2.37	668.7	3.3
150.2	260.4	2.60	392.3	3.3
150.7	397.4	2.25	109.2	3.4
151.2	571.6	2.12	202.3	3.4
151.7	494.4	2.32	109.9	3.4
152.2	299.6	2.30	147.1	3.4
152.7	282.4	2.32	100.0	3.4
153.2	282.4	2.36	116.1	3.3
153.7	312.0	2.31	97.7	3.3
154.2	330.8	2.35	117.4	3.3
154.7	263.2	2.49	190.9	3.4
155.2	266.6	2.52	240.2	3.4
155.7	247.2	2.36	274.1	3.3
156.2	278.4	2.46	237.4	3.3
156.7	260.4	2.51	109.2	3.4
157.2	263.2	2.45	161.3	3.4
157.7	277.2	2.49	144.8	3.4
158.2	260.8	2.51	121.3	3.4
158.7	236.4	2.76	209.3	3.4
159.2	229.6	2.46	206.3	3.4
159.7	246.8	2.46	245.3	3.4
160.2	249.6	2.50	266.2	3.3
160.7	288.0	2.50	180.6	3.3
161.2	284.8	2.48	185.4	3.3
161.7	319.6	2.54	200.5	3.4
162.2	297.6	2.51	195.6	3.4
162.7	293.6	2.49	229.5	3.4
163.2	322.0	2.48	161.4	3.3
163.7	399.6	2.51	147.0	3.3
164.2	353.8	2.54	131.2	3.3
164.7	330.4	2.52	118.5	3.3
165.2	324.0	2.58	100.8	3.3
165.7	302.8	2.54	105.4	3.4
166.2	296.0	2.53	112.1	3.3
166.7	254.0	2.60	140.7	3.4
167.2	231.2	2.62	271.5	3.3
167.7	228.4	2.56	248.3	3.3
168.2	238.8	2.55	294.6	3.4
168.7	239.6	2.57	327.9	3.3

169.2	256.4	2.66	347.7	3.3
169.7	283.6	2.54	258.6	3.3
170.2	293.2	2.49	157.0	3.3
170.7	334.0	2.64	174.4	3.4
171.2	203.2	2.54	193.4	3.4
171.7	294.4	2.56	192.9	3.4
172.2	332.0	2.63	184.7	3.3
172.7	304.0	2.58	268.1	3.4
173.2	314.0	2.52	200.8	3.3
173.7	278.4	2.56	194.3	3.4
174.2	293.2	2.56	238.2	3.4
174.7	292.4	2.56	254.9	3.4
175.2	279.6	2.56	293.2	3.4
175.7	307.2	2.57	202.2	3.4
176.2	294.4	2.70	282.7	3.3
176.7	232.4	2.74	510.6	3.3
177.2	188.0	2.85	927.4	3.3
177.7	256.0	2.53	337.9	3.4
178.2	292.8	2.57	361.3	3.3
178.7	293.6	2.48	207.9	3.3
179.2	267.2	2.51	411.9	3.3
179.7	243.2	2.52	700.1	3.4
180.2	236.8	2.48	625.1	3.3
180.7	256.8	2.47	662.3	3.3
181.2	255.2	2.47	531.3	3.3
181.7	255.2	2.49	543.2	3.3
182.2	264.4	2.47	587.5	3.4
182.7	257.4	2.47	528.6	3.4
183.2	298.8	2.46	423.3	3.3
183.7	257.2	2.43	539.9	3.4
184.2	234.0	2.62	753.0	3.3
184.7	210.8	2.34	1006.4	3.3
185.2	196.0	2.52	1052.0	3.3
185.7	220.8	2.52	1199.8	3.4
186.2	219.2	2.46	987.7	3.3
186.7	265.6	2.39	769.7	3.3
187.2	224.4	2.35	876.2	3.3
187.7	187.2	2.38	949.3	3.3
188.2	159.6	2.30	927.2	3.3
188.7	151.6	2.24	992.8	3.4
189.2	167.6	2.26	881.4	3.3
189.7	188.8	2.35	752.1	3.3
190.2	210.0	2.44	733.4	3.4
190.7	181.2	2.38	833.2	3.4
191.2	129.2	2.39	1068.5	3.4
191.7	104.8	2.55	1634.4	3.4
