5 THE INVESTIGATION

The purpose of this investigation was to carefully observe, inquire and examine systematically the events surrounding the January 2, 2006, Sago Mine Disaster. The WVOMHS&T investigation started on the morning of January 2, 2006, and certain aspects of it continue.

The WVOMHS&T joined representatives of MSHA, Anker West Virginia Mining Company, Inc. (ICG), the Sago Mine and the United Mine Workers of America so as to conduct an investigation that provided an opportunity to collect and share jointly information obtained during the investigation.

Mr. Doug Conaway (former Director), on January 9, 2006 formed the WVOMHS&T Investigation Team. This team consisted of: Mr. Conaway, Mr. Terry Farley, Mr. Brian Mills, Mr. Monte Hieb, Mr. John Collins, Mr. John Scott, Mr. John Hall, Mr. Jeff Bennett, Mr. Barry Fletcher and Mr. Robert True, Jr.

On January 10, 2006, the members of the WVOMHS&T team met with the MSHA Investigation Team at the MSHA District 3 Field Office in Bridgeport, WV. The MSHA Investigation Team members consisted of the following: Mr. Richard Gates, Mr. Richard Stoltz, Mr. John Urosek, Mr. Clete Stephan, Mr. Russell Dresch, Mr. Dennis Swentosky, Mr. Gary Harris, Mr. Joe O'Donnell, Mr. James Crawford, Mr. Robert Wilson and Mr. Tim Williams. Discussions at this meeting focused on joint participation during interviews, the recovery of the mine and on site investigations.

During the investigation additional representatives of WVOMHS&T were called upon to participate in the investigation. Those persons were Mr. Mike Rutledge, Mr. John Cruse, Mr. Bennie Comer, Mr. John Meadows, Mr. James Dean (acting Director), Mr. Randy Harris and Mr. David Stuart.

5 THE INVESTIGATION

5.1 Statistics and fact-finding

5.2 Evidence documentation

5.3 Omega seals

5.4 Flames and forces

5.5 What caused the explosion?

5.6 Self-contained self-rescuers (SCSR)

5.1 Statistics and Fact-finding

5.1-1 Enforcement Actions

5.1-2 Victim and Accident Information

5.1-3 Interviews

5.1-1 Enforcement Actions

The following enforcement actions have been taken as a result of the investigation.

Two (2) non-assessed control orders were issued in accordance with West Virginia Administrative Regulation Title 36, Series 19, Section 7.1 during the investigation.

On January 27, 2006 a notice of violation was issued that resulted in an order being issued to the operator for failure to allow United Mine Workers of America Representatives to accompany West Virginia Office of Miners' Health, Safety, and Training inspectors during the investigation. Case Number 002-0208-2006.
See **Appendix 5:** *Statistics and Fact-finding*.

Attached are copies of the violations issued by the electrical inspectors John Scott and Bennie Comer during this investigation. Case Numbers 129-0364-2006 and 023-0295-2006.
See **Appendix 5:** *Statistics and Fact-finding.*

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. TERRY M. HELMS

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 50

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 29 YEARS

EXPERIENCE AT THIS MINE 26 WEEKS

REGULAR OCCUPATION MINE EXAMINER/BELTMAN

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. MARTIN TOLER, JR.

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 51

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 32 YEARS

EXPERIENCE AT THIS MINE 14 WEEKS

REGULAR OCCUPATION SECTION FOREMAN

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. ALVA M. BENNETT

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 51

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 29 YEARS

EXPERIENCE AT THIS MINE 2 YEARS AND 26 WEEKS

REGULAR OCCUPATION CONTINUOUS MINING MACHINE OPERATOR

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. FRED G. WARE, Jr.

