CAI-2007-12-14

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION
Shaft Construction for Underground Mine
Fatal Fall of Persons
August 10, 2007

Frontier-Kemper Constructors Inc. (A01)
Evansville, Indiana

at

Gibson Mine
Gibson County Coal, LLC
Princeton, Gibson County, Indiana
ID No. 12-02215

Accident Investigators

Charles H. Grace, P.E.
Assistant District Manager, Technical Programs, District 7, Barbourville, KY

Michael G. Kalich, CMSP
Senior Mining Engineer, Headquarters Safety Division

J. Jarrod Durig, P.E.
Civil Engineer, Technical Support, Pittsburgh, PA

Michael P. Snyder, P.E.
Mining Engineer, Technical Support, Triadelphia, WV

Kevin L. Doan
Roof Control and Ventilation Specialist, District 7

Originating Office
Mine Safety and Health Administration
Office of the Administrator
Coal Mine Safety and Health
1100 Wilson Boulevard
Arlington, VA 22209
Kevin G. Stricklin, Administrator

CAI-2007-12-14

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION
Shaft Construction for Underground Mine
Fatal Fall of Persons
August 10, 2007

Frontier-Kemper Constructors Inc. (A01)
Evansville, Indiana

at

Gibson Mine
Gibson County Coal, LLC
Princeton, Gibson County, Indiana
ID No. 12-02215

Accident Investigators

Charles H. Grace, P.E.
Assistant District Manager, Technical Programs, District 7, Barbourville, KY

Michael G. Kalich, CMSP
Senior Mining Engineer, Headquarters Safety Division

J. Jarrod Durig, P.E.
Civil Engineer, Technical Support, Pittsburgh, PA

Michael P. Snyder, P.E.
Mining Engineer, Technical Support, Triadelphia, WV

Kevin L. Doan
Roof Control and Ventilation Specialist, District 7

Originating Office
Mine Safety and Health Administration
Office of the Administrator
Coal Mine Safety and Health
1100 Wilson Boulevard
Arlington, VA 22209
Kevin G. Stricklin, Administrator

TABLE OF CONTENTS

View of Shaft Sinking Operation

OVERVIEW

At 10:43 a.m. on Friday, August 10, 2007 an accident involving a fatal fall of persons occurred at the Gibson County Coal, LLC., Gibson Mine, North Portal 2 shaft sinking site, resulting in the deaths of two employees and one retired employee of Frontier-Kemper Constructors, Inc., an independent contractor. Appendix A lists the names of the victims fatally injured as a result of the accident.

The accident occurred when the three men were being lowered inside the sinking bucket into the shaft to observe the bottom station concrete work. A nylon sling and shackle attached to the bottom of the sinking bucket lodged into a shaft collar door, thereby tipping the sinking bucket. This resulted in the men falling from the bucket to the bottom of the shaft, a distance of approximately 550 feet. At the time of the accident, the shaft had not yet been connected to the underground mine workings.

The accident occurred as a result of Frontier-Kemper's failure to ensure the hoist was under the control of the hoistman at all times when persons were in the shaft. The toplander was not at his station as the bucket was being lowered through the shaft collar doors and the hoistman had no visual contact with the bucket at this point. The hoistman lost control of the bucket when the nylon sling and shackle entangled with the shaft collar door. The independent contractor also failed to ensure that adequate fall protection was utilized while persons were transported in the sinking bucket.

GENERAL INFORMATION

The principal officers for the mine at the time of the accident were:

Gibson County Coal, LLC:

Jimmy Allen Brown ..... Superintendent
Mark David Kitchen ..... Director, Health & Safety

Frontier Kemper Constructors, Inc.

Galyn Rippentrop .....President and CEO
Christopher T. Richardson..... Mine Development Division Manager
George Zugel ..... Corporate Safety Director

Prior to the accident, the Mine Safety and Health Administration (MSHA) completed the last regular safety and health inspection of the Gibson Mine on July 25, 2007. The Non-Fatal Days Lost (NFDL) injury incidence rate for the Gibson Mine in 2006 was 2.05 compared to a National NFDL rate of 4.90. For 2006, Frontier-Kemper Constructors, Inc. had an NFDL rate of 10.90 compared to a National NFDL rate of 2.43.

The Gibson Mine Main Portal is located approximately 2 miles north of Princeton, Indiana and 1 mile west of US Highway 41. The North Portal 2 site, where the accident occurred, is located approximately 2 miles northwest of the intersection of Indiana State Highways 64 and 65, and the Gibson Mine and the North Portal 2 site are located in Gibson County, Indiana. The mine is operated by Gibson County Coal, LLC., a subsidiary of Alliance Coal, LLC. The mine began production in the Illinois Number 5 seam in December 2001. The average thickness of the seam is 78 inches. The last recorded total liberation for the mine indicates 3,472,207 cubic feet of methane liberated every 24 hours. The principal operating officer for Gibson County Coal at the time of the accident was Mike Stanley, General Manager.

The North Portal 2 Shaft Sinking Project is operated by Frontier-Kemper Constructors, Inc., a subsidiary of Deilmann-Haniel International Mining and Tunneling GmbH, Dortmund, Germany. The shaft construction began in October 2006, and the shaft was at the coal level, 570 feet below the surface, at the time of the accident, but the shaft had not yet been connected to the underground mine workings. The person in charge of the operation for Frontier-Kemper was Kyle Wooten, Project Manager. The shaft sinking operation consists of three 8 hour shifts per day, 7 days a week.

