MAI-2007-24

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
Metal and Nonmetal Mine Safety and Health

REPORT OF INVESTIGATION

Underground Nonmetal Mine
(Trona)

Fatal Powered Haulage Accident
September 19, 2007

FMC @ Westvaco
FMC Corporation
Green River, Sweetwater County, Wyoming
Mine I.D. No. 48-00152

Investigators

Thomas E. Barrington
Mine Safety and Health Inspector

Eugene D. Hennen, PE
Mechanical Engineer

Originating Office
Mine Safety and Health Administration
Rocky Mountain District
Denver Federal Center 6th & Kipling
2nd Street, Bldg. 25, E-16
Denver, CO 80225
Richard R. Laufenberg, District Manager

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OVERVIEW

On September 19, 2007, Carder A. Largent, Jr., underground mechanic, age 41, was fatally injured when the service truck he was driving struck a rib and overturned. A coworker riding in the truck was seriously injured in the accident.

The steering cylinder disengaged from the tie rod causing the truck to veer right and subsequently rollover. Management failed to identify the hazard that normal wear would have on the fastener clips that secured the steering cylinder clevis pin. One of the two hairpin-type retaining clips used to secure the steering cylinder clevis pin was not in place causing the pin to fall out.

GENERAL INFORMATION

FMC @ Westvaco mine, an underground trona mine, owned and operated by FMC Corporation, was located 23 miles west of Green River, Sweetwater County, Wyoming. The principal operating official was James M. Pearce, resident manager. The mine normally operated three overlapping 10-hour shifts per day, seven days a week. Total employment was 215 persons.

Trona was mined using borer mining machines and longwall machinery. Ore was transported by conveyors to loading pockets at two shafts. It was hoisted to the surface, processed at the mine site, and sold for commercial use.

The last regular inspection of this operation was completed on September 19, 2007.

DESCRIPTION OF ACCIDENT

On September 19, 2007, Carder A. Largent, Jr., (victim) reported to work at 8:00 a.m., his normal starting time. John Morrison, maintenance foreman, told Largent and Daniel Hellickson, mine mechanic, to assist with the next longwall setup.

About 8:30 a.m., Largent and Hellickson rode the second man-cage into the mine and took a service truck assigned to Largent.

Largent and Hellickson traveled approximately six miles from the number eight shaft into the 592 longwall panel number 3 where they worked on hydraulic valves and hoses in the head gate. Between 10:00 a.m. and 10:30 a.m., they rode the service truck from the 592 longwall panel toward the underground shop to fabricate hydraulic hoses needed to complete the work in the tailgate.

Between crosscuts 38 and 39, Largent suddenly lost control of the truck. The vehicle veered right, climbed the rib and rolled over onto its top. Largent was pinned under the service truck and Hellickson was thrown clear of the vehicle.

At approximately 11:20 a.m., Morris Sheets, mechanic, Lea Hutzenbiler and Amy Manger, industrial hygienists, saw Hellickson near the 46 crosscut. Hellickson reported the accident and they went to the accident scene and attended to Largent. Largent was extracted from beneath the service truck. Paul Maestas, forklift operator, performed cardiopulmonary resuscitation (CPR) until emergency medical personnel arrived and transported the victim to the surface. Largent was transported to a local hospital where he was pronounced dead by the attending physician. The cause of death was blunt force trauma.

INVESTIGATION OF THE ACCIDENT

The Mine Safety and Health Administration (MSHA) was notified of the accident at 11:54 a.m., on September 19, 2007, by a telephone call from Robert Hunter, mine utilities assistant, to the National Call Center. The message was forwarded to Richard Laufenberg, district manager. An investigation was started the same day.

An order was issued under the provisions of Section 103(k) of the Mine Act to ensure the safety of the miners. MSHA's accident investigators traveled to the mine, made a physical inspection of the accident scene, interviewed employees, and reviewed conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine management, employees, miners' representatives, and the State of Wyoming Mine Inspectors.

DISCUSSION

Location of the Accident

The accident occurred in the middle entry of the 592 longwall panel number 3 between crosscuts 38 and 39. The entry was driven using a borer mining machine and was about 16 feet wide and 10 feet high. The roof and floor were cut flat with the radial cutter heads but the borer created convex curved ribs on both sides of the entry.

Two high pressure emulsion pipes were attached to the roof on one side of the entry. Three-phase, grounded power cables along with other cables were attached to the roof on the opposite side. Scuff marks were noted on the power cable.

The right front tire of the service truck contacted the right rib of the entry. The same tire created a mark on the roof approximately 15 feet from initial contact with the rib. The angle of climb on the rib measured 11%. There was no indication that the truck slid forward once it landed upside down indicating a slower speed/weight ratio. As the vehicle rolled, it rotated counter clockwise with the passenger side coming to rest across the entry to the left (north) rib.