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 58

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 37 YEARS

EXPERIENCE AT THIS MINE 1 YEAR AND 26 WEEKS

REGULAR OCCUPATION CONTINUOUS MINING MACHINE OPERATOR

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. JESSE L. JONES

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 44

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 16 YEARS

EXPERIENCE AT THIS MINE 1 YEAR AND 36 WEEKS

REGULAR OCCUPATION ROOF BOLTING MACHINE OPERATOR

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. DAVID W. LEWIS

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 28

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 1 YEAR AND 32 WEEKS

EXPERIENCE AT THIS MINE 1 YEAR AND 32 WEEKS

REGULAR OCCUPATION ROOF BOLTING MACHINE OPERATOR

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. JERRY L. GROVES

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 55

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 28 YEARS

EXPERIENCE AT THIS MINE 1 YEAR

REGULAR OCCUPATION ROOF BOLTING MACHINE OPERATOR

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. THOMAS P. ANDERSON

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 39

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 10 YEARS

EXPERIENCE AT THIS MINE 16 WEEKS

REGULAR OCCUPATION SHUTTLE CAR OPERATOR

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. GEORGE J. HAMNER

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 54

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 26 YEARS

EXPERIENCE AT THIS MINE 1 YEAR 26 WEEKS

REGULAR OCCUPATION SHUTTLE CAR OPERATOR

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. JAMES A. BENNETT

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 61

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 25 YEARS

EXPERIENCE AT THIS MINE 20 WEEKS

REGULAR OCCUPATION SHUTTLE CAR OPERATOR

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. MARSHALL C. WINANS

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 50

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 23 YEARS

EXPERIENCE AT THIS MINE 1 YEAR 8 WEEKS

REGULAR OCCUPATION SCOOP OPERATOR

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's, Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

VICTIM INFORMATION
(Privacy Information Removed)

NAME OF VICTIM MR. JACKIE L. WEAVER

ADDRESS CONFIDENTIAL

DATE OF BIRTH CONFIDENTIAL AGE 50

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 26 YEARS

EXPERIENCE AT THIS MINE 2 YEARS

REGULAR OCCUPATION ELECTRICIAN

SPOUSE'S NAME CONFIDENTIAL

DEPENDENTS CONFIDENTIAL

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the medical report, death was caused by carbon monoxide poisoning.

5.1-2 Victim and Accident Information

ACCIDENT INFORMATION
(Privacy Information Removed)

NAME OF INJURIED Mr. RANDAL L. McCLOY

DATE OF BIRTH CONFIDENTIAL AGE 26

SOCIAL SECURITY NUMBER CONFIDENTIAL

EMPLOYED BY ANKER WEST VIRGINIA MINING COMPANY, INC.

MINE NAME SAGO MINE PERMIT # U-2016-98B

COAL MINER'S CERTIFICATION NUMBER CONFIDENTIAL

TOTAL MINING EXPERIENCE 4 YEARS AND 3 MONTHS

EXPERIENCE AT THIS MINE 1 YEAR AND 4 MONTHS

REGULAR OCCUPATION ROOF BOLTING MACHINE OPERATOR

INFORMATION CONTACT PERSON CONFIDENTIAL

DATE OF ACCIDENT 2nd DAY OF JANUARY , 2006

DESCRIPTION OF ACCIDENT:

On January 2, 2006 at approximately 6:30 A.M. a methane and/or coal dust explosion occurred behind the 2 North East Mains seals of the Anker West Virginia Mining Company's Sago Mine causing a mine disaster. The explosion resulted in the immediate death of (1) one miner and blocking the escape route of twelve other miners, causing the death of eleven of these miners. The explosion destroyed the North East Mains Seals, the stopping line and overcasts that provided intake air to the seals, the intake stopping line that provided intake air to the 2nd Left working section, several intake and return stoppings along the 4 track and an overcast at 12 block of 4 track, creating a short circuit of ventilation. According to the accident report submitted by the operator, Mr. McCloy's injuries were caused by carbon monoxide poisoning.

5.1-3 Interviews

An important part of this investigation, obtaining information through interviews, was a coordinated effort between MSHA and WVMHS&T.

Representatives of MSHA and WVMHS&T participated in the questioning of persons interviewed. *A list of these representatives can be found in* **Appendix 5:** *Statistics and Fact-finding.*

As in any interview process, the information obtained usually helps to answer questions directly or provides information as to where other answers may be obtained.