DESCRIPTION OF ACCIDENT

Crew A, led by George Foster, Walker Boss, began work as usual at 8:00 a.m. on the day of the accident. Foster, Greg Clevidence (Miner/Driller), Chris Girten (Mucker Operator), Daren Stout (Miner/Driller), Jerry Rhodes, Jr. (Miner/Driller), and Cody Robinson (Miner/Driller) entered the shaft shortly after starting time. The scheduled work in the shaft that day was to "spade tights," which involved manually removing rock from the shaft wall that protruded excessively into the concrete pour area and to otherwise prepare for a

concrete pour. Work proceeded normally, with 2 pieces of 6-inch angle iron being called for and subsequently lowered in a bucket, using a nylon sling and shackle attached to the bottom of the sinking bucket. (See Exhibit 1) Cody Robinson exited the shaft at approximately 10:30 a.m. to drop off some parts.

On the surface, Jarred Ashmore, Project Engineer, was assisting and supervising Frank Peavler, Parts Runner, and Cliff Schass, Electrician, in building forms for two work deck hoist platforms. This was being done in preparation for splitting the work decks to construct the curtain wall from the shaft bottom to the collar, since the shaft had reached its approximate designed depth.

On the day of the accident, Frontier-Kemper was celebrating the 100th Anniversary of Kemper Construction Company and had several guests from their Evansville, Indiana headquarters as well as from their parent company, Deilmann-Haniel International Mining and Tunneling GmbH, on site being trained in preparation for a tour of the surface facilities. Christopher (Todd) Richardson, Mine Development Division Manager for Frontier-Kemper, and Daniel McFadden, Retired Senior Executive Vice President and Director of Frontier-Kemper, requested to view the operations in the shaft. Ashmore met with them, and after ensuring that Peavler and Schass could continue building the concrete forms, Ashmore, Richardson and McFadden boarded the sinking bucket for a trip to the shaft bottom. Dennis Splittorff, Toplander, reportedly rang the appropriate code to have the bucket raised to clear both the bucket and nylon sling above the collar doors. Splittorff then opened the collar doors, signaled to have the sinking bucket lowered and then resumed cleaning bolts in the top shack.

Charles (Chuck) Crandell, Hoistman, began lowering the bucket. He stated he saw the hoist rope move in an unusual manner and stopped the hoist. He next called Splittorff and asked him to look and see if anything was wrong. At the same time, John Branson, Master Mechanic, and Robinson reportedly heard a clang and saw the ropes slackening or "shaking" and ran to the shaft collar. Branson then went in the freeze cellar to get a better view of the bucket and saw that the bucket was inverted and empty. On the work deck, approximately 570 feet below the collar, Foster and Girten reportedly saw objects falling and moved to protected positions. They next heard an impact noise on the work deck. They moved from their separate positions behind the concrete forms and saw that Ashmore was lying on the work deck. Rhodes stated he saw a second victim (later identified as McFadden) had fallen through the hoist well in the work deck and onto the shaft bottom. Branson, who was on the surface, called on the mine phone to the work deck and asked if everyone was alright. Foster informed him that all those working at the shaft bottom were uninjured, but there were two men fatally injured. Branson called Crandell on the mine phone and had him

bring the bucket up slowly. Branson removed the sling and shackle from the bottom of the bucket. The sinking bucket was then lowered to bring Crew A from the bottom of the shaft.

Kyle Wooten, Project Manager, and Rhodes subsequently traveled to the shaft bottom so Wooten could verify the victims' conditions. They located the third victim (Richardson) who was on the shaft bottom next to the concrete forms and shaft wall. Richardson had apparently fallen between the work deck and the forms.

George Zugel, Corporate Safety Director, notified the MSHA call center of the accident at 10:53 a.m. CDT. Jeff Williams, MSHA Roof Control Specialist, learned of the possibility of an accident when he returned to the surface after conducting normal inspection activities at the Gibson Mine. Williams traveled to the North Portal 2 site and immediately issued a 103(k) Order at 11:25 a.m. Mark Odom, Mike Rennie and Ron Stahlhut, MSHA Supervisors arrived on the scene a short time later. The Gibson County Coal mine rescue team was also called to the site and assisted in the recovery of the victims.

Stahlhut had the hoist rope and attachments thoroughly checked before lowering anyone into the shaft for recovery work. A team was assembled to perform the recovery work. This team consisted of Rennie, Stahlhut, Don "Blink" McCorkle, Deputy Commissioner, Indiana Bureau of Mines, and Terry Phegley and Rod Dilbeck from the Gibson County Coal mine rescue team. This team entered the shaft at 1:25 p.m. and began recovering the victims. The first victim arrived on the surface at 1:56 p.m., and the recovery work was completed with the removal of the third victim at 3:09 p.m.

INVESTIGATION OF THE ACCIDENT

On August 10, 2007 MSHA began an investigation of the accident pursuant to the Mine Safety and Health Act of 1977. The Administrator for Coal Mine Safety and Health assigned an investigation team consisting of personnel from MSHA Coal District 7, Headquarters Safety Division, MSHA Pittsburgh Safety and Health Technology Center, MSHA Approval and Certification Center, MSHA Educational Field Services and the United States Department of Labor, Office of the Solicitor. Charles Grace, Acting District Manager for District 7, was assigned as the accident investigation team leader.

Preliminary information was gathered from the MSHA District 8 Office, located in Vincennes, Indiana, the Indiana Department of Labor, Bureau of Mines, the Gibson County Coal, LLC. Office, and the Frontier-Kemper Constructors Inc. operations office at the site.

Persons were identified for the purpose of interviews. Interviews were conducted with 11 persons thought to have pertinent information regarding the accident. The interviews were conducted at the MSHA District 8 Office, at the Evansville Marriot Hotel, at the Quality Inn Evansville North in Haubstadt, Indiana and via telephone. Kyle Wooten, Project Manager for Frontier-Kemper Constructors, Inc., declined to be interviewed. Appendix B lists the persons interviewed.

The accident investigation team made site visits on August 11, 12 and 16, 2007. The team took measurements, photographs and made sketches on the surface and at the shaft bottom. The accident investigation team also conducted tests of the rope and all hoist safety systems. The uniform mine file, the shaft sinking plan and all training records were reviewed for compliance with procedures and appropriate standards.