Service Truck

The vehicle involved in the accident was a Sien Equipment Company, Model Brute 612 Mantrip powered by a 3 cylinder diesel engine. Originally a 14 passenger mantrip, the vehicle was used as a combination mechanics transport and service truck. Approximately 1,000 pounds of tools and supplies were being transported. The total load capacity of the truck was about 2,800 pounds. The manufacturer was no longer in business.

The braking systems were inspected and tested. The service brake was a foot pedal operated hydraulic, applied system with disc brakes on the front axle and drum brakes on the rear axle. The brakes on both the front and rear axles were activated by a foot activated master cylinder. The service brake system did not have a power assist.

No grease or oil was found on the brake components on either the front or rear axle of the vehicle. After the truck was turned over and placed on its wheels, the master cylinder reservoir was still full of brake fluid. A service brake test was conducted and the service brake held the vehicle in place through the entire range of forward and reverse gears.

The park/emergency brake was a foot-operated cable type brake system that applied the drum brake on the rear axle. When tested, it did not function. The rear wheels could be turned by hand when the park/emergency brake was fully applied. The brake cables were stuck and could not be pulled. A non-contributory citation was issued for this violation.

The hydraulic steering system consisted of a gear driven power steering pump, an orbitrol power steering valve, and a hydraulic steering cylinder. Flow from the power steering pump was directed to the power steering valve. When the engine was operating, movement of the steering wheel would cause the power steering valve to direct flow from the power steering pump to the hydraulic steering cylinder allowing the front wheels to turn. A new pin was installed in the steering cylinder clevis to replace the missing pin. A test of the steering system showed that it was functional.

The steering cylinder on the vehicle was a Spencer Model 20X08A-L-SAL. The cylinder had a 2-inch bore and an 8-inch stroke. The cylinder rod was 1-⅛ inches in diameter and the distance between the centers of the cylinder mounting pins was 20-¼ inches when the cylinder was retracted and 28-¼ inches with the cylinder extended. The nominal diameter of the cylinder mounting clevis pin hole was 1-inch diameter on both the rod and cylinder sides of the steering cylinder. The steering cylinder had a maximum working pressure of 2,500 pounds per square inch (psi). When tested, the maximum steering system operating pressure was 1,350 psi.

Figure 2 (Appendix B) shows a photo of the steering cylinder clevis pin that came out of the steering cylinder clevis at the time of the accident. One end of this pin still had the hairpin fastener (clip) in place. The nominal diameter of the pin was 1-inch and the length was approximately 3-⅜ inches. This pin had a groove at each end that was approximately ⅛ inch wide and approximately ⅛ inch deep. A hole with a diameter of approximately $^{3}/_{16}$ inch was drilled through the pin at the location of each groove.

A hairpin fastener was placed in the groove on each end of the clevis pin to secure it in the clevis. This pin (top pin) is depicted in Figure 3 (Appendix B).

A pin similar to the pin that came out of the steering cylinder clevis at the time of the accident and two new hairpin clips are shown in the bottom of the photo in Figure 3 (Appendix B).

Figure 4 (Appendix B) depicts the cylinder on the machine at the time of the accident. This drawing shows hairpin clips holding the clevis pins in place.

The outside diameter of the steering cylinder clevis pin that fell out at the time of the accident was compared with the inside diameter of the clevis pin hole on the rod end of the steering cylinder. The wear on these parts allowed the cylinder clevis pin to move while the vehicle traveled. This movement allowed the clevis pin to slide out when the hairpin fastener installed on one end of the pin came off.

The suspension system was inspected and no defects were found.

Training and Experience

Carder A. Largent, Jr., had 17 years, 5 months experience and had received training in accordance with 30 CFR, Part 48.

Daniel Hellickson had 2 years, 10 months experience and had received training in accordance with 30 CFR, Part 48.

ROOT CAUSE ANALYSIS

A root cause analysis was conducted and the following causal factor was identified:

Causal Factor: The mine operator and the equipment manufacturer failed to identify the possible hazard of using this type of fastener clip to secure the steering cylinder clevis pin in place. No compensation was made for the normal wear caused by the movement of the clevis pin.

Corrective Action: Procedures should be implemented to utilize a different type of fastener to secure the steering cylinder clevis pin.

CONCLUSION

Management failed to identify the hazard that normal wear would have on the fastener clips that secured the steering cylinder clevis pin. The steering cylinder disengaged from the tie rod causing the truck to veer right and subsequently rollover. One of the two hairpin type retaining clips used to secure the steering cylinder clevis pin was not in place causing the pin to fall out.

The mine operator replaced the steering pins with a 1 inch diameter grade 5 bolt trimmed to 5 inches in length. A $^{3}/_{16}$ inch diameter hole was drilled through the threaded end to accept a cotter pin. A castle nut, washer, and cotter pin were used to secure the bolt to the steering connections.