192.2	99.4	2.56	1970.6	3.3
192.7	90.8	2.61	1801.7	3.4
193.2	92.4	2.49	1307.8	3.4
193.7	119.8	2.28	916.1	3.4
194.2	138.0	2.36	785.5	3.4
194.7	106.4	2.10	831.8	3.3
195.2	85.2	2.16	910.5	3.4
195.7	80.4	2.18	844.3	3.3
196.2	80.4	2.25	1045.3	3.3
196.7	78.8	2.18	997.2	3.3

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197.2	90.8	2.13	884.1	3.3
197.7	85.2	2.14	847.8	3.4
198.2	110.8	2.12	869.7	3.3
198.7	100.0	2.20	837.3	3.3
199.2	125.6	2.20	901.3	3.3
199.7	100.0	2.27	861.9	3.3
200.2	123.2	2.24	896.1	3.3
200.7	112.4	2.28	915.1	3.4
201.2	114.8	2.25	789.8	3.3
201.7	120.0	2.23	528.7	3.3
202.2	145.2	2.27	471.0	3.3
202.7	130.0	2.24	416.1	3.4
203.2	152.8	2.27	421.6	3.4
203.7	85.6	2.18	505.3	3.3
204.2	88.0	2.10	562.1	3.3
204.7	98.4	2.17	455.9	3.4
205.2	96.4	2.17	473.9	3.3
205.7	109.4	2.20	439.9	3.3
206.2	98.8	2.17	485.0	3.4
206.7	77.2	2.15	620.0	3.3
207.2	86.6	2.16	789.3	3.4
207.7	96.8	2.12	691.9	3.3
208.2	161.6	2.03	509.1	3.3
208.7	321.2	2.45	115.7	3.3
209.2	497.6	2.47	75.4	3.3
209.7	430.8	2.49	131.7	3.3
210.2	411.6	2.40	154.9	3.3
210.7	342.8	2.27	150.7	3.3
211.2	323.2	2.26	172.4	3.3
211.7	322.0	2.33	161.3	3.3
212.2	434.4	2.31	195.0	3.3
212.7	332.4	2.34	156.5	3.3
213.2	323.0	2.29	117.2	3.3
213.7	287.8	2.27	92.1	3.3
214.2	309.2	2.28	86.4	3.3
214.7	294.8	2.28	95.3	3.3
215.2	250.4	2.20	113.0	3.3
215.7	181.2	2.10	224.5	3.3
216.2	163.2	2.19	266.4	3.3
216.7	198.0	2.18	179.6	3.3
217.2	195.6	2.26	180.7	3.3
217.7	202.4	2.16	195.4	3.3
218.2	143.6	2.20	379.5	3.3
218.7	201.6	2.33	275.5	3.3
219.2	227.6	2.33	202.0	3.3
219.7	251.2	2.26	212.0	3.3
220.2	273.2	2.29	198.4	3.3
220.7	244.0	2.29	181.7	3.3
221.2	252.0	2.31	186.9	3.3
221.7	254.8	2.32	262.3	3.3
222.2	232.0	2.29	297.5	3.3
222.7	253.2	2.32	435.4	3.3
223.2	237.2	2.34	553.0	3.3
223.7	257.6	2.25	472.0	3.3
224.2	260.0	2.29	532.2	3.3
224.7	257.6	2.30	611.4	3.3

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225.2	222.4	2.35	629.4	3.3
225.7	207.6	2.33	814.6	3.3
226.2	193.6	2.30	811.2	3.3
226.7	189.2	2.23	900.6	3.3
227.2	179.2	2.30	607.8	3.3
227.7	152.4	2.23	422.8	3.3
228.2	95.6	2.08	1659.9	3.3
228.7	52.8	2.07	3431.5	3.3
229.2	37.6	2.03	3941.6	3.3
229.7	54.8	2.06	2938.0	3.3
230.2	70.0	2.06	747.5	3.3
230.7	49.2	2.07	977.7	3.3
231.2	49.2	2.03	1570.6	3.3
231.7	36.8	2.04	2110.9	3.3
232.2	25.6	2.04	3261.2	3.3