In order to determine the actual manner in which the sling/shackle combination could have lodged in the collar doors, several configurations were tested. The collar doors were moved to the open position, and the nylon sling and shackle were attached to the sinking bucket, as on the day of the accident. The arrangement shown in the drawing labeled Exhibit 2 and the photograph, labeled Exhibit 3, (with the shackle pin end down at the floor side of the Wide Flange section (I-beam) and the rounded end atop the lower end of the I-beam, with the sling coming over the top) would bind tightly with downward pressure and release easily with upward pressure. This confirmed witness' statements that the sling/shackle tightly engaged with downward pressure and released easily when the bucket was raised. No other tested arrangement produced this result.

DISCUSSION

PHYSICAL FACTORS:

1) GENERAL: Frontier-Kemper began making preparations for sinking the shaft in October 2006. The design indicated the depth of the shaft from the top of the collar to the bottom of the shaft to be 570 feet. The shaft log, maintained in the office trailer, indicated that as of January 8, 2007 freezing of the outer strata had been accomplished and excavation had begun. Installation of lagging and I-beams continued until March 4, 2007. Further excavation continued until March 16, 2007, and the first concrete was poured on March 19, 2007. The concrete for the hornset was poured on March 28, 2007 and subsequent concrete pours continued toward the

collar of the shaft until April 7, 2007. At that point, conventional shaft sinking procedures (drilling, blasting, and mucking) were implemented. Setting forms and pouring concrete followed the excavation portion of the shaft development cycle. A water ring was installed between the hornset and the station of the shaft. The excavation of the shaft was nearing completion at the time of the accident.

2) DESCRIPTION OF THE HOISTING EQUIPMENT/OPERATION: The shaft is enclosed at the top with a collar deck sub-frame and the deck. The collar deck consists of one-half inch thick steel plates with a raised pattern on top to resist slipping. Personnel hoisting and material removal for the shaft sinking operation is primarily accomplished with the use of a sinking bucket. Typically, the bucket remains idle on the collar deck when no one is in the shaft. When personnel, equipment, or supplies are transported into the shaft with the bucket, the bucket is loaded, raised high enough to clear the two collar doors, and then lowered into the shaft. The collar door opening measured 10 feet 9 inches wide (north - south) and 9 feet 6 inches long (east – west). Each collar door is 57 inches long (half of the 9'6"), hinged at opposite sides of the collar deck (east – west) and opens upward. Each door is opened with a pneumatically driven jack into a vertical position (approximately 90 degrees from the closed position). Each collar door activates an electronic limit switch (Rockwell Automation, Allen-Bradley model 802M) mounted to the head frame. This provides an indication to the hoist operator that the doors are in the open position. Each door structure consists of a set of perpendicular W6 x 25 steel beams running north – south and east – west and welded to the one-half-inch steel plate. The W6 x 25 section has an inside-flange depth of 5.47 inches. When the doors are in the closed position, these members are beneath the steel plate of the door and are not visible. When the doors are open, these members are exposed and face toward the shaft opening.

The bucket had a serial number of "045" marked along the top outer portion. Also, the number 6126, representing the listed weight of the bucket, was marked on the top outer portion of the bucket,. The inner dimensions of the bucket were measured to be 74 inches in diameter with a height of 67 inches along the inside wall of the bucket. The bucket was attached to a 25-ton swivel hook with a master link and four 5-foot-long, ¾-inch link diameter chain slings. The chain slings were connected to the bucket in pairs with a 1 ⅛-inch shackle attached to two eyes welded to the inside of the bucket. The swivel hook (self closing type) was integrated into the hoisting system with a 1 ¼ - 1 ⅜-inch resin-poured open-type wire rope socket. A threaded pin connection and cotter pin secured the swivel hook to the wire rope attachment. With the bucket on the collar deck, the

hoist rope travels over the main sheave wheel to the hoist house. Approximately 245 feet of wire rope is exposed with approximately 15 feet extending from just outside the hoist house to the top of the hoist drum. The hoist rope construction was listed as a 1 ⅜-inch diameter, 19 X 7 EEIPS IWRC, Non-Rotating wire rope. The hoist was a model 4023 (FKCI No. 02-0021) manufactured by Ottumwa Iron Works, Ottumwa, Iowa, with the following specifications:

Drum Diameter	120	Inches
Drum Width	120	Inches
Flange Depth	14	Inches
Bull Gear	351	Teeth
Pinion	21	Teeth
Rope Size	1.375	Inches
Gear Ratio	16.71 : 1	
Motor	1,200	HP
Motor Speed	591	RPM
Motor Torque	127,919	Inch Pounds
Drum Torque	2,138,071	Inch Pounds
Drum Speed	35.36	RPM
Wraps/Layer	85	

Two additional hoists were used to support and move the work deck in the shaft. Both hoists were manufactured in Canada by New Era Tool and Die Limited. As viewed from the hoist operator's position, the hoists were numbered left to right, with the hoist on the operator's left being the No. 1 hoist. The Frontier-Kemper identification number for the Nos. 1 and 2 hoists were 03-5528 and 03-5527, respectively. Each hoist was driven by a 30-horsepower electric motor and had a rated line pull of 45,000 pounds. The maximum rope speed for each hoist was listed at 22 fpm. The hoist ropes were manufactured by Bridon American Corporation. The rope construction was a 1 ⅜-inch diameter, 18 X 26 DY 18 RREG lay. This construction has a nominal breaking strength of 212,000 pounds and a nominal weight of 4.17 pounds/foot. A Bridon American Corporation test certificate with order No. 44023, and a test date of August 26, 2005, provided by Frontier-Kemper personnel, indicated an actual breaking strength of 242,000 pounds. Additional break test information was provided by Hanes Supply Incorporated test certificate dated April 11, 2006, indicating an actual breaking strength of 217,900 pounds.