Several people participated in interviews. Included in those interviewed were miners underground at the time of the accident, mine management persons who entered the mine during the initial rescue attempt, persons who were involved in the seal construction, mine rescue team members, representatives of mine management (Anker and ICG), representatives of MSHA, representatives of WVOMHS&T, medical field persons, and consultants. *A list of persons and date of interviews can be found in* **Appendix 5:** *Statistics and Fact-finding.*

Transcripts of interviews can be found at www.wvminesafety.org.

5.2 Evidence Documentation

5.2-1 Mapping of Evidence

5.2-2 Collection of Evidence

5.2-1 Mapping of Evidence

As soon as mine recovery efforts permitted general re-entry into the mine a coordinated mapping effort was conducted in order to document in detail the location and description of all relevant evidence. This involved ten (10) different mapping teams comprised of personnel from MSHA, OMHS&T, employees and consultants of International Coal Group (ICG), United Mine Workers of America (UMWA), and on occasion other guest representatives who either assisted or observed.

The following is a list of the organized mapping teams:

GENERAL MAPPING -- SIX (6) teams

EVIDENCE MAPPING AT THE BARRICADE – ONE (1) team

FLAMES AND FORCES -- ONE (1) team

ELECTRICAL MAPPING – TWO (2) teams

The mapping effort began on January 27, 2006. Maps were compiled on a variety of scales ranging from 1" = 10' up to 1" = 100'. Mapping proceeded generally on a 7-day schedule, although a day break in the schedule was taken now and again. The effort was largely conceived and organized by personnel within MSHA Tech Support. Assisting in this effort to a significant degree were ICG personnel and representatives, including representatives of Alpha Engineering who provided consulting services to ICG and produced a final composite version of all work maps compiled. These were proofed for completeness and accuracy by MSHA Tech Support and are included in **Appendix 5.2.**

Evidence of post-explosion debris such as pieces of Omega blocks, toppled overcasts, pieces of ventilation curtain, equipment, wire mesh roof mesh, etc. were carefully described and their

positions measured relative to known reference points and were located on the work maps. At the end of each mapping day the work maps from each team were turned in and reproduced for the principle parties involved in the mapping effort (see **Section 5.3-2**).

The Flames and Forces mapping teams recorded damage magnitudes, directions, and bending sequences to roof pans and plates, wire roof mesh, and belt hangers. Notes were made as to the direction of propagation of explosion forces as interpreted by this evidence. A summary map of some of this information compiled by OMHS&T is contained in **Appendix 5.4-1:** *Flames and Forces Map.* Engineering tests conducted on samples of these metal structures were performed through MSHA and contributed to this effort.

At the request of OMHS&T mapping also included supplemental surveying of the mine roof and floor in the areas inby the Old 2nd Left seals. This work was performed by Alpha Engineering, consultants for ICG. The elevation control points provided have been compiled into a set of contour maps by OMHS&T and are included in **Appendix 5.4-1**: *Floor Contour Map/ Roof Contour Map*.

Surface mapping of gas lines and wells, utility lines, and lightning-related documentation was performed by OMHS&T with the cooperation of ICG and others, including representatives of the gas producers in the area who donated valuable time and information to the effort. General informational maps of various topographic and aerial photography formats showing the relationship of surface features to underground features were also prepared and have been contributed in various paper and electronic formats to assist in the investigation.

Maps of electrical systems and resistivity surveys were also prepared and are addressed in **Section 5.5**.

5.2-2 Collection of Evidence

An important phase of the investigation centered on the collection of physical evidence. MSHA was the primary collector, documentor, and custodian of evidence obtained during the investigation.

- Mr. Gary Harris of MSHA was in charge of the evidence collected.
- Mr. Robert L. True, Jr. assisted and represented the WVOMHS&T.
- Other representatives of Anker West Virginia Mining Company, Inc. (ICG), Sago Mine and the UMWA also assisted in the collection of evidence.