232.7	33.6	2.11	1913.7	3.3
233.2	27.6	2.12	1469.4	3.3
233.7	35.6	2.10	1782.3	3.3
234.2	72.0	1.77	261.6	3.3
234.7	71.2	1.47	261.6	3.3
235.2	96.0	1.63	416.5	3.3
235.7	76.8	1.40	255.4	3.3
236.2	75.6	1.43	345.0	3.3
236.7	131.6	1.53	270.1	3.3
237.2	358.4	2.30	101.0	3.3
237.7	418.0	2.52	56.7	3.3
238.2	346.4	2.44	51.9	3.3
238.7	296.4	2.45	60.9	3.3
239.2	301.6	2.42	85.0	3.3
239.7	275.2	2.53	113.0	3.3
240.2	291.6	2.48	114.4	3.3
240.7	294.0	2.48	78.1	3.3
241.2	286.4	2.53	84.9	3.3
241.7	287.6	2.58	77.5	3.3
242.2	238.8	2.96	94.1	3.3
242.7	260.0	2.04	100.5	3.3
243.2	260.4	2.40	123.8	3.3
243.7	281.2	2.51	85.9	3.3
244.2	265.2	2.85	89.0	3.3
244.7	270.0	2.43	114.4	3.3
245.2	272.8	2.40	112.7	3.3
245.7	246.0	2.41	152.0	3.3
246.2	259.2	2.41	173.7	3.3
246.7	252.0	2.45	135.7	3.3
247.2	263.2	2.40	213.8	3.3
247.7	272.0	2.41	231.2	3.3
248.2	315.2	2.58	83.9	3.3
248.7	275.6	2.43	104.0	3.3
249.2	310.0	2.72	79.0	3.3
249.7	278.0	2.35	87.8	3.3
250.2	320.4	2.42	79.2	3.3
250.7	278.0	2.40	101.8	3.3
251.2	291.2	2.42	166.7	3.3
251.7	270.4	2.41	89.8	3.3
252.2	306.0	2.38	80.9	3.3
252.7	290.8	2.43	88.0	3.3

253.2	300.4	2.43	100.1	3.3
253.7	317.2	2.39	76.4	3.3
254.2	288.4	2.39	68.9	3.3
254.7	253.2	2.63	64.5	3.3
255.2	189.6	3.04	1332.0	3.3
255.7	128.0	2.88	2228.5	3.3
256.2	109.2	2.55	537.0	3.3
256.7	98.8	2.74	328.0	3.3
257.2	101.6	2.76	954.3	3.3
257.7	132.4	3.18	144.3	3.3
258.2	208.4	2.23	101.5	3.3
258.7	241.6	2.15	55.4	3.3
259.2	269.6	2.42	51.1	3.3
259.7	275.2	2.39	66.6	3.3
260.2	282.8	2.26	50.4	3.3
260.7	266.0	2.28	62.8	3.3
261.2	252.4	2.39	68.9	3.3
261.7	252.8	2.37	69.7	3.3
262.2	241.0	2.43	70.3	3.3
262.7	238.8	2.50	77.1	3.3
263.2	234.4	2.55	92.1	3.3
263.7	242.4	2.50	85.5	3.3
264.2	252.0	2.39	96.0	3.3
264.7	214.0	2.59	109.7	3.3
265.2	240.0	2.43	109.1	3.3
265.7	255.2	2.46	129.5	3.3
266.2	265.6	2.38	115.6	3.3
266.7	284.0	2.41	118.5	3.3
267.2	260.0	2.40	112.0	3.3
267.7	282.4	2.48	107.5	3.3
268.2	259.2	2.44	107.4	3.3
268.7	262.0	2.40	106.1	3.3
269.2	276.4	2.40	92.9	3.3
269.7	254.6	2.42	82.5	3.3
270.2	242.0	2.41	79.8	3.3
270.7	245.6	2.50	78.0	3.3
271.2	204.8	2.91	109.7	3.3
271.7	264.4	2.40	71.5	3.3
272.2	262.8	2.70	60.6	3.3
272.7	238.0	2.43	71.3	3.3
273.2	280.0	2.38	71.1	3.3
273.7	268.4	2.38	50.6	3.3
274.2	262.0	2.39	51.8	3.3
274.7	260.4	2.61	1649.4	3.2
275.0	300.0	2.63	20000.0	3.2