3) WIRE ROPE EXAMINATION: A visual examination was conducted on the hoist rope, crosshead block and end attachment. The visual examination did not reveal any broken wires or corrosion at the load end

attachment or crosshead block. At the time of the examination, a field dressing was applied to these areas of the rope to protect the rope from the environment. Caliper measurements were also taken at 100-foot intervals along the entire working length of the rope, starting with the bucket located just below the collar doors. Table 1 shows the measurements along with the averages and a comparable measurement location documented in the August 6, 2007 daily report of Frontier-Kemper 's hoisting equipment book.

Table 1. Caliper measurements taken at 100-foot intervals with the sinking bucket starting at the top of the shaft and traveling to the bottom.

Distance (Feet)	#1 (Inches)	#2 (Inches)	#3 (Inches)	Average (Inches)	FKCI 8/6/07 (Inches)
0	1.375	1.374	1.377	1.375	1.375
100	1.378	1.378	1.378	1.378	1.375
200	1.363	1.363	1.362	1.363	1.365
300	1.369	1.369	1.370	1.369	1.370
400	1.368	1.371	1.369	1.369	1.370
500	1.375	1.377	1.375	1.376	1.375

4) HOIST ROPE SPEED TESTS: Tests were conducted to verify the speed of the hoist rope under various conditions. The hoist rope was marked (painted) in three 50-foot increments for a total of 150 feet. The distance for each increment and total distance traveled were timed with a stopwatch to the nearest half second. Three tests were conducted with the hoist operating at various speeds including the following:

Test 1 – The speed at which personnel usually travel through the open doors.
Test 2 – The speed at which personnel travel when they are within 100 feet of any stop.
Test 3 – The maximum speed at which personnel are lowered.

During each of the tests the speed indicated at the hoist operator's station was recorded along with a timed test of the rope. Each test was conducted twice and the results are shown in Table 2.

Table 2. Hoist Rope Speeds for Hoisting Personnel under various conditions.

	0 – 50 feet	50 – 100 feet	100 – 150 feet	0 – 150 feet	Hoist House Speed
Test 1 (a)	55 FPM (55 sec)	56 FPM (54 sec)	57 FPM (53 sec)	55 FPM (162 sec)	20 FPM
Test 1 (b)	58 FPM (52 sec)	59 FPM (51 sec)	59 FPM (51 sec)	58 FPM (154 sec)	
Test 2 (a)	120 FPM (25 sec)	136 FPM (22 sec)	130 FPM (23 sec)	129 FPM (70 sec)	100 FPM
Test 2 (b)	130 FPM (23 sec)	136 FPM (22 sec)	136 FPM (23 sec)	134 FPM (67 sec)	
Test 3 (a)	333 FPM (9 sec)	375 FPM (8 sec)	400 FPM (7.5 sec)	367 FPM (24.5 sec)	380 FPM
Test 3 (b)	300 FPM (10 sec)	375 FPM (8 sec)	425 FPM (7 sec)	360 FPM (25 sec)	

Additionally, the maximum overspeed for lowering personnel in the shaft was verified. Three tests were conducted by lowering the bucket into the shaft at the maximum speed for personnel. A tachometer was used to measure the rope speed at the top of the shaft as the bucket was lowered. The tachometer measurements of the rope speed at the top of the shaft ranged from 450 to 465 fpm when the overspeed controller activated. The speed indicator inside the hoist house for each of the tests was approximately 500 fpm.

5) EQUIPMENT AND CONSTRUCTION MATERIALS: The sinking bucket was typically used for lowering materials in the shaft. Items that could not be readily lifted or easily put into the bucket were rigged beneath it. At the time of the accident, a 20-foot-long, 2-inch-wide nylon sling (SN 4230767) manufactured by Black Diamond Lifting Products, Booneville, IN, was attached to the bottom of the bucket with a shackle. The sling was rated for 11,000 pounds in a vertical hold, and 8,800 pounds in a choker hold position. A similar shackle, model S-209, manufactured by The Crosby Group Incorporated, was attached through the eye of the sling and allowed to hang freely from the bottom of the bucket when the sling was not being used. This shackle had an overall length of 6.56 inches and a nominal diameter of 1 inch.

6) SHACKLE POSITION IN COLLAR DOORS: Based upon eyewitness accounts, the shackle attached to the end of the 20-foot nylon sling (free end) was found in one of the collar door horizontal beams immediately after the accident. Given the geometry of the shaft opening and assuming

the bucket is oriented in the center of this opening when entering the shaft, a range of horizontal distances and swing angles necessary for the shackle to become caught in the collar door structure was determined. The shackle would have to travel between 20 ⅝ and 68 ½ –inches with swing angles between 4.9 and 16.5 degrees (from vertical) to come to rest in the collar door structure. MSHA investigators used the interview information and examined several positions of the shackle in the door in an attempt to recreate a possible final position of the shackle. Three positions of the shackle were examined in the collar doors. They are shown in Exhibits 4-6. For each of the shackle positions examined, a force was applied to the sling in the up and down direction to simulate the travel direction of the bucket. Forces applied in the up and down direction to the sling as shown in Position 1 (Exhibit 4) caused it to pull out of the beam. Forces applied in the down direction to the sling shown in Position 2 (Exhibit 5) caused it to pull out of the beam, while forces applied in the up direction caused the shackle to wedge itself into the beam, causing the sling to tighten. Forces applied in the up direction to the sling shown in Position 3 (Exhibit 6) caused it to pull out of the beam, while forces applied in the down direction caused the shackle to wedge itself into the beam, causing the sling to tighten. Based on these tests, it is consensus of the accident investigation team that the sling was in Position 3, causing the bucket to tip or overturn as it was lowered.

7) WEATHER AT THE TIME OF THE ACCIDENT: According to the Mt. Carmel, Illinois National Weather Station, the temperature at the time of the accident was approximately 84 degrees and the wind was generally NNW between 6 and 10 MPH.