ENFORCEMENT ACTION

Order No. 6304764 was issued on September 19, 2007, under the provisions of Section 103(k) of the Mine Act:

A fatal accident occurred at this operation on September 19, 2007, when a Sien Brut service truck overturned on the longwall main roadway. This order is issued to ensure the safety of all persons at this operation. It prohibits all activity on the longwall main roadway between crosscuts 38 and 39, and all Sien Brut Model # 612 vehicles. The mine operator shall obtain prior approval from an Authorized Representative for all actions to recover and restore operations to the affected area and equipment.

This order was terminated on December 6, 2007. Conditions that contributed to the accident no longer existed.

Approved by: Date: February 4, 2008

Richard Laufenberg
District Manager

APPENDICES

~~A.~~A. Persons Participating in the Investigation
B. Figures 1 through 4
C. Victim Data Sheet

APPENDIX A
Persons Participating in the Investigation

FMC Corporation

Richard L. Steenberg	mine manager
Ted K. Walker	mine maintenance manager
Mike Crum	safety team leader
David S. Hutchinson	safety & health coordinator/IH
Garth Mitchell	mine maintenance supervisor

United Steel Workers of America LU 13214

Michael K. Burd	vice-president
Daniel W. Haanpaa	safety chairman
T. Jay Kelso	executive board

State of Wyoming

Terry Adcock	state inspector of mines
Michael McCann	state inspector of mines

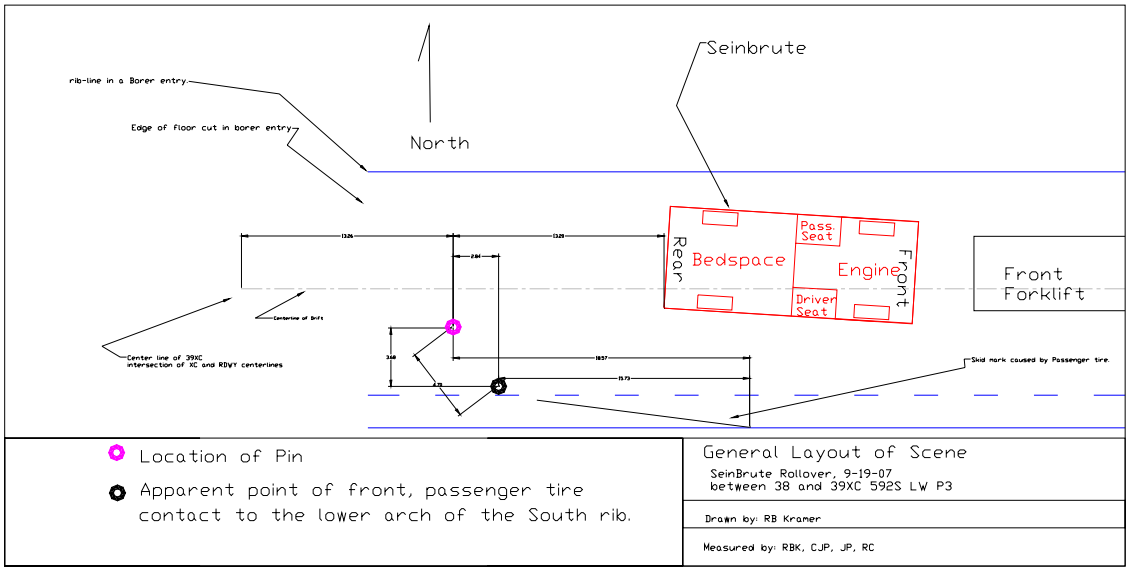
Mine Safety and Health Administration

Thomas E. Barrington	mine safety and health inspector
Eugene D. Hennen, PE	mechanical engineer

