

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

METAL AND NONMETAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

**Underground Metal Mine
(Gold)**

**Fatal Explosives Accident
May 28, 2010**

**Discovery Day Mine
Gold Run Enterprises LLC
Forks of Salmon, Siskiyou County, CA
Mine ID No. 04-05222**

Investigators

**James Fitch
Supervisory Mine Safety and Health Inspector**

**Brad Breland
Supervisory Mine Safety and Health Inspector**

**Tom Lobb
Physical Scientist**

**Originating Office
Mine Safety and Health Administration
Western District
2060 Peabody Road, Suite 610
Vacaville, CA 95687
Wyatt S. Andrews, Acting District Manager**

MAI-2010-09

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Shot Material



Location of fatal victim



Location of injured miner



OVERVIEW

On May 28, 2010, James S. Bennett, supervisor, age 62, died when an unplanned delayed initiation of explosives occurred. The victim and Michael Engelke, miner, entered a blast area to check it. When they were within 25 feet of the face, the misfire detonated and both miners were struck by fly rock from the blast. Engelke was injured, hospitalized, and later released.

The accident occurred because management failed to ensure that policies and procedures to protect miners in blast areas were followed. The procedures did not ensure that miners did not return to the blast site for at least one hour after the suspected burning stopped.

GENERAL INFORMATION

The Discovery Day Mine, an underground gold mine operated by Gold Run Enterprises LLC, is located near Forks of Salmon, Siskiyou County, California. The principal operating official is Patrick A. Fagen, manager. The mine normally operates one 10 hour shift per day, for 10 to 14 days, with one to two weeks between rotations. Total employment is 14 persons.

Gold bearing ore is drilled and blasted from stopes in the mine. The broken rock is transported by a haul truck to the primary crusher where it is crushed and processed. The finished product is sold to commercial industries.

The last regular inspection was completed at this mine on February 26, 2010.

DESCRIPTION OF THE ACCIDENT

On the day of the accident, James S. Bennett (victim) started work at 7:00 a.m., his normal start time. Bennett went to the 13 east drift with Ralph Kuntz and Michael Engelke, miners, to set up to drill the next round in the heading. The crew drilled the round before lunch.

After lunch, Bennett and Kuntz loaded the round. Kuntz then left the area. About 8:00 pm, Bennett lit the fuse and went to the inby bend in the 13 east drift to wait for the round to detonate. Engelke went further down the drift toward the 72 crosscut. After the blast detonated, Engelke walked to Bennett and they discussed that the blast did not sound right.

Bennett and Engelke waited for about 15 to 20 minutes before reentering the area. Bennett was walking in the center of the drift, slightly ahead of Engelke. When Bennett was about 20 to 25 feet from the face, several of the still loaded holes detonated. Both Bennett and Engelke were struck by broken rock and debris from the blast.

They left the 13 east heading and started out of the mine, with Bennett assisting Engelke. Bennett and Engelke met Kuntz in the B9 crosscut, who then walked with them out of the mine. The victims were treated and then life-flighted to a hospital in Redding, California, where Bennett died on May 29, 2010. The cause of death was attributed to blunt force trauma. Engelke was hospitalized and later released.

INVESTIGATION OF THE ACCIDENT

On May 28, 2010, the Mine Safety and Health Administration (MSHA) was notified at 11:08 p.m. PST by a telephone call from manager Patrick Fagen to MSHA's emergency call center. Brad Breland, supervisory mine safety and health inspector, was notified and an investigation started the next day. An order was issued under the provisions of section 103(j) of the Mine Act to ensure the safety of the miners. A citation was issued for late reporting.

MSHA's accident investigation team traveled to the mine, conducted a physical inspection of the accident scene, interviewed employees, and reviewed conditions and work practices relevant to the accident. MSHA conducted the investigation with the assistance of the state of California Occupational Safety and Health, Mining and Tunneling Unit (Cal/OSHA), the Siskiyou County Sheriff's Bomb Squad, and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (BATFE).

DISCUSSION

Location of the Accident

The accident occurred at the face of the 13 east drift. The toe of the muck pile was approximately 17 feet from the face. The floor of the drift was wet and muddy. Individual rocks ranging up to approximately 6 inches wide by 6 inches long and 6 inches thick were observed on the floor past the toe of the muck pile. The upper 3 feet of the face was visible above the muck pile. The blasted face was deeper on the left side than the right. Shock tubes from the detonators, used when the face was loaded, were observed in two holes. Both of these holes were to the right of the center line of the face.

13 East Drift

The 13 east drift extended northeast off the 72 crosscut drift. It was being developed to intersect with the #1 and #2 veins which run northwest to southwest. The drift was 8 feet high and 8 feet wide. Ground control consisted of a mixture of timber, split set, point anchor bolts, and mats. Ground water had been encountered in the face when the lower holes were drilled.

Explosive Product Involved With the Accident

The explosives and detonators used in the blast were as follows:

ANFO (Ammonium Nitrate Fuel Oil) - Alpha Mix Explosives Blasting Agent
1.5D, EX-9311228 NA 0331

Powder - "Dyno." AP Plus 1 ¼ X 8 inch emulsion based 1.1D explosive
18FE04J1-29611

Explosive Boosters - Dyno Nobel Red Stingers 10 gram cast boosters 1.1D

Detonation Cord - DYN0 Special 25, UN0065 1.1D

Detonators - "DYN0 LP." Nonelectric 1.1B 1 - 11 period delays with 12 foot
lead-ins.

- #1 - 500mS delay time
- #2 - 800mS delay time
- #3 - 1100mS delay time
- #4 - 1400mS delay time
- #5 - 1700mS delay time
- #6 - 2000mS delay time
- #7 - 2300mS delay time
- #8 - 2700mS delay time
- #9 - 3100mS delay time
- #10 - 3500mS delay time
- #11 - 3900mS delay time
- #12 - 4400mS delay time

Detonators - 'Non-Electric' blasting caps (unassembled for safety fuse) 1.4b
UN0267, EX- 8511062

Safety Fuse - Red Plastic Coated 1.4S, UNK parameters (Burns at 40 seconds per
foot)

Factors Relating to Blasting Practices

No stemming was used for this blast.

Number of caps used - 18 Non-Electric Shock Tube

Number of timing circuits - 1 series

Number of holes per delay period - 2 - 3

Maximum explosive weight used per delay - 10-15 pounds

Range of pounds of explosives used per hole- 4-5 pounds (0.5 lb/ft blast hole)

Type of firing circuit - Detonation Cord initiated Shock-Tube [w/in hole delays]

Blast initiating device - 1 Instantaneous Blasting Cap with 10 feet of Safety Fuse

Contributing Factors of the Explosion

ANFO (ammonium nitrate/fuel oil) is a non-ideal explosive, meaning that its explosive properties are dependent on the conditions of use. The steady state velocity of ANFO varies from approximately 8,000 feet per second (fps) in 1 ½ inch diameter blastholes to over 15,000 fps in 12 inch or larger blastholes.¹ This minimum detonation velocity of 8,000 fps is the advertised detonation velocity of a 1 ½ inch column of ANFO. Lesser velocities are considered a “Low-Order-Deflagration” which can result after or with burning.

The ALPHA ANFO had an expired shelf life and sat for a long period of time in moist conditions. Therefore it would not have been as sensitive to initiation from the primer as it was originally, because ammonium nitrate acts as a desiccant and readily adsorbs water. Another problem resulting from this extended storage is referred to as “Fuel Migration”. Fuel Migration is a result of the fuel oil portion separating from the ammonium nitrate during extended storage. Portions of the ANFO become under fueled making the affected product less sensitive to detonation.

Two of the blastholes were reported to have been wet and muddy. The primer used in these two blastholes was the much smaller 10 gram DYNO Stinger instead of the recommended 1 ½ X 8 inch cartridge of Nitroglycerin Dynamite. The portions of “shock tube” observed remaining in the face at the time of inspection would have been consumed if these two blastholes detonated as planned.

Training and Experience

James Bennett (victim,) had 20 years of mining experience with 3 months and 2 weeks at this mine. He had received training in accordance with 30 CFR Part 48.

Michael Engelke had 20 years of mining experience with 4 years, 3 months and 2 weeks at this mine. He had received training in accordance with 30 CFR Part 48.

¹ 17th Edition ISEE Blaster’s Handbook, pg 264

ROOT CAUSE ANALYSIS

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

Root Cause: Management failed to ensure that miners were clear of areas where burning explosives were suspected.

Corrective Action: The deteriorated explosives have been removed from the mine site. Management trained all miners in the proper time to wait for suspected misfires or burning explosives.

CONCLUSION

The accident occurred because management failed to ensure that policies and procedures to protect miners in blast areas were followed. The procedures did not ensure that miners did not return to the blast area for at least one hour after the suspected burning stopped.

ENFORCEMENT ACTIONS

Order No. 6398906 was issued on May 29, 2010, under the provisions of Section 103(j) of the Mine Act:

A serious accident occurred at this operation on May 28, 2010, when two miners were injured by a detonated blast. This order is issued to insure the safety of all persons at this operation. Very little communication has occurred with the plant manager due to poor communications at the mine. A verbal order was issued to the mine manager during a brief telephone conversation at 8:25 a.m. All persons are prohibited from entering the mine.

Note: The inspector was delayed contacting mine management because the phone system was not operating at the mine.

The order was subsequently modified to a Section 103(k) order on May 29, 2010. The Section 103(k) order has not been terminated because the mine is closed and has not operated since the accident occurred.

Citation No. 8564422 was issued on October 12, 2010, under the provisions of Section 104(d)(1) of the Mine Act for a violation of 30 CFR 57.6903:

A fatal accident occurred at this operation on May 28, 2010, when two miners were reentering their work area after initiating a blast. A delayed detonation occurred and they were struck by fly rock and the concussion from the blast. The second miner received serious injuries. Mine management engaged in aggravated conduct constituting more than ordinary negligence in that they knew the requirements of burning explosive material, were aware of multiple recent failures at this mine of charges to explode when expected, were aware of an obvious and improper audible report from this blast, and had reason to suspect burning explosives at the blast site, yet failed to ensure that miners waited the proper period of time before returning to the area. This is an unwarrantable failure to comply with a mandatory standard.

The mine is closed and has not operated since the accident occurred. Therefore, the citation has not been terminated.

Approved By:

Wyatt S. Andrews
Acting District Manager

Date

Appendices

- A. Persons participating in the investigation
- B. Victim data sheet
- C. Diagram of lower haulage blast round indicating detonator timing sequence
- D. Mine Map

Appendix A

Persons Participating in the Investigation

Gold Run Enterprises LLC

Patrick Fagen	Manager
Ralph Kuntz	Miner
Michael Engelke	Miner

Bureau of Alcohol, Tobacco and Firearms

Michael Briw	Investigator
Roger Root	Investigator

State of California, Department of Industrial Relations

Jarel Snapp	Associate Engineer, Mining and Tunneling
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Siskiyou County Sherriff's Department

Robert Buker	Bomb Squad Commander
Charles Pipkin	Deputy
Ronald Quigley	Deputy

Mine Safety and Health Administration

Brad Breland	Supervisory Mine Safety and Health Inspector
Tom Lobb	Physical Scientist
James Fitch	Supervisory Mine Safety and Health Inspector
Steve Kidwell	Mine Safety and Health Inspector

Appendix B

Victim Data

Accident Investigation Data - Victim Information

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

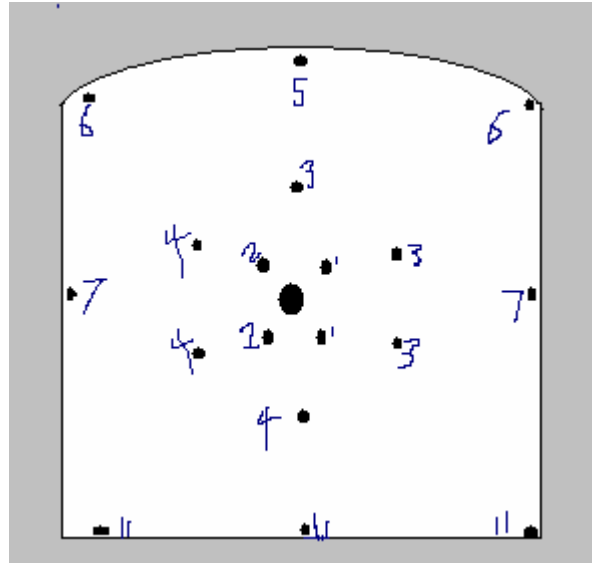


Event Number: 1 1 5 0 4 2 8

Victim Information: 1																				
1. Name of Injured/Ill Employee: <i>James S. Bennett</i>				2. Sex <i>M</i>		3. Victim's Age <i>62</i>			4. Degree of Injury: <i>01 Fatal</i>											
5. Date(MM/DD/YY) and Time(24 Hr.) Of Death: <i>a. Date: 05/29/2010 b. Time: 15:30</i>							6. Date and Time Started: <i>a. Date: 05/28/2010 b. Time: 7:00</i>													
7. Regular Job Title: <i>049 Supervisor</i>					8. Work Activity when Injured: <i>087 Inspecting blast area</i>					9. Was this work activity part of regular job? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>										
10. Experience		Years	Weeks	Days	b. Regular			Years	Weeks	Days	c. This		Years	Weeks	Days	d. Total		Years	Weeks	Days
a. This					Job Title:						Mine:					Mining:				
Work Activity:		<i>20</i>	<i>0</i>	<i>0</i>				<i>20</i>	<i>0</i>	<i>0</i>			<i>0</i>	<i>5</i>	<i>3</i>			<i>20</i>	<i>0</i>	<i>0</i>
11. What Directly Inflicted Injury or Illness? <i>044 Flyrock from unplanned detonation</i>							12. Nature of Injury or Illness: <i>140 Death</i>													
13. Training Deficiencies:																				
Hazard:		New/Newly-Employed Experienced Miner:					Annual:			Task:										
14. Company of Employment: (if different from production operator) <i>Operator</i>											Independent Contractor ID: (if applicable)									
15. On-site Emergency Medical Treatment:																				
Not Applicable:		First-Aid:		<input checked="" type="checkbox"/>	CPR:		EMT:		Medical Professional:			None:								
16. Part 50 Document Control Number: (form 7000-1)							17. Union Affiliation of Victim:													

Appendix C

Diagram of blast round indicating detonator timing sequence



Sketch indicating the pattern drilled for this blast round. This is a typical 'Burn-Cut' blast round. The center empty blast hole is about 5 ½ inches in diameter and closely surrounded by four opening blastholes (#1 [500 mS] & # 2 [800mS] time delays). The second row of six blastholes is shaped like a wagon wheel containing both # 3 [1100 mS] & #4 [1400 mS] time delays. The back is shot next with #5 [1700 mS] & #6 [2000 mS] time delays. Both walls are shot with #7 [2300 mS] time delays and finally, the bottom lifters are shot with # 11 [3900 mS] timing delays, completing the round. Total elapsed time from the first detonation to the final lifter is designed to be approximately 3 ½ seconds total. [mS = milli-seconds]

Appendix D

Mine Map

DISCOVERY DAY MINE
 Siskiyou County, CA
 LOWER (HAULAGE) LEVEL
 VENTILATION PLAN MAP
 SEPTEMBER 2010

Accident site