SHAFT SINKING PLAN:

Frontier-Kemper's Shaft Sinking Plan, which was in effect at the time of the accident, was approved on September 12, 2006. The content for approval of Slope and Shaft Sinking Plans is regulated by 30 CFR Section 77.1900(a). The plan did not specifically address the use of personal protective equipment to be utilized (fall protection) while in the bucket, nor contain details of equipment and procedures to be utilized for transporting supplies and materials (slings).

However, the use of fall protection (belts) and the requirements for the transporting of supplies and materials are mandated by 30 CFR Sections 77.1908(o) and 77.1908 (i), respectively.

The approved shaft sinking plan, issued to Frontier-Kemper rather than the mine

operator, was reviewed by the accident investigation team. Based upon the circumstances and preliminary findings of the accident investigation, it was determined that Frontier- Kemper's plan should be revised to adequately address the use of fall protection equipment and the transporting of supplies and materials. In order to address the investigators' concerns and to prevent a similar occurrence, the District 8 Manager requested the plan be revised.

Additional safety precautions were added to the shaft sinking plan to further enhance the safety of the miners throughout the shaft sinking operation and included the following:

- All persons shall use a suitable full harness and be tied off when riding in the shaft sinking bucket.
- When entering and exiting the shaft sinking bucket at the work deck, all persons shall be tied off. All persons must remain tied off to the bucket until they are tied off to the deck.
- Adequate fall protection shall be in place or used when personnel are working on the work deck, such as a third cable rail.
- A means shall be provided for safe footing when persons are embarking or disembarking from the sinking bucket at the work deck, such as a chain securing the bucket to the deck.
- Permissible wireless emergency communication devices shall be required between persons riding the bucket, the hoistman and the toplander.
- Straps, lanyards or rigging shall not be attached to the bottom of the bucket when transporting persons.
- When transporting personnel in the shaft, the toplander or other personnel will be stationed at the collar, in communication with the hoistman and be able to visually observe the bucket until it descends past the collar doors.
- The speed of the buckets transporting persons shall not exceed 500 feet per minute and not more than 200 feet per minute when within 100 feet of any stop per Title 30 Code of Federal regulations, Part 77, Subpart T, Section 1908, Paragraph (j).
- The means for preventing these speeds shall be provided automatically by Lilly controls or other similar means.
- Training shall be provided regarding these items and 5000-23 forms shall be completed for the training.

These provisions were approved and made a part of the shaft sinking plan on August 23, 2007.

FALL PROTECTION-ANSI STANDARDS

As previously stated, at the time of the accident Frontier-Kemper's approved plan did not address the use of full body harness fall protection. Full body harness protection is widely practiced throughout industry where fall hazards of greater than four (4) feet are known to exist.

At the time of the accident, standards of the American National Standards Institute (ANSI) and MSHA's own regulations, (30 C.F.R. Section 77.1710(g) and 77.1908(o)), did not specifically address the use of full body harness fall protection in these situations.

In October 2007, ANSI implemented new standards that now provide guidelines for fall prevention. The ANSI Z359-2007 standard, which was not in effect at the time of this accident, is designed to provide a proactive, multi-faceted fall protection program with emphasis on training of both supervisors and employees in work-at-heights activities. Design of the work site with fall prevention in mind is recommended as well as personal fall arrest systems when the work-at-heights distance exceeds four feet.

The accident investigation team recommends that these standards be considered when formulating and evaluating all future shaft and slope sinking plans.

MECHANISM OF THE ACCIDENT:

The use of the sling suspended from the bottom edge of the bucket created a medium for the introduction of external forces and, combined with the absence/non-use of properly attached fall protection (belts), contributed to the fatal accident.

A number of safety belts, with attached lanyards, piled near the shaft collar and among the detritus of used medical supplies and rescue equipment, were found by the investigation team,. However, at that time it could not be positively determined to whom the belts were assigned or belonged, or if they had been in use by the victims at the time of the accident. Interviews revealed that full body harness fall protection, although available at the site, was not routinely used by miners being transported in the bucket prior to the accident.

A review of MSHA training videos available at the time of the accident showed persons being transported in sinking buckets, with and without use of fall protection. However, the training videos did not show the use of slings attached to the bucket while persons were being transported in the bucket. These training materials were recalled by MSHA following this accident.

MSHA standards clearly address the use of 'safety belts' when persons are required to work in or over a shaft where there is a drop of 10 or more feet. Use of safety belts in this instance may have either prevented or mitigated the severity of this accident.

Use of the described sling, in and of itself, is not directly contrary to any standard. However, the presence of the unsecured sling allowed for the loss of control of the bucket required by the standard found at 30 C.F.R. 1908-1. During interviews, it was revealed that, prior to the accident, the sling and accompanying materials and supplies, had been frequently attached to the sinking bucket while persons were being transported in the bucket.

Due to the geometry and weight of the sinking bucket, absent the exertion of external forces (sling), it is highly improbable that the bucket could have sufficiently tipped or inverted, to cause its contents to fall.

TRAINING OF THE VICTIMS:

Frontier-Kemper's training records were examined by representatives of MSHA's Educational Field Services. The record of experienced miner training and task training for Ashmore and the hazard training record for Richardson could not be produced. Due to the knowledge and experience of the victims, these deficiencies were deemed as non-contributory to the accident and were cited separately.

ROOT CAUSE ANALYSIS

An analysis was conducted to identify the most basic causes of the accident that were correctable through reasonable management controls. During the analysis, root causes were identified that, if eliminated, would have either prevented the accident or mitigated its consequences. The following root causes were identified as a result of the investigation. In each case, an effective management system, procedure or policy was not in place to assure compliance with the regulation or safe mining procedure.

Listed below are root causes identified during the analysis and the respective corrective actions implemented to prevent a recurrence of the accident:

1. *Root Cause:* A nylon sling and shackle used for lowering supplies were left attached to the sinking bucket while transporting persons. The lack of an effective administrative control to assure that extraneous objects were not attached to the bucket when transporting persons contributed to the loss of control of the hoist.

   Corrective Action: The independent contractor's approved shaft sinking plan has been revised to include provisions that persons will not be transported with anything attached to the bucket.

2. *Root Cause:* The toplander was not at his duty station observing the mantrip as it passed through the collar doors. Inadequate policies and procedures resulted in the hoist operating without the toplander and contributed to the loss of control of the hoist.

   Corrective Action: The independent contractor's approved shaft sinking plan has been revised to require the toplander or other personnel to be stationed at the collar, in communication with the hoistman and be able to visually observe the bucket until it descends past the collar doors.

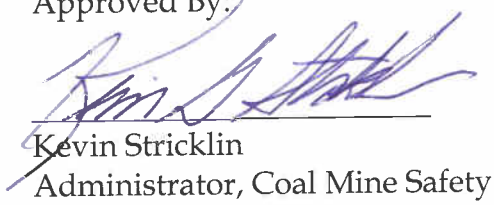
3. *Root Cause:* The independent contractor had no policy in place requiring the use of fall protection when personnel are transported in the sinking bucket.

   Corrective Action: The independent contractor's approved shaft sinking plan has been revised to include the use of fall protection when persons are transported in the sinking bucket.

CONCLUSION

The accident occurred as a result of Frontier-Kemper's failure to ensure that the hoist was under the control of the hoistman at all times when persons were in the shaft. The toplander was not at his station as the bucket was being lowered through the shaft collar doors and the hoistman had no visual contact with the bucket at this point. The hoistman lost control of the bucket when the nylon sling and shackle entangled with the shaft collar door. The contractor also failed to ensure that adequate fall protection was utilized while persons were transported in the sinking bucket.

Approved By:



02/29/2008

Kevin Stricklin
Administrator, Coal Mine Safety and Health

Date

ENFORCEMENT ACTIONS

1. A 103(k) Order, No. 7489388 was issued to ensure the safety of the miners until the investigation could be completed.

2. A 104(a) Citation, No. 7502227, was issued to Frontier-Kemper Constructors Inc. for a violation of 30 CFR 77. 1908 – 1, stating that the independent contractor failed to ensure that the hoist was under the control of the hoistman when men were in the shaft.

During the course of the investigation of a multiple fatality accident which occurred on August 10, 2007, the following was revealed;

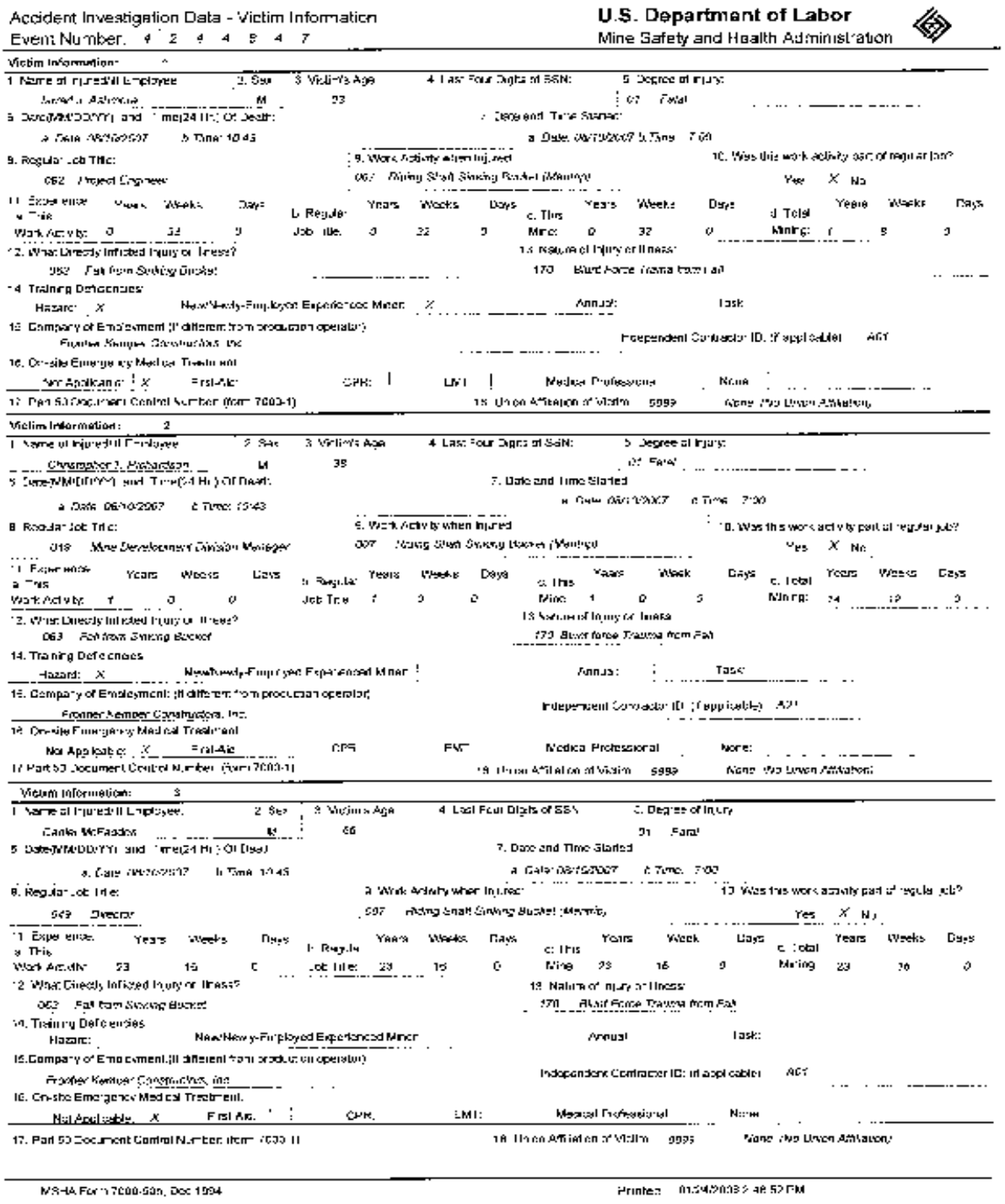
The independent contractor failed to assure that the hoist was under the control of a hoistman at all times when men were in the shaft. The sinking bucket from which three victims fell to their deaths was not visible to the hoistman, due to distances and structural obstructions between the hoistman's operating station and the shaft collar. In addition, the 'toplander', whose duties include advising the hoistman of the positions of men and equipment, was not at his station at the time of the accident. Finally, control of the hoist was lost when a sling and shackle, attached to the bottom of the sinking bucket, became entangled with the shaft collar door, resulting in the sinking bucket tipping over and causing three victims to fall to their deaths. In addition to the three persons in the sinking bucket, five other men were working at or near the shaft bottom at the time of the accident and were exposed.

3. A 104(a) Citation, No. 7502228, was issued to Frontier-Kemper Constructors Inc. for a violation of 30 CFR 77.1908(o) stating that the Contractor allowed persons to ride the sinking bucket without proper fall protection.

During the course of the investigation of a multiple fatality accident which occurred on August 10, 2007, the following was revealed;

The independent contractor failed to require the use of properly attached fall protection when persons were riding the sinking bucket. Three persons traveling in the sinking bucket fell approximately 550 feet to their deaths after the bucket inverted. None of the victims wore properly attached fall protection.

Appendix A
List of Victims



Accident Investigation Data - Victim Information
Event Number: 4 2 4 4 5 4 7

U.S. Department of Labor
Mine Safety and Health Administration

Victim Information: 1

1. Name of Injured/Ill Employee: Leonard Adkins | 2. Sex: M | 3. Victim's Age: 33 | 4. Last Four Digits of SSN: | 5. Degree of Injury: 07 Fatal

6. Date(MM/DD/YY) and Time(24 Hr.) Of Death: a. Date: 08/10/2007 b. Time: 10:45

7. Date and Time Started: a. Date: 08/10/2007 b. Time: 7:00

8. Regular Job Title: 052 Project Engineer

9. Work Activity when Injured: 067 Riding Shaft Sinking Bucket (Muning)

10. Was this work activity part of regular job? Yes X No

11. Experience: a. This Work Activity: Years 0, Weeks 32, Days 0 | b. Regular Job Title: Years 0, Weeks 32, Days 0 | c. This Mine: Years 0, Weeks 32, Days 0 | d. Total Mining: Years 1, Weeks 8, Days 0

12. What Directly Inflicted Injury or Illness? 062 Fall from Sinking Bucket

13. Nature of Injury or Illness: 170 Blunt Force Trauma from Fall

14. Training Deficiencies: Hazard: X | New/Newly-Employed Experienced Miner: X | Annual: | Task:

15. Company of Employment (If different from production operator): Frontier Kemper Constructors, Inc | Independent Contractor ID, If applicable: | AOI:

16. On-site Emergency Medical Treatment: Not Applicable: X | First-Aid: | CPR: | EMT: | Medical Professional: | None:

17. Part 50 Document Control Number (form 7000-1): | 18. Union Affiliation of Victim: 9999 None (No Union Affiliation)

Victim Information: 2

1. Name of Injured/Ill Employee: Christopher J. Richardson | 2. Sex: M | 3. Victim's Age: 38 | 4. Last Four Digits of SSN: | 5. Degree of Injury: 07 Fatal

6. Date/MM/DD/YY) and Time(24 Hr.) Of Death: a. Date: 08/10/2007 b. Time: 10:45

7. Date and Time Started: a. Date: 08/10/2007 b. Time: 7:00

8. Regular Job Title: 019 Mine Development Division Manager

9. Work Activity when Injured: 067 Riding Shaft Sinking Bucket (Muning)

10. Was this work activity part of regular job? Yes X No

11. Experience: a. This Work Activity: Years 1, Weeks 0, Days 0 | b. Regular Job Title: Years 1, Weeks 0, Days 0 | c. This Mine: Years 1, Weeks 0, Days 0 | d. Total Mining: Years 24, Weeks 12, Days 0

12. What Directly Inflicted Injury or Illness? 063 Fall from Sinking Bucket

13. Nature of Injury or Illness: 170 Blunt Force Trauma from Fall

14. Training Deficiencies: Hazard: X | New/Newly-Employed Experienced Miner: | Annual: | Task:

15. Company of Employment: (If different from production operator): Frontier Kemper Constructors, Inc.

Independent Contractor ID: (If applicable) AOI:

16. On-site Emergency Medical Treatment: Not Applicable: X | First-Aid: | CPR: | EMT: | Medical Professional: | None:

17. Part 50 Document Control Number (form 7000-1): | 18. Union Affiliation of Victim: 9999 None (No Union Affiliation)

Victim Information: 3

1. Name of Injured/Ill Employee: Carlie McFadden | 2. Sex: M | 3. Victim's Age: 56 | 4. Last Four Digits of SSN: | 5. Degree of Injury: 01 Fatal

6. Date/MM/DD/YY) and Time(24 Hr.) Of Death: a. Date: 08/10/2007 b. Time: 10:45

7. Date and Time Started: a. Date: 08/10/2007 b. Time: 7:00

8. Regular Job Title: 049 Director

9. Work Activity when Injured: 067 Riding Shaft Sinking Bucket (Muning)

10. Was this work activity part of regular job? Yes X No

11. Experience: a. This Work Activity: Years 23, Weeks 16, Days 0 | b. Regular Job Title: Years 23, Weeks 16, Days 0 | c. This Mine: Years 23, Weeks 16, Days 0 | d. Total Mining: Years 23, Weeks 36, Days 0

12. What Directly Inflicted Injury or Illness? 062 Fall from Sinking Bucket

13. Nature of Injury or Illness: 170 Blunt Force Trauma from Fall

14. Training Deficiencies: Hazard: | New/Newly-Employed Experienced Miner: | Annual: | Task:

15. Company of Employment (If different from production operator): Frontier Kemper Constructors, Inc

Independent Contractor ID: If applicable: AOI:

16. On-site Emergency Medical Treatment: Not Applicable: X | First Aid: | CPR: | EMT: | Medical Professional: | None:

17. Part 50 Document Control Number (form 7000-1): | 18. Union Affiliation of Victim: 9999 None (No Union Affiliation)

MSHA Form 7000-50h, Dec 1994 Printed: 01/24/2008 9:48:52 PM

Appendix B
List of Persons Participating in the Investigation

Frontier-Kemper Constructors, Inc.

