CAI-2008-03

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Surface Coal Mine

Fatal Machinery Accident
February 1, 2008

Thompson Tractor Company, Inc. (DL2)
Birmingham, Jefferson County, Alabama

at

Reed Minerals, Inc.
Jap Creek Mine
Walker County, Alabama
I.D. No. 01-02996

Accident Investigators

John M. Church
Mine Safety and Health Specialist (Electrical)

David H. Allen, Jr.
Mining Engineer

Phillip McCabe
Mechanical Engineer
Mine Safety and Health Technical Support
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Originating Office
Mine Safety and Health Administration
District 11
135 Gemini Circle, Suite 213
Birmingham, Alabama 35209
Richard A. Gates, District Manager

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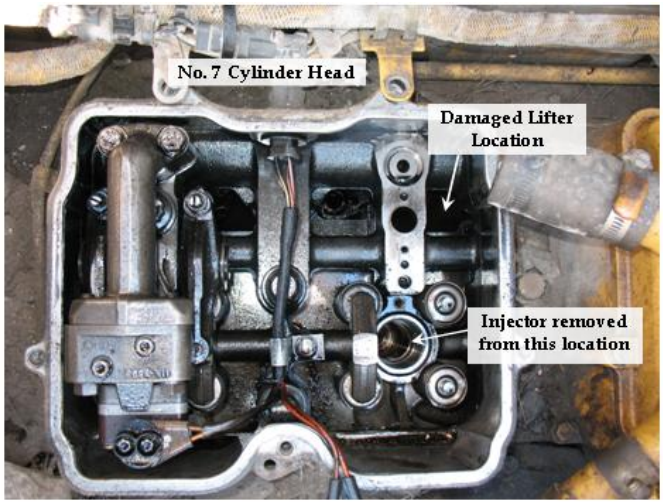


OVERVIEW

On February 1, 2008, a 34-year old field service mechanic for Thompson Tractor Company, Inc., was fatally injured while working on the diesel engine of a Caterpillar D10R bulldozer at the Reed Minerals, Inc., Jap Creek Mine in Walker County, Alabama. To observe movement of a potentially damaged lifter and to place it in a better position for retrieval, the victim requested that a co-worker "bump" the engine. "Bumping" the engine involves supplying power to the engine starter to produce limited movement of internal engine components without starting the engine by turning the ignition key to the start position and quickly releasing it. The victim was struck in the left eye when diesel fuel that had accumulated in the cylinder bore was ejected from the open injector sleeve orifice under pressure at a high velocity when the co-worker "bumped" the engine.

The accident occurred because: (1) the victim had not been provided with hazard training in safe working procedures and the safety hazards related to the failure to remove residual fluid from cylinder bores, (2) power was supplied to the engine starter causing motion of internal engine components while repairs/maintenance was being performed, and (3) the victim was not wearing eye protection.

GENERAL INFORMATION

The Jap Creek Mine, I.D. No. 01-02996, is owned and operated by Reed Minerals, Inc., and is located in Walker County, Alabama. Operations at the Jap Creek Mine began August 1, 1993, and 59 persons are currently employed at the mine. The mine operates 6 days per week with two 10-hour shifts per day. Coal is mined from 5 separate seams ranging from 10 inches to 26 inches in thickness. The mine produced 524,210 tons of coal in 2007.

A safety and health inspection was completed on January 15, 2008, and no inspection was ongoing at the time of the accident. The Non-Fatal Days Lost (NFDL) injury incidence rate for the mine for the previous quarter was 7.09 compared to the national NFDL rate of 1.00 for surface coal mines.

The principal officials of the mine at the time of the accident were:

Robert Reed……..Owner
Frances Nibler……..Director of Operations
Allen Scott…….……Safety Manager
Donald Johnson……Mine Superintendent

Thompson Tractor Company, Inc. (Thompson), contractor I.D. No. DL2, is headquartered in Birmingham, Alabama, and is the full-line Caterpillar dealer for Alabama, northwest Florida, and most of Georgia. The company specializes in leasing, sales, and service of Caterpillar products, including earthmoving, construction and material handling equipment, and diesel engines used for electric power generation, on-highway and marine propulsion applications. Field mechanics are deployed to sites as needed or as scheduled. There were three field service mechanics working at the mine at the time of the accident.

The Non-Fatal Days Lost (NFDL) injury rate for the contractor for the previous quarter was 0.00 compared to the national NFDL rate of 0.82 for all contractors at surface mines.