APPENDIX B

Figures 1 through Figure 4

Figure 1



SCHEMATIC OF ACCIDENT SCENE

Figure 2

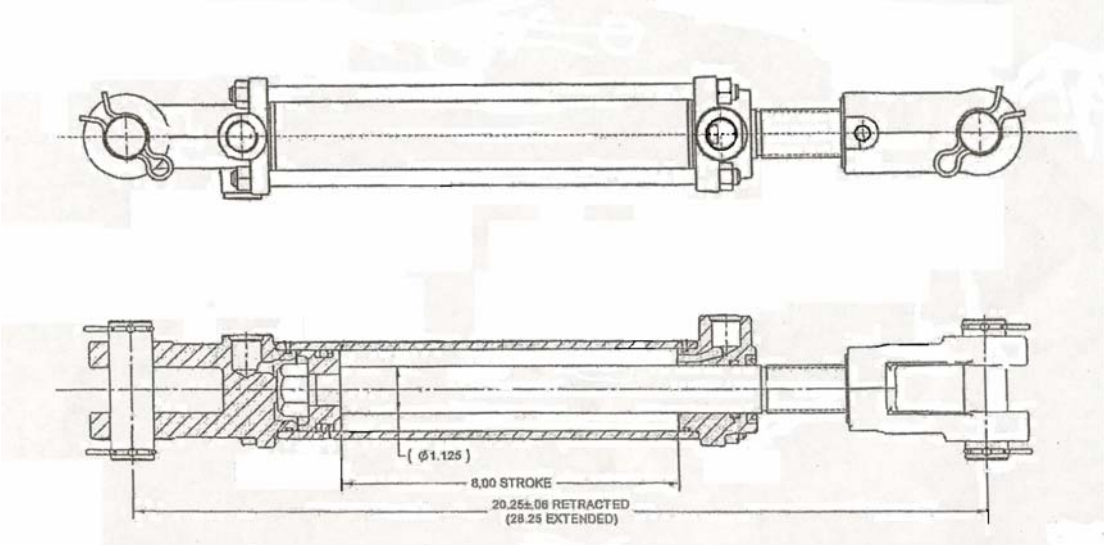
CLEVIS PIN THAT CAME OUT OF STEERING CYLINDER, ONE HAIRPIN STILL ATTACHED

APPENDIX B - continued

Figure 3

T0P: PIN AND HAIRPIN CLIP THAT CAME OUT OF THE STEERING CYLINER CLEVIS ON THE MACHINE INVOLVED IN THE ACCIDENT
BOTTOM: NEW CLEVIS PIN WITH NEW HAIRPIN CLIPS

Figure 4



STEERING CYLINDER WITH HAIRPIN CLIPS HOLDING CLEVIS PINS IN PLACE

APPENDIX C
VICTIM DATA SHEET

Accident Investigation Data - Victim Information
Event Number: 1 0 9 8 6 9 0

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

Victim Information: 1

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Last Four Digits of SSN:	5. Degree of Injury:
Carden A. Largent, Jr.	*M*	*41*		*01 Fatal*

6. Date(MM/DD/YY) and Time(24 Hr.) Of Death: *a. Date: 09/19/2007 b.Time: 11:15*

7. Date and Time Started: *a. Date: 09/19/2007 b.Time: 8:00*

8. Regular Job Title: *004 A Class Mechanic*

9. Work Activity when Injured: *090 Travel Between Longwall to UG Shop*

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

11. Experience	Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days		Years	Weeks	Days
a. This Work Activity:	17	5	0	b. Regular Job Title:	17	5	0	c: This Mine:	17	5	0	d. Total Mining:	17	5	0

12. What Directly Inflicted Injury or Illness? *110 Rollover on to victim*

13. Nature of Injury or Illness: *170 Crushing*

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

15. Company of Employment:(If different from production operator) *Operator*
Independent Contractor ID: (if applicable)

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

17. Part 50 Document Control Number: (form 7000-1)

18. Union Affiliation of Victim: *2605 United Steel Workers of America*

Victim Information: 2

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Last Four Digits of SSN:	5. Degree of Injury:
Daniel Hellickson	*M*	*24*		*04 Days away from work & days restrict acty*

6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:

7. Date and Time Started *a. Date: 09/19/2007 b.Time: 8:00*

8. Regular Job Title: *004 Mechanic*

9. Work Activity when Injured: *090 Travel*

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

11. Experience:	Years	Weeks	Days		Years	Weeks	Days		Years	Week	Days		Years	Weeks	Days
a. This Work Activity:	2	10	0	b. Regular Job Title:	2	10	0	c: This Mine:	2	10	0	d. Total Mining:	2	10	0

12. What Directly Inflicted Injury or Illness? *002 Bodily Motion*

13.Nature of Injury or Illness: *180 Contusions/Abrasions/Lacerations*

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

15. Company of Employment: (If different from production operator) *Operator*
Independent Contractor ID: (if applicable)

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

17.Part 50 Document Control Number: (form 7000-1)

18. Union Affiliation of Victim: *2605 United Steel Workers of America*

Victim Information:

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Last Four Digits of SSN:	5. Degree of Injury:

6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:

7. Date and Time Started:

8. Regular Job Title:

9. Work Activity when Injured:

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

11. Experience:	Years	Weeks	Days		Years	Weeks	Days		Years	Week	Days		Years	Weeks	Days
a. This Work Activity:				b. Regular Job Title:				c: This Mine:				d. Total Mining:			

12. What Directly Inflicted Injury or Illness?

13. Nature of Injury or Illness:

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

15.Company of Employment:(If different from production operator)
Independent Contractor ID: (if applicable)

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

17. Part 50 Document Control Number: (form 7000-1)

18. Union Affiliation of Victim: