

*This presentation is for illustrative and **general** educational purposes only and is not intended to substitute for the official MSHA Investigation Report analysis nor is it intended to provide the sole foundation, if any, for any related enforcement actions.*

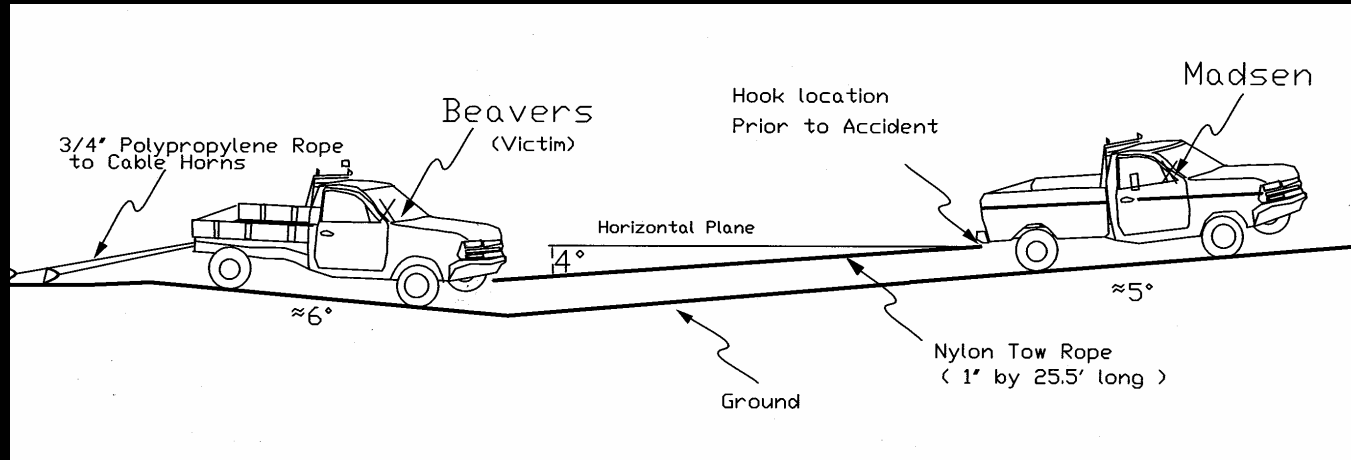
# GENERAL INFORMATION

## Coal Mine Fatal Accident 2003-24



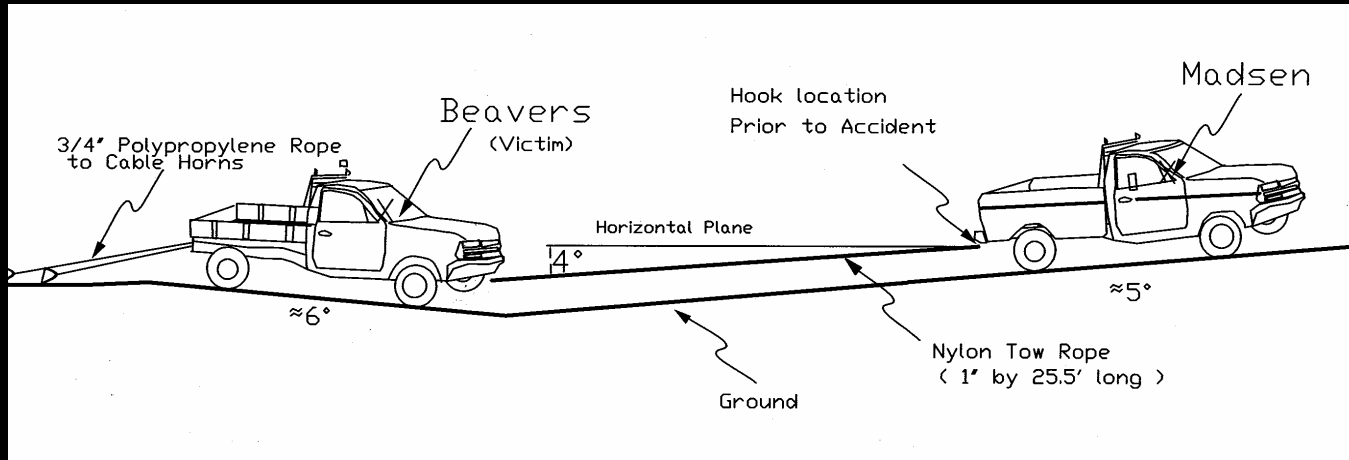
Operator:	RAG Coal West, Inc.
Mine:	Belle Ayr Mine
Accident Date:	September 9, 2003
Classification:	Powered Haulage
Location:	District 9, Gillette, Wyoming
Mine Type:	Surface
Employment:	235
Production:	50,000 tons/day

## Coal Mine Fatal Accident 2003-24



- On September 9, 2003, a 36-year old utility person with 4 years of mining experience was fatally injured when he and a co-worker were using two pick-up trucks to move power cable for an electric shovel.
- One of the trucks lost traction in a muddy area and a nylon tow rope was attached to a hook on the truck's front end. The tow rope was then attached to a hook on the back of the second pick-up.

## Coal Mine Fatal Accident 2003-24



- On the first attempt to pull the truck, the metal hook broke loose from the hitch of the front truck, pierced the windshield of the rear truck and struck the victim's head.
- The use of a hook, welded on the hitch receiver of the towing truck, as the attachment point for the tow rope, created an unsafe condition that resulted in the hook fracturing the receiver steel and projecting back towards the truck being towed.
- The use of a nylon tow rope as the towing device contributed to the cause of the accident as the elongation characteristics of the nylon rope allowed greater energy storage than that which would occur in other types of towing devices.

# ACCIDENT DETAILS

## Coal Mine Fatal Accident 2003-24

- The A-crew employees arrived at the mine at approximately 6:40 a.m. for the start of day shift.
- Brad A. Beavers, victim, and Charley Madsen, both oilers, were assigned to assist with the move of the Marion 301 shovel from the top of the coal bench to the overburden bench above.
- A motor grader was used to attach to, move, and position the trailing cable for the shovel during the move.
- Beavers and Madsen operated two Chevrolet K2500 Silverado pickup trucks with hooks welded on rear hitch assemblies to help move end segments of the trailing cable.
- Beaver's truck had a modified flat utility bed while Madsen's truck had its factory installed, conventional truck bed.
- The shovel had to be moved on the coal bench and then up a ramp to overburden bench No. 1.
- As the shovel moved toward the ramp, cable was attached to the motor grader, which pulled the cable behind the shovel.

# ACCIDENT DETAILS

## Coal Mine Fatal Accident 2003-24

- A power change had to be made, so the shovel's trailing cable was disconnected from the J-box (referred to as a "spider") at the bottom of the ramp.
- Using the utility-bed pickup truck, Beavers pulled the end of the cable and connected it to the spider at the bottom of the ramp. Power was re-energized.
- The shovel then proceeded up the ramp followed by the motor grader pulling the trailing cable.
- Due to the location of the motor grader behind the shovel, two "horns" of cable, which connected directly to the spider at the bottom of the ramp, had to be moved using the utility-bed pickup truck.
- A horn consists of a semi-circular steel connection that is attached to the cable to prevent kinking and used to pull approximately 200 feet of cable.
- A nylon rope is used to connect the horns to hooks on the back of the truck.

# ACCIDENT DETAILS

## Coal Mine Fatal Accident 2003-24

- After the two horns were connected to the hooks on the back of the utility-bed truck, Beavers proceeded in the truck to follow the shovel and motor grader up the ramp.
- The cable from these two horns would have been laid out quickly on the ramp, as they attached directly to the spider.
- As the truck traveled through a muddy area at the bottom of the ramp, it lost traction.
- Madsen pulled the second pickup truck in front of Beavers' truck and they attached a nylon tow rope with braided eyes between the trucks.
- Madsen connected the tow rope to a hook that had been welded to the right side of the hitch receiver on the towing truck.
- Beavers connected the rope to the right side hook on the front of his truck.
- They returned to their trucks and Madsen started to pull Beavers' truck.

# ACCIDENT DETAILS

## Coal Mine Fatal Accident 2003-24

- Madsen pulled with a slow steady pull (not jerking the rope), and on the first pull, the hook from his truck broke off.
- The hook projected back toward Beavers' truck.
- It struck the top of the hood and broke through the lower left corner of the windshield on the driver's side.
- The hook struck the metal support on the side of the windshield and deflected into the left front side of Beavers' head, causing severe traumatic head injuries.
- After the hook broke, Madsen got out of his truck.
- He noticed a dent in the hood of Beavers' truck and couldn't figure out why Beavers had not gotten out of his truck.
- He went to Beavers and found him injured and bleeding profusely from the head.
- An EMT treated Beavers at the scene and he was transported to the hospital.
- Beavers was pronounced dead on arrival by the emergency physicians.



# PHYSICAL FACTORS

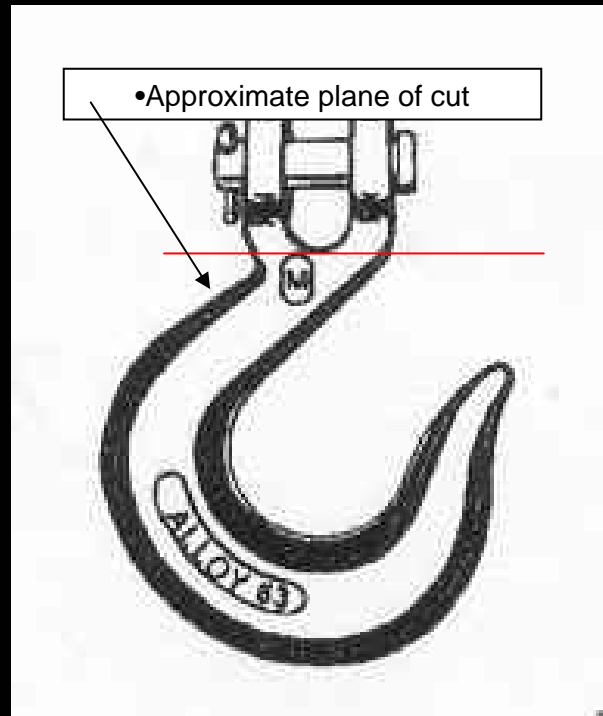
## Coal Mine Fatal Accident 2003-24

- The tow rope was approximately 25 feet long and made of 1-inch diameter 3-strand nylon rope with hand tucked (braided) eyes on each end.
- A clevis was attached to one of the eyes.
- Statements indicated that Beavers had braided the eyes on this tow rope and that he preferred using a nylon tow rope to other types.
- The rope had a Safe Working Load Limit of 2,445 pounds, a New Unused Tensile Strength of 22,230 pounds, a weight of 2.5 pounds/10 ft, and 16 percent elongation at Full Tensile.
- Identification markings on the hook indicated that the hook was originally a Midland (Columbus McKinnon Corporation) alloy clevis type slip hook, grade 63, manufactured for use with a ½-inch chain.

# PHYSICAL FACTORS

## Coal Mine Fatal Accident 2003-24

- The clevis pin eyes had been cut off, leaving a base on the hook approximately  $\frac{3}{4}$  inches thick and  $1\frac{1}{4}$  inches in length.
- The base of the hook appeared to have then been butt welded to the receiver hitch's tubular frame.



# PHYSICAL FACTORS

## Coal Mine Fatal Accident 2003-24

- Two metal hooks had been welded to the tubular steel hitch receiver on Madsen's truck (towing truck).
- These hooks were mainly used to attach the ropes from the cable horns when moving trailing cable.
- The hook on the left side had broken off previously, but the area where it was welded was clearly visible.
- Madsen attached the tow rope to the hook on the right side when hooking up to Beavers' truck before the accident.
- He placed the eye with the clevis on the hook.
- Examination of the hook found no markings from the steel clevis, indicating only the rope eye had been placed over the hook.
- The tubing of the receiver frame failed, allowing the hook to dislodge from the receiver frame.

# PHYSICAL FACTORS

## Coal Mine Fatal Accident 2003-24



- This hook broke off during the attempt to pull Beavers' truck and projected back causing the injuries to Beavers.
- Visual observations indicated the welds remained intact but the tube wall failed around the welds on the sides adjacent to the hook base.

# PHYSICAL FACTORS

## Coal Mine Fatal Accident 2003-24

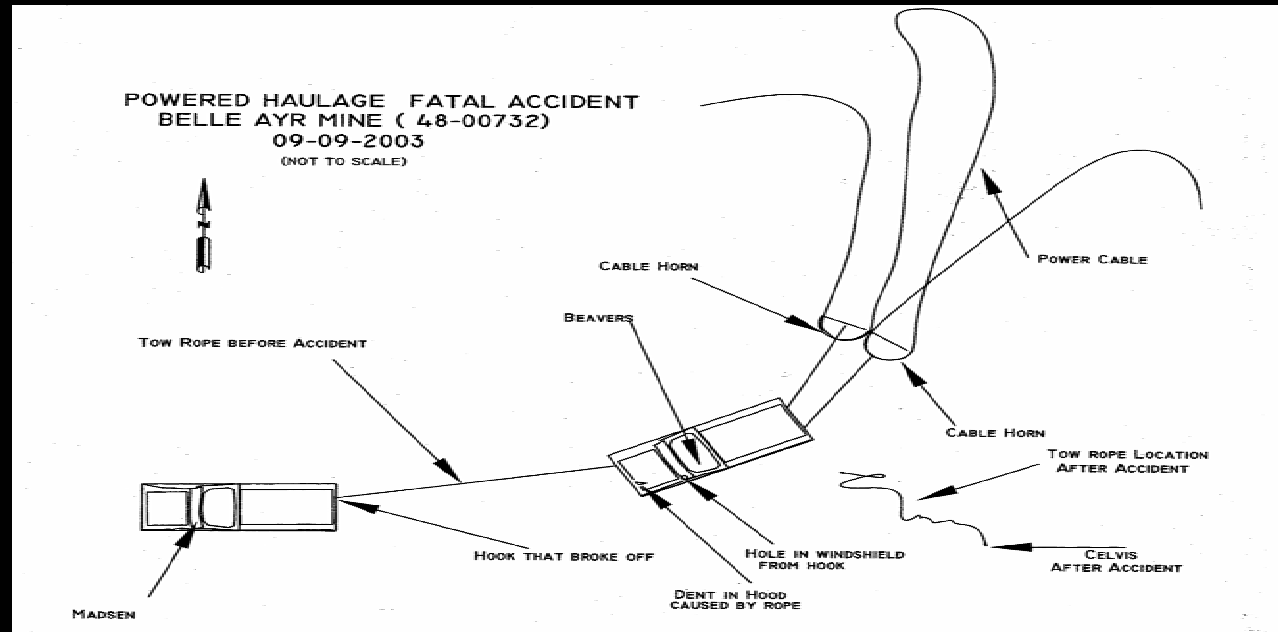
- The broken hook was found on the floor of the truck. The weight of this hook was 2.5 pounds.
- The tow rope was found on the ground on the left side of the truck to the rear.
- Damage to Beavers' truck, indicated the tow rope flipped back over the hood at an angle from right to left, denting it in the front and marking the hood at an angle from the front/middle toward the back/left side of the hood.



# PHYSICAL FACTORS

## Coal Mine Fatal Accident 2003-24

- At the time of the accident, Beavers truck was crossing from the coal seam to the bottom of the ramp through soft, muddy material. He had almost exited this material when his tires lost traction. His truck stopped on a slight downgrade of approximately 6 degrees.
- Madsen's truck was on the ramp on an upgrade of approximately five degrees. The ramp surface consisted of loose dirt with small granular material and small rocks. It was relatively dry at the time of the accident.



# ROOT CAUSE ANALYSIS

- **Causal Factor:** The tow rope was attached to a hook welded on the hitch receiver of the towing truck.
- **Corrective Actions:** The rope's pulling force was not applied to the hitch, the point of the receiver designed to carry the rated load. The operator removed all rear tow hooks from all light service vehicles and implemented a policy that hooks shall not be installed in this manner on such trucks in the future.
  
- **Causal Factor:** A nylon rope was used as a tow rope between the two trucks.
- **Corrective Actions:** The elongation characteristics of the nylon rope allowed greater energy storage than that which would occur in other types of towing devices. The operator has stopped using nylon tow ropes for towing vehicles and will use other devices such as straps which store less energy when stretched.

# ROOT CAUSE ANALYSIS

- **Causal Factor:** Corrective actions were not taken regarding welded hooks on receivers following the previous incident when the hook on the left side of the receiver broke off during a towing operation.
- **Corrective Action:** Following the September 9, 2003, accident RAG removed all rear tow hooks from all light service vehicles and implemented a policy that hooks shall not be installed on such trucks in the future.



# CONCLUSION

The use of a hook, welded on the hitch receiver of the towing truck, as the attachment point for the tow rope between the two trucks, created an unsafe operating condition that resulted in the hook fracturing the receiver steel and projecting back towards the truck being towed, causing the accident. The physical orientation of the hook on the receiver frame combined with the direction of the rope's pulling force induced a load that exceeded the structural capabilities of the receiver frame in the area in which the fracture started. The fracture appeared to have initiated in the heat affected zone of the welded area of the receiver frame. The use of a nylon tow rope as the towing device contributed to the cause of the accident as the elongation characteristics of the nylon rope allowed greater energy storage than that which would occur in other types of towing devices.

# ENFORCEMENT ACTIONS

## **104(a) Citation for a violation of 30 CFR 77.404(a).**

**The Chevrolet pickup truck, was not maintained in safe operating condition. An alloy clevis type slip hook, grade 63, with the clevis pin eyes cut off, had been welded to the hitch receiver installed on the rear of the truck and was used as an attachment point for tow ropes. This hook broke off during a towing operation on September 9, 2003, and projected back into the truck being towed causing fatal injuries to the driver of that truck. A previous towing incident with truck 968.21 occurred on August 20, 2003, in which a second hook, which was welded on the opposite side of the receiver, broke off during a towing operation. This incident demonstrated that an unsafe condition and safety hazard were present in the use of these welded hooks for towing and no action was taken to correct this safety defect."**

# BEST PRACTICES

- **Use only tested and approved mechanisms for pulling or towing.**
- **Obtain approval of manufacturer for modifications to original towing equipment.**
- **Ensure employees are properly instructed on proper towing practices.**
- **Ensure vehicles have sufficient traction for surface conditions.**
- **Conduct audits (observations) of specific tasks to ensure proper techniques are employed and tools/materials are maintained.**
- **Never exceed the rated capacity of a tow vehicle or towing equipment.**
- **Use hands-on training specific to the individual task.**
- **Communicate & prepare pre-task check of materials and techniques for every application.**