The contractor's principal officials at the time of the accident were:

Bob Bacon…….Vice President and
General Manager Service
Mike Snow……Central Region Service Manager
Keith Pardue ……Birmingham Service Manager
Earthmoving
Johnny Wilson……..Field Service Mining Supervisor

DESCRIPTION OF THE ACCIDENT

On Friday, February 1, 2008, C. Barret Stratton (victim), a field service mechanic for Thompson, traveled to the Jap Creek Mine to diagnose and, if possible, repair an operational problem with the diesel engine on a Caterpillar D10R bulldozer (dozer). Stratton helped Thomas Frost, a Thompson field service mechanic, work on other equipment at the mine before beginning work on the dozer. Stratton left Frost to begin work on the dozer shortly before 10:00 a.m. Frost joined Stratton at the dozer at approximately 10:00 a.m. Johnny Peterman, a Thompson field service mechanic, worked on a job at a different surface mine before arriving at the dozer at approximately 11:30 a.m.

Stratton, Frost, and Peterman removed guards and shields to expose the diesel engine compartment and work proceeded to diagnose the problem. The number 7 cylinder valve cover, valve rocker arms, and injector were removed. Stratton positioned himself over the number 7 cylinder near the open injector sleeve to observe lifter movement. At approximately 12:30 p.m. Stratton asked Frost to "bump" the engine. Peterman immediately observed what was described as a "mist" of diesel fuel around Stratton's head when Frost "bumped" the engine.

Peterman saw Stratton slump over and called out to him but received no response. Peterman and Frost removed Stratton from his work location on the dozer track and placed him on the ground. Stratton's vital signs were checked and he was not breathing and had either a faint or no pulse. Peterman and Frost began 2-man CPR and Peterman called 911 at 12:34 p.m. CPR resumed for approximately 30 minutes until an ambulance arrived. A medical services helicopter had also been dispatched to the mine but returned to base when notified that their services were not needed. Stratton was pronounced dead at the mine at 1:26 p.m. An autopsy was performed and the cause of death determined to be blunt force trauma.

INVESTIGATION OF THE ACCIDENT

At approximately 12:45 p.m. on Friday, February 1, 2008, Frances "Buck" Nibler, Director of Operations for Reed Minerals, Inc., notified MSHA Assistant District Manager Gary Wirth that a serious accident possibly resulting in a fatality had occurred at the Jap Creek Mine. MSHA accident investigators were sent to the mine and an order pursuant to § 103(k) of the Federal Mine Safety & Health Act of 1977 was issued to ensure the safety of miners until an investigation could be conducted. The accident investigators made an examination of the accident scene, interviewed witnesses, and reviewed work conditions relative to the scene. MSHA conducted the investigation with the assistance of state investigators, Thompson employees, and mine management.

Persons participating in the investigation are shown in Appendix A. Eight people were interviewed throughout the investigative process.

DISCUSSION OF THE ACCIDENT

Site Conditions

The weather was overcast and cool in the morning and sunny in the afternoon. The dozer had been moved to a location away from active mining for repairs. The site was wet and fairly level.

Engine Description and Findings

The engine involved in the accident was a Caterpillar 3412E diesel engine. The Caterpillar 3412E engine is a 12-cylinder, turbo-charged diesel engine with a rating of 661 gross horsepower. This electronically controlled engine is designed with one fuel injector for each cylinder. Fuel is delivered to each injector by a common rail. This engine has a common rail for each bank of 6 cylinders.

Residual fuel from the common rail will drain into the combustion chamber and piston cylinder if the fuel is not drained prior to removing an injector. Representatives of the contractor and manufacturer indicated up to one quart of fuel can potentially drain into the piston cylinder when an injector is removed from this engine model.

On February 6, 2008, investigators and representatives from the mine and Thompson witnessed the removal of the cylinder heads by Frost and Peterman. Residual fluid was observed in the number 7 cylinder (see Appendix B). Nothing internal to the piston cylinder or combustion chamber was observed to be broken. Engine components were examined for damage. All previously removed hardware was identified and counted and nothing was missing. It was observed, however, that a lifter guide spring was broken, indicating a possible failed lifter or camshaft lobe. The lifter was removed and observed to be damaged (see Appendix B). The lifter and guide spring are external to the piston cylinder and any broken pieces would have fallen into the engine oil pan through the oil drains. The engine was subsequently removed from the dozer and taken to the Thompson facility near Birmingham, Alabama, for further inspection.

On February 11, 2008, investigators traveled to the Thompson facility to observe additional dismantlement of the engine. The oil filters contained small metal shavings that, according to shop mechanics, appeared to be lifter fragments. The broken piece of the guide spring was found in the oil pan (see Appendix B) along with additional metal from the damaged lifter.

Recommended Work Procedures

The manufacturer's injector installation manual for this engine emphasizes the evacuation of fluid from the cylinder bore before installing an injector to prevent hydraulic lock of the engine. Installation of the injector creates a closed system. Hydraulic lock occurs in a closed system when a cylinder contains fluid and upward movement of the piston stops short due to the incompressibility of the fluid. This would cause engine damage. The manufacturer's literature does not address the evacuation of fluid from cylinders as a safety precaution to protect persons from injury.

Observations in a Controlled Environment

Rebuilt engines are tested on a dynamometer to ensure compliance with Caterpillar specifications before they are sent to the field. According to a Thompson CRC Engine Supervisor, "about every 6 to 7 months" rebuilt engines contain fluid, which is usually water, in the cylinder bores. If fluid is present in a cylinder bore, it is removed while the engine is on the dynamometer and before the engine is tested. To remove the fluid, the injector is removed, persons are withdrawn to safe locations, and the engine is started remotely. He indicated that the resulting stream of fluid is ejected from the injector sleeve orifice at a high rate of speed and strikes the ceiling, which is approximately 20 feet high, with resounding force.

Hazard Training Program

Thompson developed and submitted a Hazard Training Program that was approved June 24, 2002. The Hazard Training Program requires, in part, that instruction be given in safe working procedures.

Work History and Training

Stratton began his employment with Thompson as a trainee at the shop facility on October 23, 1995. He was promoted to a Class C mechanic on April 21, 1997, to a Class B mechanic on October 19, 1998, and to a Class A mechanic on October 16, 2000. He became a field service mechanic on October 17, 2005. He last completed annual refresher training September 30, 2007.

Work Activities

A mine supervisor had previously observed white smoke from the diesel exhaust system of the company number 5202 Caterpillar D10R bulldozer. The white smoke is often indicative of an injector problem. Stratton, Peterman, and Frost removed guards and shields to open the engine compartment. At the number 11 cylinder, Stratton

removed the injector, evacuated fluid from the cylinder bore using a vacuum device, installed a new injector, and completed reassembly. This did not repair the problem.

Next, the valve cover, valve rocker arms, and injector at the number 7 cylinder were removed. With the rocker arms removed from the engine head, all 4 valves (2 intake valves and 2 exhaust valves) of the number 7 cylinder were held in the closed position by the valve springs. Stratton apparently made the determination that there was nothing wrong with the injector and turned his attention to the lifters. According to Thompson officials, the determination that there was a more significant problem with the engine was most likely made after observing a broken lifter guide spring and realizing that the lifter was probably damaged. Stratton tried to retrieve the questionable lifter but was unable to do so. In an attempt to observe movement of the lifter and to place it into a better position for retrieval, he requested that Frost "bump" the engine. Stratton was leaning over the open injector sleeve opening when Frost "bumped" the engine. Stratton had not removed residual fluid from the number 7 cylinder and diesel fuel was ejected from the open 0.33-inch diameter injector sleeve orifice, which was the only opening to the atmosphere, under pressure at a high velocity and struck Stratton in the left eye. Stratton was not wearing eye protection. (See Appendix C for illustrative cylinder sketches.)

According to Frost and Peterman, Stratton normally wore darkly tinted safety glasses and had been wearing them before the accident. Stratton probably removed the darkly tinted safety glasses because he was trying to see lifter movement in the dark recesses of the engine. Thompson provides different styles of safety glasses that range from untinted to moderately tinted to darkly tinted.

Interviews with Stratton's immediate supervisor indicated that Stratton probably did not remove the fuel in the cylinder bore because he was not concerned with hydraulic lock that would occur if the injector was re-installed without evacuating the fluid from the cylinder bore. He further indicated that hydraulic lock would not be a concern because Stratton would have realized that the engine would have to be removed and rebuilt upon seeing the broken lifter guide spring and realizing the lifter was not functioning properly. A Thompson manager indicated that Stratton probably wanted to remove the lifter in the field to show the mine operator proof that the engine had to be rebuilt.

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, three root causes were identified that, if eliminated, would have either prevented the accident or mitigated its consequences.

Root Cause: The victim had not been provided with hazard training in safe working procedures and the safety hazards related to the failure to remove residual fluid from cylinder bores.

Corrective Action: Train all field mechanics in the safety hazards associated with failing to remove residual fluids from cylinder bores.

Root Cause: Power was supplied to the engine starter causing motion of internal engine components while repairs/maintenance was being performed.

Corrective Action: Safe means, such as by manually turning the engine or by using other equally safe and effective alternative means, must be used to cause motion of internal engine components when repairs and/or maintenance are being performed.

Root Cause: The victim was not wearing eye protection.

Corrective Action: Train all field mechanics in the requirements to use appropriate eye protection and require field mechanics to wear clear safety glasses when working in dark areas.

CONCLUSION

On February 1, 2008, a 34-year old independent contractor employee was fatally injured when he was struck by diesel fuel that was ejected from a cylinder bore through the injector sleeve orifice of the diesel engine of a Caterpillar D10R bulldozer. The diesel fuel was ejected from the orifice under pressure at a high velocity when the engine was "bumped" to place a lifter in a better position for retrieval. The accident occurred because: (1) the victim had not been provided with hazard training in safe working procedures and the safety hazards related to the failure to remove residual fluid from cylinder bores, (2) power was supplied to the engine starter causing motion of internal engine components while repairs/maintenance was being performed, and (3) the victim was not wearing eye protection.

Approved by:

For Richard A. Gates
District Manager

4/24/08
Date

ENFORCEMENT ACTIONS

§ 103(k) Order No. 7691157:

At approximately 12:34 p.m., an employee of Thompson Tractor Company, Inc. (contractor ID DL2) was involved in an accident resulting in fatal injuries on mine property as he was performing maintenance on the company number 5202 Caterpillar D-10R dozer, S/N AKT943. This order is issued to assure the safety of persons until an accident investigation is conducted.

> *Area or Equipment:* The #5202 D-10R Caterpillar dozer (S/N) AKT943), the Thompson Tractor Co., Inc., #134 Ford F-650 service truck, and the access road adjacent to this equipment.

§ 104(d)(1) Citation Issued to Thompson Tractor Company, Inc., Contractor ID DL2, for Violation of § 48.31(a)(3):

On February 1, 2008, an employee of Thompson Tractor Co., Inc. (Thompson), an independent contractor performing services at the Reed Minerals, Inc., Jap Creek Mine, was fatally injured when diesel fuel was ejected from an open 0.33-inch diameter injector sleeve orifice. Thompson has not provided its employees with hazard training in safe working procedures and the safety hazards related to the failure to remove residual fluid from cylinder bores. Thompson management officials had knowledge of the safety hazards caused by failure to remove fluid from a cylinder bore and by starting the engine to remove excess fluid through an open injector sleeve orifice but did not train field service mechanics in these hazards. This is aggravated conduct constituting more than ordinary negligence and an unwarrantable failure to comply with a mandatory safety standard.

§ 104(a) Citation Issued to Thompson Tractor Company, Inc., Contractor ID DL2, for Violation of § 77.404(c):

On February 1, 2008, an employee of Thompson Tractor, Co., Inc., an independent contractor performing services at the Reed Minerals, Inc., Jap Creek Mine, was fatally injured while performing repairs/maintenance on the diesel engine of the company number 5202 Caterpillar D10R bulldozer. Power was supplied to the starter which caused movement of internal engine components. The movement of the internal engine components caused diesel fuel to be ejected from an open 0.33-inch diameter injector sleeve orifice. The victim received fatal injuries when the diesel fuel struck him in the left eye.

§ 104(a) Citation Issued to Thompson Tractor Company, Inc., Contractor ID DL2, for Violation of § 77.1710(a):

On February 1, 2008, an employee of Thompson Tractor Co., Inc., an independent contractor performing services at the Reed Minerals, Inc., Jap Creek Mine, was fatally injured when diesel fuel was ejected from the open 0.33-inch diameter injector sleeve orifice on the number 7 cylinder of the diesel engine on the company number 5202 Caterpillar D10R bulldozer and struck the victim in the left eye. The victim was not wearing eye protection at the time of the accident.

APPENDIX A

Persons Participating in the Investigation

THOMPSON TRACTOR COMPANY, INC.

Bob Bacon (Vice President and General Manager Service)
Mark Schropp (Technical Communicator)
Terry Benton (CRC Process & Quality Auditor)
Rick Lansdell (CRC Engine Supervisor)
Johnny Wilson (Field Service Mining Supervisor)
Thomas Frost (Field Service Mechanic)
Johnny Peterman (Field Service Mechanic)

REED MINERALS, INC.

Frances Nibler (Director of Operations)
Allen Scott (Safety Manager)
Donald Johnson (Mine Superintendent)

STATE OF ALABAMA DEPARTMENT OF INDUSTRIAL RELATIONS MINING AND RECLAMATION DIVISION

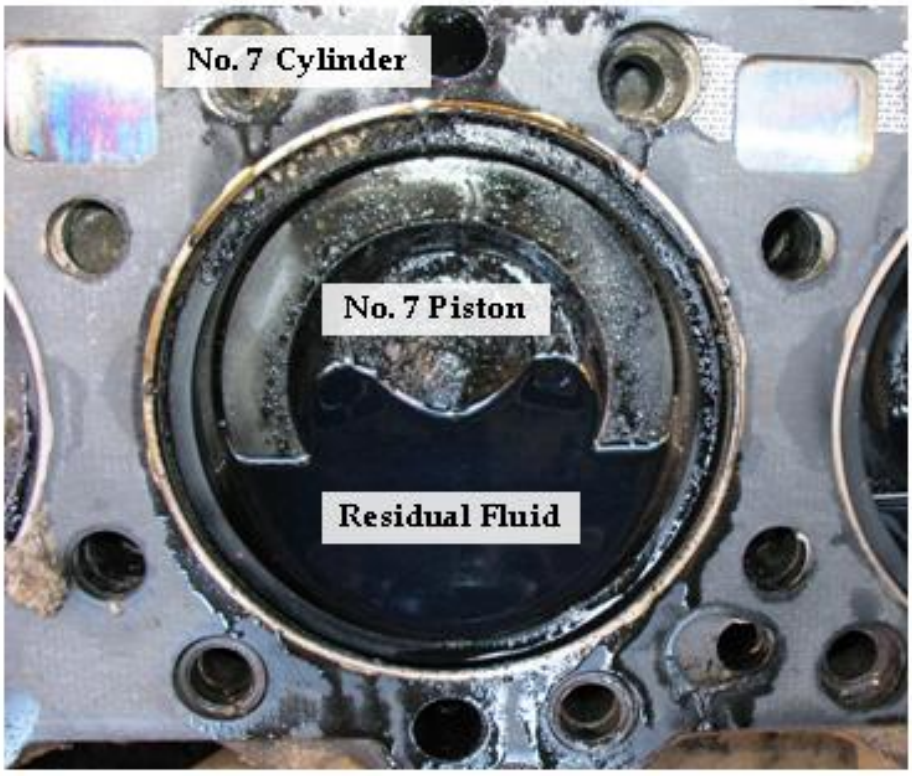
Gary Key (Chief, Mine Safety and Inspection)
Ronnie West (Mine Inspector)
David Keeton (Mine Inspector)
Leon Herren (Mine Inspector)

MINE SAFETY AND HEALTH ADMINISTRATION

John Church (District 11 Mine Safety and Health Electrical Specialist, Lead Investigator)
David Allen (District 11 Mining Engineer)
Jarvis Westery (District 11 Surface Coal Mine Inspector)
Phillip McCabe (Mine Safety and Health Technical Support, Division of Mechanical and Engineering Safety Mechanical Engineer)

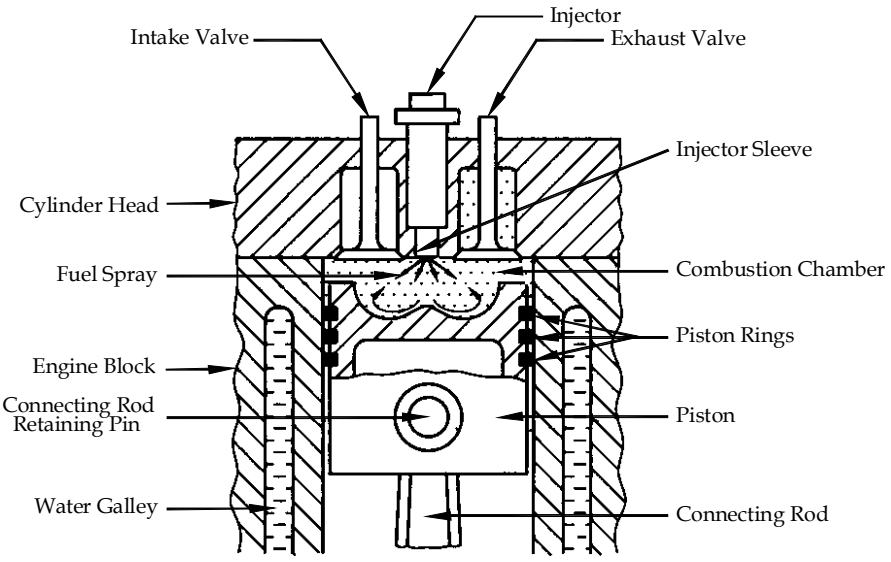
APPENDIX B

Additional Photographs

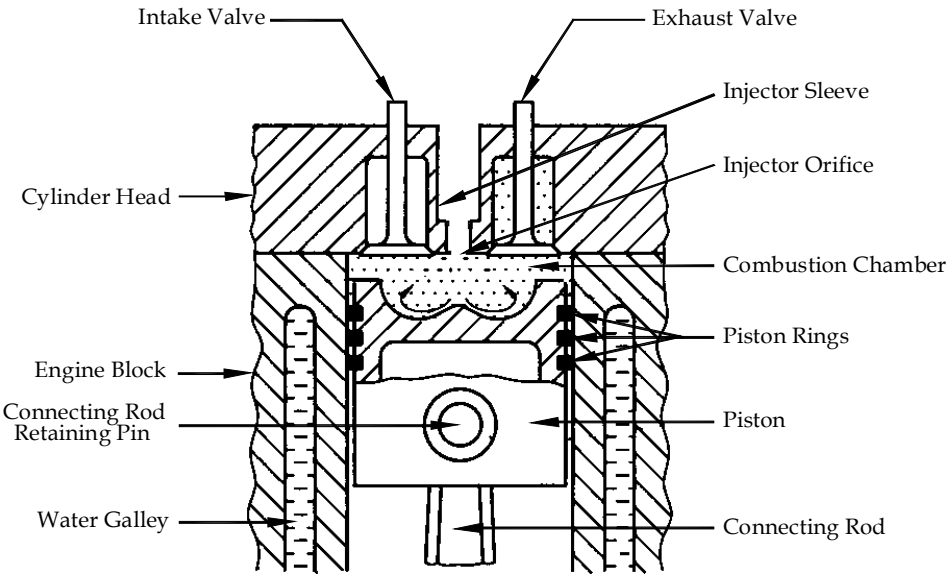

No. 7 Cylinder
No. 7 Piston
Residual Fluid

APPENDIX C

Cylinder Sketches
(general sketches for illustrative purposes only)



SKETCH 1
Typical sketch showing injector in place



SKETCH 2
Typical sketch showing injector removed

APPENDIX D

Victim Information

Accident Investigation Data - Victim Information
Event Number: 4 2 9 8 6 8 6

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. Degree of Injury:
C. Barret Stratton	M	34	01 Fatal

5. Date(MM/DD/YY) and Time(24 Hr.) Of Death: a. Date: 02/01/2008 b.Time: 13:26

6. Date and Time Started: a. Date: 02/01/2008 b.Time: 7:00

7. Regular Job Title: 004 Diesel Mechanic

8. Work Activity when Injured: 039 Machine Maintenance/Repair

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

10. Experience	Years	Weeks	Days
a. This Work Activity:	12	14	3
b. Regular Job Title:	2	16	2
c: This Mine:	0	4	2
d. Total Mining:	2	16	2

11. What Directly Inflicted Injury or Illness? 127 Liquid under pressure

12. Nature of Injury or Illness: 390 Blunt Force

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

14. Company of Employment: (If different from production operator) Thompson Tractor Independent Contractor ID: (if applicable) DL2

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

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

17. Union Affiliation of Victim:

Victim Information:

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Degree of Injury:

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

6. Date and Time Started:

7. Regular Job Title:

8. Work Activity when Injured:

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

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

11. What Directly Inflicted Injury or Illness?

12. Nature of Injury or Illness:

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

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

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

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

17. Union Affiliation of Victim:

Victim Information:

1. Name of Injured/Ill Employee:	2. Sex	3. Victim's Age	4. Degree of Injury:

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

6. Date and Time Started:

7. Regular Job Title:

8. Work Activity when Injured:

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

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

11. What Directly Inflicted Injury or Illness?

12. Nature of Injury or Illness:

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

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

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

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

17. Union Affiliation of Victim:

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