Name	Title
George Zugel	Corporate Safety Director
Kyle Wooten	Project Manager
Scott Harrell	Corporate Human Resources Director
R. Brian Hendrix	Attorney, Patton-Boggs, LLP
Mark Savitt	Attorney, Patton-Boggs, LLP
Henry Chajet	Attorney, Patton-Boggs, LLP
H. John Head	Consulting Engineer, Continental Placer Inc.

Gibson County Coal, LLC.

Mike Stanley	General Manager

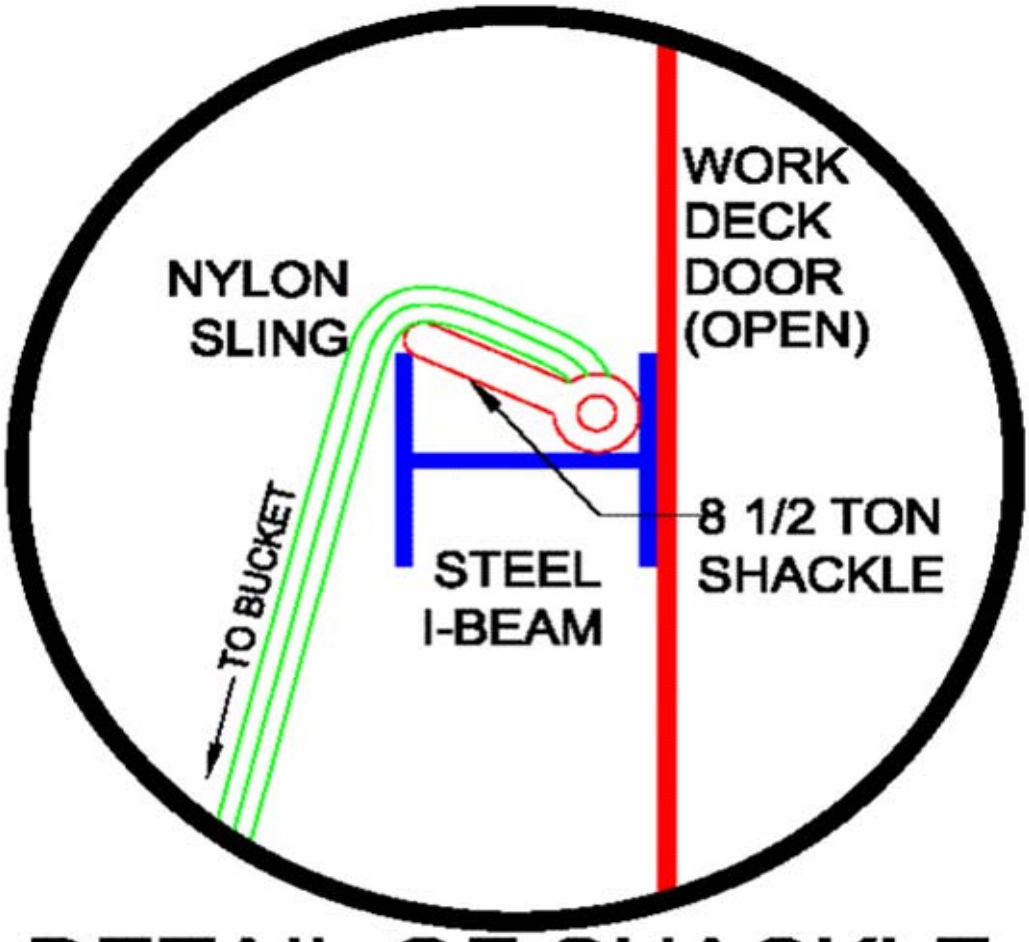
Indiana Bureau of Mines

Don "Blink" McCorkle	Deputy Commissioner

MSHA

Charles Grace	Assistant District Manager, District 7
Carl Boone	Acting District Manager, District 8
David Whitcomb	Assistant District Manager, District 8
Mike Rennie	Supervisory C. M. S. & H., District 8
Ronald Stahlhut	Supervisory C. M. S. & H., District 8
Edward Ritchie	Conference and Litigation Officer, District 8
Bryan Sargeant	Supervisory Special Investigator, District 8
Bruce Harris	Special Investigator, District 8
Michael Kalich	Mining Engineer, Headquarters Safety Division
Jarrod Durig	Civil Engineer, Technical Support
Michael Snyder	Mining Engineer, Technical Support
Leyland Payne	Supervisory Training Specialist
Javier Romanach	Office of the Solicitor
Kevin Doan	Mining Engineer, District 7

EXHIBIT 1
PHOTO OF NYLON SLING AND SHACKLE



DETAIL OF SHACKLE
IN WORK DECK DOOR

EXHIBIT 2
DRAWING OF SLING/SHACKLE IN COLLAR DOOR

EXHIBIT 3
PHOTO OF NYLON SLING AND SHACKLE IN COLLAR DOOR

EXHIBIT 4
PHOTO OF POSITION 1 OF SHACKLE IN COLLAR DOOR

EXHIBIT 5
PHOTO OF POSITION 2 OF SHACKLE IN COLLAR DOOR

EXHIBIT 6
PHOTO OF POSITION 3 OF SHACKLE IN COLLAR DOOR