The physical evidence collected was documented and verified through chain of custody records kept by MSHA. The WVOMHS&T, as part of the investigation, requested and obtained a dewatering pump with its power cable and other components that were found in the previously sealed area. This pump and components are currently in our custody.

Mr. Michael Rutledge served as the person responsible for the photography for WVOMHS&T. Mr. Rutledge and his assistants produced several photographs as part of the investigation.

5.3 Omega Seals

5.3-1 Approvals and Construction

5.3-2 Post-explosion Examination

5.3-1 Approvals and Construction Summary

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 Mines.
These are included in the **Appendix 5.3.**

Anker West Virginia Mining Company (ICG) representatives abandoned the area of the Sago Mine referred to as North East Mains or Old 2nd Left Section. 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 5.3.**

On October 12, 2005, Anker West Virginia Mining Company submitted to the WVMHS&T Region One office (received 10/18/05) a request for 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 5.3.**

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

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 5.3**

According to testimony of persons interviewed the Seal Plan and Step 2 of the approved plan were completed on December 11, 2005. *See transcripts of persons interviewed at: www.wvminesafety.org.*

5.3-2 Omega Seals: Post-explosion Examination

Ten (10) Omega block seals were installed to isolate the Old 2nd Left Section from the remaining active Sago Mine (**Figure 1**). Constructed of Omega 384 Blocks and a high-strength (2,000 PSI) Bloc Bond mortar, these seals are considered an alternative seal to the standard Mitchell/Barrett seal[1]. This seal design creates a forty inch (40") thick barrier between the abandoned area of the mine and the active area of the mine. This seal has been designed, tested, and approved to be installed without hitching into the roof, floor or ribs and construction utilized this no-hitching proviso. The actual design specifications are detailed in the approved plan (see **Section 5.3-1**). Mine seals should conform to the following guidelines:

(1) The seal is constructed of flame-resistant materials or be sufficiently coated with flame resistant materials.

(2) The entry with the lowest elevation must be equipped with a water trap to prevent impounding of water.

(3) The entry with the highest elevation must be equipped with a tube to permit the monitoring of mine gases as they build up behind the seal.

(4) Except for the gas sampling tube, no other continuous metal structures pass through the seal structure, either internally or around the seal perimeter.

(5) The materials and design must be able to withstand a minimum of 20 psi static pressure in the event of an explosion, as prescribed by MSHA.

Seals construction was completed on December 11, 2005. On January 2, 2006 a methane explosion occurred from within the sealed area which resulted in the destruction of all ten (10)

[1] Mitchell/ Barrett seals are typically built of 8"x 8"x16" solid concrete blocks that are cross-linked, fully mortared, and contain a center pilaster.

seals. On January 27, 2006 investigation teams entered the mine to map and gather evidence to assist in determining the cause, intensity, and point of origin of the explosion.

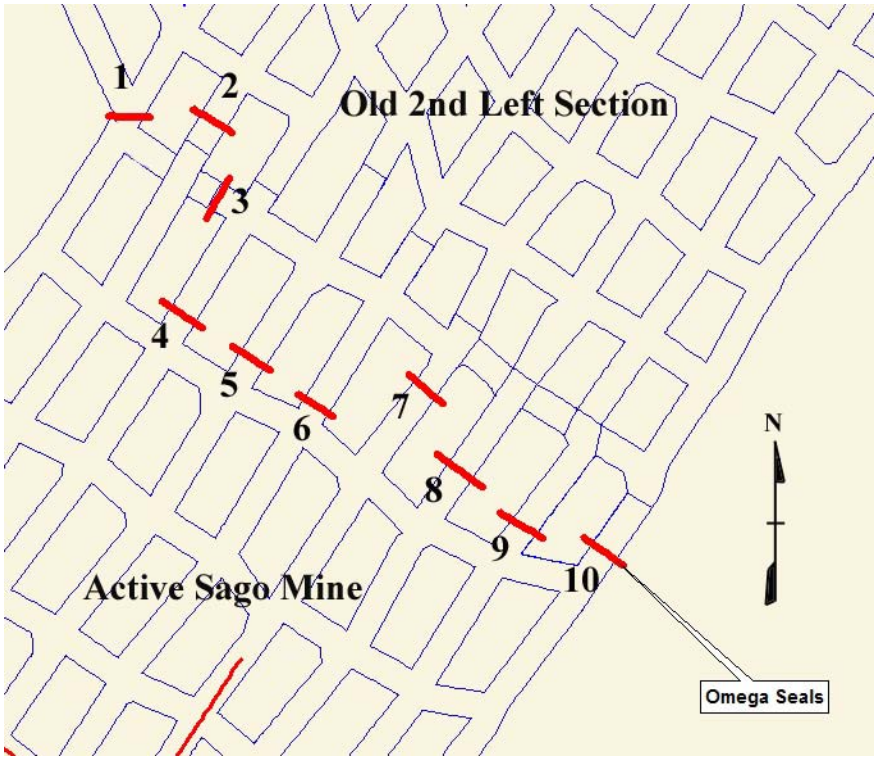

Figure 1: Location of Omega seals in the Sago mine.

All ten (10) Omega Block seals were totally destroyed in the explosion. Remnant pieces of Omega blocks ranged in size from baseball-sized pieces to sand-sized. The majority of the debris appeared golf ball-size or smaller [2].

Mapping of the seal remnants and debris was performed in order to document the manner and the extent of damage. The force of the explosion completely removed and pulverized the seals to the point that mapping teams could determined the location of the seals only by locating the concrete and mortar attached to the roof, ribs or floor. Only three (3) seals had Omega blocks still remaining at their installed seal locations (seals #1, #2 and #9). The debris from the seals was distributed in an outby direction from their installed location over a distance of several hundred feet. This, together with other evidence, led to a determination that the explosion forces originated from inside the sealed area (see **Figure 2**).

[2] The exception was Seal #1 which had a large number of pieces that were ¼-size or larger.

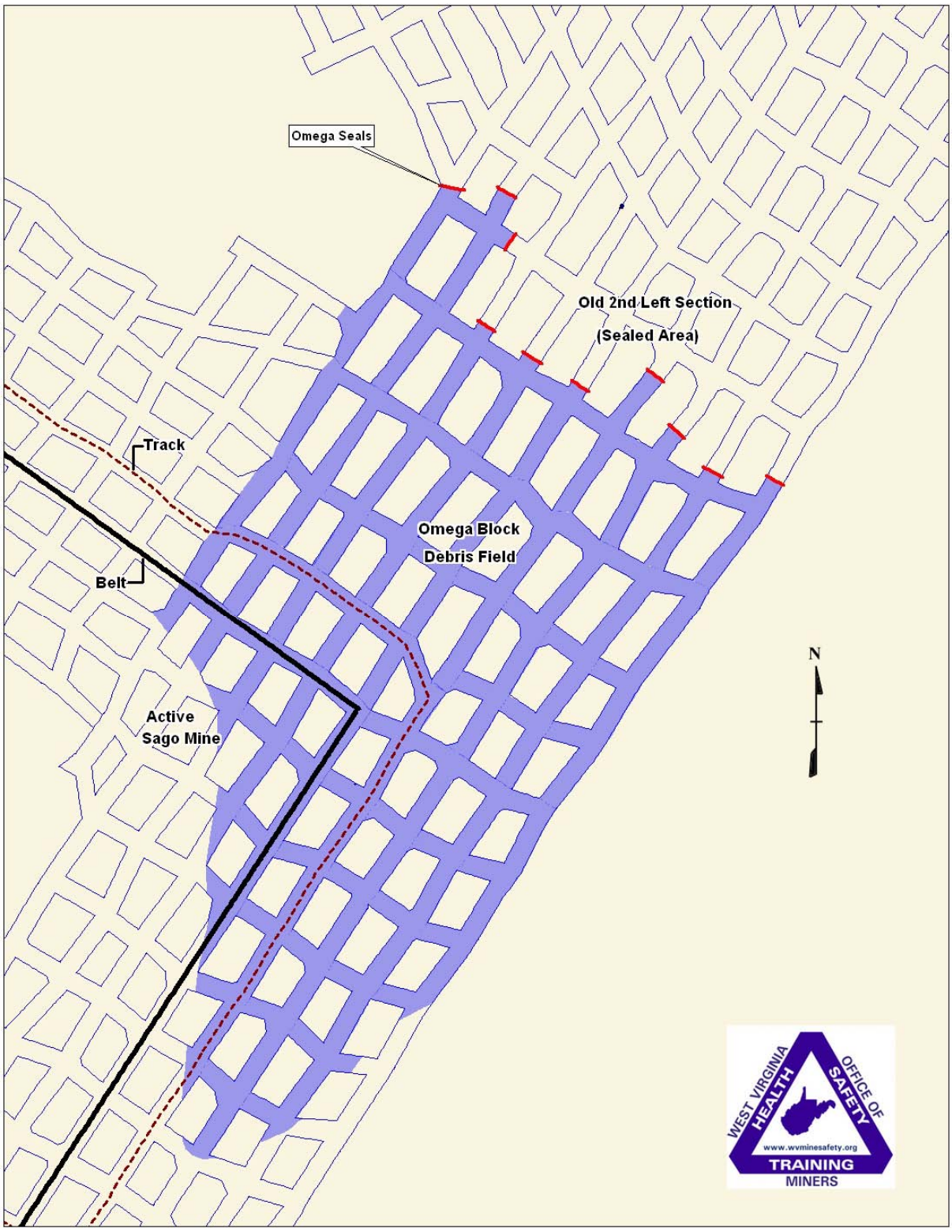

Figure 2: This illustration shows the approximate distance and symmetry of the debris field created by the ten (10) destroyed Omega seals.

Photo 1: Omega Debris - In First Outby Crosscut Between Seal #1 & #2 (Courtesy of MSHA)

Prior to installation of the #6, #7 and #8 seals, an 8-guage, 4"wire roof mesh was installed against the roof as supplemental roof protection. As is the required practice, this mesh was found to have been cut away prior to seal construction as a precaution to preclude the possibility of allowing stray electricity to enter the sealed area. The lengths of the removed sections allowed for a minimum of one (1) foot of gap from the seal surface to the remaining wire mesh.

Two water traps in #1 seal were constructed of non-metallic pipe. No confirmed components of the water trap were discovered during the investigation. The gas monitoring sample pipe in #10 seal was steel pipe, as prescribed in the approved plan. Except for the required sample tube, no other metallic structures were found which may have crossed the seal barrier.

As a matter of sound practice, seals are installed at a location where the ribs, roof, and floor are competent and stable. This criteria was complied with, in regards to all ten (10) Omega seals. However, it is worth mentioning that the #10 seal had some mild cutter roof problems on the outside rib, which could have been a possible source of some of the methane gas that had been detected on occasions outby the seals. In addition, the #1 seal was installed diagonally across the entry, which is not a typical installation. Evaluation of the rib surfaces after the explosion, however, did not indicate that anchorage at the rib was an issue in seal failure.

Members of the work crews involved in construction of these seals were interviewed and their testimony evaluated in conjunction with the mapped evidence. Several aspects of possible variations to the approved seal designs were identified and their potential role in performance reduction of the seals was given scrutiny during the investigation. Variations from the approved plan were found to include:

(1) some application of dry mortar mix to the prepared mine floor prior to seal installation,

(2) the application of at least some of the mortar in vertical internal joints was indirectly applied by working it into seams between blocks rather than directly to individual block faces,

(3) the wedging of two instead of three header boards at the top of the seal and the sideways rather than end-facing installation of wedges between the header board and mine roof,

(4) the average width of seal #1 was 21.2 feet, and

(5) the average width of seal #2 was 20.36 feet.

In June – 2006 foundation coring of all ten (10) seal locations was performed, under the direction of MSHA. The floor of a mine is not necessarily level and smooth. Dry mortar was used in places to establish a level and smooth foundation to initiate seal construction. The thickness of the mortar foundations varied from no mortar on the mine floor to approximately 2 ¾ inches of mortar. The mathematical average of all samples was 1 inch. Conditions of the samples taken ranged from dry powder to semi-cured mortar (see **Appendix 5.3**: *Seal Foundation Boring Test*).

The method of mortar application of the vertical joints varied. In some cases it was troweled on, in others it appears it was applied from the horizontal by mixing the mortar to a soupy texture and forcing it between the joint faces. The outer facing appears to be consistently applied, and in accordance with the approved plan.

The anchoring of the seal to the mine roof is done by wedging three rows of header boards between the roof and top row of Omega blocks (along the length of the seal). Between each row of wedged boards, mortar is placed in the voids. This anchoring is difficult at best, involving driving wedges that are over one's head securely with a sledge hammer. Interviews indicate this was the most difficult phase of the seal construction. Interviews of the workers who constructed the seals indicate that the header boards were placed full length, across the entry and wedged, with spacing of the wedges around 12 inches and on occasions up to 18 inches. The boards closest to the outer edges of the seal were wedged continuously along the boards. Installing the middle board was often a most difficult task.

Investigative findings of the seal materials and construction practices that were used in the Old 2nd Left seals were used to build and test seals of equivalent construction at NIOSH's Lake Lynn Experimental Mine during the period April 15, 2006 to October 19, 2006. These tests were designed to

(1) determine if the construction practice employed at the Sago Mine met or exceeded the 20 PSI static pressure criteria, and

(2) replicate the actual forces of the explosion that were exhibited at the Sago Mine.

This testing is still under review and final results have not been officially released. Preliminary findings indicate that the seal construction methods and materials used to construct the Old 2nd Left seals were capable of producing a seal that could withstand an explosion in excess of 20 PSI, static pressure.

The following are a series of photographs illustrating the remains of the seals at Sago after the explosion. These photographs were taken by MSHA photographers and the photos are courtesy of MSHA.

Photo 2. Location: Seal #1 (Courtesy of MSHA)

Photo 3. Location: Seal #2 (Courtesy of MSHA)

Photo 4. Location: Seal #3 (Courtesy of MSHA)

Photo 5. Location: Seal #4 (Courtesy of MSHA)

Photo 6. Location: Seal #5 (Courtesy of MSHA)

Photo 7. Location: Seal #6 (Courtesy of MSHA)

Photo 8. Location: Seal #7 (Courtesy of MSHA)

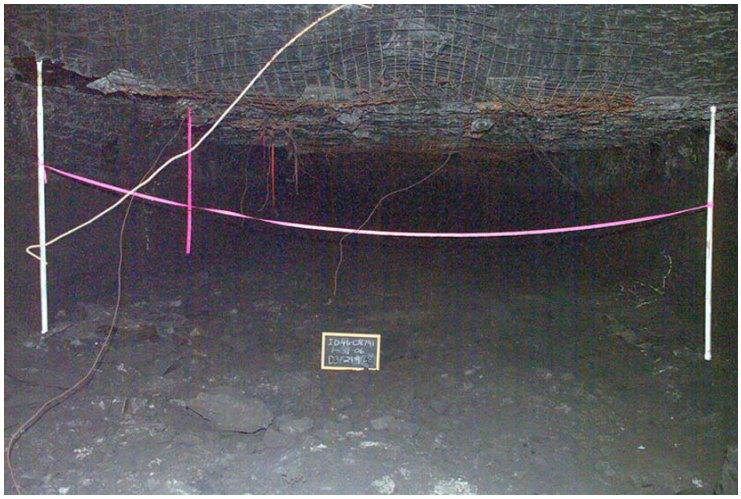

Photo 9. Location: Seal #8 (Courtesy of MSHA)

Photo 10. Location: Seal #9 (Courtesy of MSHA)

Photo 11. Location: Seal #10 (Courtesy of MSHA)